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ORIGINAL ARTICLE

The effect of patient body mass index on surgical difficulty in gynaecological laparoscopy

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Abstract The objective of this pilot study was to evaluate the extent to which laparoscopic gynaecological surgery could be completed as planned in overweight and obese patients versus patients of normal weight. A prospective surgical audit was conducted of 64 women undergoing laparoscopy for benign gynaecological conditions. Patients were grouped according to their body mass index (BMI). The number of attempts required for successful laparoscopic entry, the ability to identify key surgical landmarks, the ability to complete the planned surgery, the rate of conversion to laparotomy and the complication rates were recorded. Surgery was completed as planned in 95.31% of participants. Completion rates declined with increasing BMI. Increased entry attempts and an inability to identify key surgical landmarks were associated with increased BMI, although the sample size was insufficient to provide any statistically significant conclusions. The overall complication rate was 6.25%. There was a higher mean BMI in patients with a complication; however, there was insufficient data to show a significant difference. This study suggests an association between increasing BMI and increased entry attempts for laparoscopy, increased difficulty in surgical landmark identification and an overall reduction in completion of gynaecological laparoscopy as planned.

Keywords Laparoscopic surgery · Body mass index · Obesity · Surgical outcomes · Complications

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Introduction

Overweight and obesity are measured using the body mass index (BMI)—the ratio of weight (measured in kilogrammes) over the square of height (measured in metres). A normal BMI is between 18.5 and 24.99. A BMI of 25 kg/m^2 or greater indicates overweight, and 30 kg/m^2 or greater indicates obesity [1]. Obesity has reached epidemic proportions in the Western World with more than one billion adults overweight and at least 300 million clinically obese [2]. In Australia, obesity has almost tripled over the past 20 years [3] and costs the country $21 billion annually [4]. According to the 2007–2008 National Health Survey, 55% of Australian women are either overweight or obese [5].

Obesity is associated with numerous chronic health issues such as respiratory difficulties, musculoskeletal problems and infertility. It is also a major risk factor for cardiovascular disease, type 2 diabetes, hypertension and stroke and some forms of cancer such as cancers of the endometrium, breast and colon [2].

Obesity has been well studied in obstetrics and is linked to a number of adverse obstetric outcomes, as well as increased maternal and neonatal morbidity and mortality [6]. These complications include gestational hypertension, pre-eclampsia, gestational diabetes, caesarean section, postpartum haemorrhage, foetal macrosomia, congenital abnormalities and antepartum stillbirth [6–10]. In contrast to the plethora of research on obesity in the obstetric population, there is comparatively little data to guide the pre-operative counselling process in overweight and obese patients presenting to their gynaecologists requiring laparoscopic surgery.

An Ovid Literature Search, using the search terms ‘laparoscopic surgery and obesity’, yielded 758 results. The papers reviewed, however, mostly assessed surgical

difficulties and outcomes in bariatric surgery and robot-assisted laparoscopic radical prostatectomy, specifically in older male patients with medical comorbidities. Few of the papers reviewed were relevant to our younger female population undergoing elective laparoscopic gynaecological procedures. The currently available literature supports laparoscopic surgery in favour of open surgery in the obese population given the reduction in post-operative hospital stay, post-operative pain and wound infection rates, as well as reduced post-operative ileus and fever, compared with obese patients undergoing laparotomy [11].

Most of the data regarding the effect of obesity on surgical outcomes in gynaecological laparoscopy comes from retrospective reviews in the gynaecology oncology population [12–14]. The available evidence suggests that laparoscopic surgery is feasible in most obese patients; however, there is an increased risk of conversion to laparotomy compared with non-obese patients.

Whilst the available literature shows that laparoscopic surgery is a safe alternative to laparotomy in patients with an increased BMI, there is a definite paucity of good quality prospective data assessing the limitations and risks of surgery in this clinically important group of patients. In particular, there is a lack of data regarding the risks associated with increased BMI in laparoscopies for benign conditions where the level of risk acceptable to patients may be less than what would be accepted by those undergoing emergency or life-saving surgery for malignant disease.

Gynaecologists are therefore somewhat limited in the information they can provide for overweight and obese women regarding the increased risks (if any) that their weight adds to having a laparoscopic procedure and whether their BMI is likely to impact on the ability to complete the surgery as planned. This pilot study aims to address some of the gaps in the currently available data and help answer these important clinical questions.

Methods

The study group included women undergoing diagnostic or operative laparoscopy for benign gynaecological conditions. Women aged over 18 years attending for laparoscopy from January to October 2009 at our centre were invited to participate in the study after an interview with one of the authors (KM). Women included in the study were required to have an adequate grasp of the English language and be able to give informed consent. Ethical approval for this study was obtained from The Mercy Hospital for Women Human Research Ethics Committee.

Baseline demographic data were recorded including patient age, height, weight, waist and hip circumference and any prior abdominal or pelvic surgery (Table 1). Each patient was measured and weighed without shoes and wearing a hospital gown or light street clothing using the same height measuring device and scales. Waist circumference was measured with the patient in the standing position around the narrowest point between the ribs and hips when viewed from the front after exhaling. Hip circumference was measured at the point where the buttocks extend the maximum, when viewed from the side. Measurements were taken to the nearest centimetre without compression of the skin.

After obtaining written informed consent, women recruited to the study had their laparoscopic procedures performed in the usual manner as determined by the treating surgeon. Details of the operation, including

Table 1 Patient demographics

BMI	<25	25–29.9	≥30	>35	Overall
Age (mean)	30.43	39.27	36.62	39.33	35.50
Waist, Hip (mean)	0.77	0.85	0.82	0.85	0.81
Prior surgery	61.90%	50.00%	90.48%	77.78%	67.19%
Laparoscopy	47.62%	27.27%	42.86%	11.11%	40.63%
Laparotomy	14.29%	22.73%	47.62%	66.67%	26.56%
Procedure					
Diagnostic	19.00%	13.64%	33.33%	44.44%	21.88%
Simple Op	52.38%	40.91%	33.33%	33.33%	42.19%
Complex Op	19.00%	22.73%	0.00%	0.00%	14.06%
Advanced Op	9.52%	22.73%	33.33%	22.22%	21.88%
Adhesions					
Nil	33.33%	31.82%	28.57%	33.33%	31.25%
Mild	38.10%	27.27%	19.05%	11.11%	28.13%
Moderate	28.57%	18.18%	28.57%	33.33%	25.00%
Severe	0.00%	22.73%	23.81%	22.22%	15.63%

indications for the procedure, complexity of the procedure, degree of pelvic adhesions, primary operator, surgical outcomes, entry technique and any difficulties encountered, surgical landmark identification, any surgical or anaesthetic complications, and whether conversion to laparotomy was required, were documented by the operating surgeon at the conclusion of the procedure on a data collection sheet. Simple operative procedures included ovarian cystectomies, bilateral salpingo-oophorectomy (BSO), management of ectopic pregnancies and excision of stages I–II endometriosis. Complex operative procedures included excision of stage III endometriosis, and advanced procedures included total laparoscopic hysterectomy (TLH) and management of stage IV endometriosis. The degree of pelvic adhesions was scored qualitatively from nil to severe.

A further data collection sheet was completed by the gynaecologist reviewing the patient at their 6-week post-operative visit in order to detect any complications encountered following the patient's discharge from hospital.

The primary outcome of this study was whether the planned surgery could be completed in overweight and obese patients undergoing laparoscopy. Secondary outcomes were the number of attempts required for successful laparoscopic entry, the ability to identify key surgical landmarks, the conversion rate to laparotomy and the rate of surgical and anaesthetic complications.

All data were analysed using Minitab® Release 14 statistical package. Power and sample size calculations were completed using a Power=0.80 and α=0.05. The two-sample *t* test and the two-sample *p* test were used for calculations involving means and proportions respectively.

Results

A total of 64 women were recruited to the study with an even distribution across the various BMI categories of normal (BMI <25), overweight (BMI 25–29.99) and obese (BMI ≥30). Patients with a BMI exceeding 35 were analysed as a subgroup of the obese category. Nine women (14% of the study sample) had a BMI over 35.

There was no significant difference across the various BMI categories with regards to mean age, waist-to-hip ratio or the complexity of the laparoscopic procedure performed (Table 1). There was, however, a higher prior laparotomy rate in obese patients, particularly in the morbidly obese group, which may have translated to a larger proportion of patients with moderate to severe adhesions in this BMI category.

The overall completion rate of the planned surgery was 95.31% (61 patients). The completion rate of surgery declined with increasing BMI from 100% completion in the normal BMI category—95.45% in the overweight group, 90.48% in the obese group to 77.78% in the subgroup of patients with a BMI over 35 (Fig. 1).

There was a trend towards an increased number of attempts at laparoscopic entry in the subgroup of patients with a BMI exceeding 35 (Fig. 2). The majority of entries (92%) were made using the Veress needle. The Endopath® Xcel Bladeless Trocar (Ethicon Endo-Surgery, LLC Guaynabo, Puerto Rico 00969, USA) and the open technique were also used for primary entry at the discretion of the operating surgeon.

There was a trend towards a reduced ability to identify key surgical landmarks with increasing patient BMI (Table 2). The inferior epigastric vessels and ureters were recorded as being identified if they were either partially or completely visible.

One patient (1.56%) required conversion of their procedure to laparotomy. This postmenopausal patient had a BMI of 29.64 and was undergoing a laparoscopic BSO for a persistent ovarian cyst. Laparoscopic access to the pelvis was poor due to fat and adhesions.

The overall complication rate in the study group was 6.25%. There were two major and two minor complications. The major complications were a right ureterovaginal fistula following a complex TLH for severe endometriosis in a patient with a BMI of 27.24 and an episode of asystole on Veress insufflation of CO2 in a patient with a BMI of 28.58, which required atropine and cardiac compressions for correction. There were two patients with minor cases of wound cellulitis requiring oral antibiotic therapy. There was a higher mean BMI in the patients who had a complication (29.80) compared with the patients who did not have a complication (28.04); however, the sample size was insufficient to show a significant difference.

Based on the data of this pilot study, it was calculated that 299 patients would be required to demonstrate whether there is a statistically significant relationship between patient BMI and the ability to complete the surgery as planned.

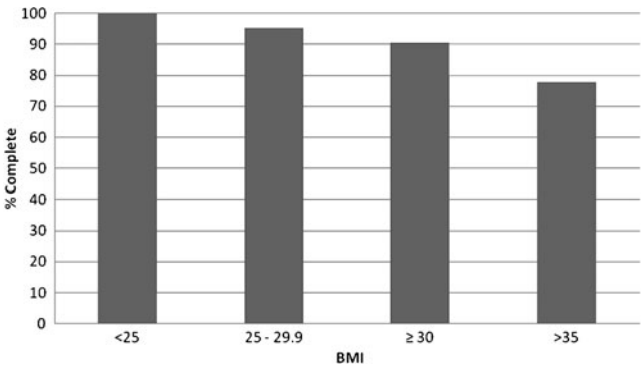

Fig. 1 Surgery completed as planned

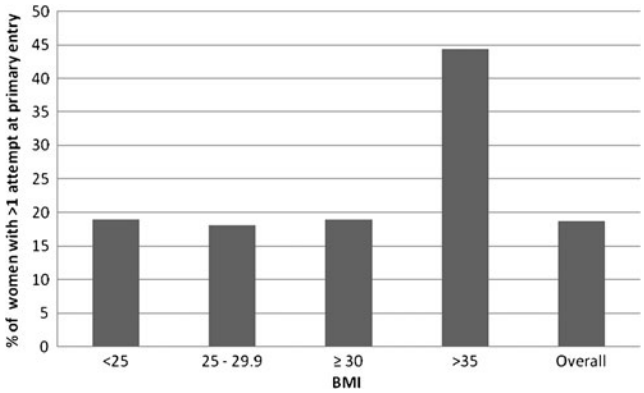

Fig. 2 Attempts at laparoscopic entry

Discussion

Obesity is fast becoming a global epidemic, and we are increasingly presented with overweight and obese patients requiring laparoscopic gynaecological surgery for a host of benign gynaecological conditions. Whilst the ideal approach for these individuals is pre-operative weight loss, this is often difficult to attain [15]. Obesity was once considered a contraindication to laparoscopic surgery; however, the laparoscopic approach is well suited to obese patients given their increased susceptibility to thromboembolic events and poor wound healing following laparotomy [15].

Most of the studies examining the effects of obesity on outcomes in laparoscopic surgery to date are non-gynaecologic in nature. The available research supports the laparoscopic approach for the treatment of endometrial cancer in obese patients although most of these studies are retrospective reviews with their attendant limitations [13, 14]. A further retrospective cohort study in 270 general gynaecology patients demonstrated that TLH could be performed successfully in most obese patients with similar complication rates to those for non-obese patients although operating times and intra-operative blood loss were increased in the obese group [16]. The observational nature of this study again makes it difficult to draw absolute conclusions. There remains little, therefore, to guide the pre-operative counselling process in patients requiring laparoscopic gynaecological surgery for benign conditions.

Table 2 Surgical landmark identification

Surgical landmark	Identified	Mean BMI
Left inferior epigastric artery	Y	27.44
	N	33.92
Right inferior epigastric artery	Y	27.44
	N	32.53
Left ureter	Y	26.96
	N	32.84
Right ureter	Y	26.99
	N	35.21

It is of critical importance to the process of obtaining informed consent to be able to advise the patient on the risks and benefits associated with the proposed surgery and to provide a realistic expectation of the likely surgical outcome. Our study aims to address the gaps in the currently available data in order to help answer these important clinical questions.

With regards to the primary outcome of this study, our results suggest a reduced ability to complete the planned surgery with increasing BMI. This was most pronounced in the subgroup of patients with a BMI over 35 where the ability to complete the surgery as planned was 77.78% compared with a completion rate of 100% in patients of normal BMI. Where surgery was unable to be completed as planned, this was attributed to poor access due to fat and/or adhesions precluding safe access to the pelvis.

Obtaining a pneumoperitoneum in obese patients can be particularly challenging due to increased abdominal wall thickness and preperitoneal fat. The percentage of women requiring more than one attempt at laparoscopic entry was highest in the morbidly obese group when compared with women in all other weight ranges. This is likely due to the Veress needle dissecting into the preperitoneum more frequently in the morbidly obese patients despite attempting insertion through the base of the umbilicus. Direct entry under vision using the Endopath® Xcel Bladeless Trocar was a useful way of obtaining primary entry in the morbidly obese and was selected more frequently in this subgroup of patients.

Technical obstacles, associated with open pelvic surgery in the obese, are primarily those related to operative exposure and access to deep pelvic structures. These obstacles present similar challenges when laparoscopy is attempted [16]. In the patient whose procedure was converted to laparotomy, fat and adhesions precluded safe access to the pelvis, and the decision was made to open through a Pfannenstiel incision. The surgery was completed uneventfully, and the patient had an unremarkable post-operative course.

Of the two major complications occurring in this series, one was a right-sided ureterovaginal fistula occurring in an overweight patient undergoing a TLH for severe endometriosis and adenomyosis. A cystoscopy that demonstrated bilateral ureteric jets was performed at the conclusion of the procedure. Post-procedure cystoscopy with intravenous injection of indigo carmine is increasingly used to demonstrate ureteric patency following gynaecologic surgery [17] and is routinely performed in our unit following TLH. This method, however, can still provide a false negative result in cases of urological injury secondary to thermal damage or where there is partial obstruction [17,

18]. The fistula in this case was thought to have formed post-operatively from a diathermy injury to the ureter whilst obtaining haemostasis at the vaginal vault. The patient underwent further surgery for reimplantation of the right ureter, and subsequently, made a full recovery. There was a higher mean BMI in patients with a complication (29.8) compared to the group with no complications (28.04); however, there was insufficient data to show a significant difference.

Conclusion

The results of this pilot study suggest an association between increasing BMI and reduced completion of planned gynaecological laparoscopy, an increased number of attempts at laparoscopic entry and increased difficulty in surgical landmark identification. A larger study is currently underway with the aim of recruiting 300 women in order to answer the question, 'Can the planned surgery be completed in overweight and obese women undergoing gynaecological laparoscopy and what are the excess risks associated with an increased BMI?'

Disclosure The authors of this paper have no commercial, proprietary or financial interest in any aspect of the work pertaining to this article.

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