European Journal of Gynaecological Oncology

Eur. J. Gynaecol. Oncol. **2022**; 43(1): 146–152
http://doi.org/10.31083/j.ejgo4301001

Case Report

Combined panniculectomy and surgical staging of endometrial cancer: the Northern Ireland experience

James P Beirne[1,2,†], Susan Addley[3,†], Gillian V Blayney[4], Sandra McAllister[5], Heather Agnew[6], Elaine F Craig[6], Ian JG Harley[2,6], Hans Nagar[6], Stephen P Dobbs[6], David Glenn[7], Patrick Comiskey[8], Michael Stafford[9], W Glenn McCluggage[10], Stephen Sinclair[5], Mark H McComiskey[6,*]

[1]Department of Gynaecological Oncology, Trinity St. James Cancer Institute, St. James' Hospital, D08 NHY1 Dublin, Ireland
[2]Patrick G Johnston Centre for Cancer Research, Queen's University, BT9 7AE Belfast, Northern Ireland
[3]Royal Derby Hospital, University Hospitals of Derby and Burton NHS Trust, DE22 3NE Derby, UK
[4]Royal Jubilee Maternity Service, Royal Group of Hospitals, Belfast Health and Social Care Trust, BT12 6BA Belfast, Northern Ireland
[5]Department of Plastic Surgery, Ulster Hospital, South-Eastern Health and Social Care Trust, BT16 1RH Dundonald, Northern Ireland
[6]Northern Ireland Gynaecological Cancer Centre, Belfast City Hospital, Belfast Health and Social Care Trust, BT9 7AB Belfast, Northern Ireland
[7]Department of Obstetrics and Gynaecology, Ulster Hospital, South-Eastern Health and Social Care Trust, BT16 1RH Dundonald, Northern Ireland
[8]Department of Medical Photography, Ulster Hospital, South-Eastern Health and Social Care Trust, BT16 1RH Dundonald, Northern Ireland
[9]Department of Anaesthetics, Ulster Hospital, South-Eastern Health and Social Care Trust, BT16 1RH Dundonald, Northern Ireland
[10]Department of Pathology, Royal Group of Hospitals, Belfast Health and Social Care Trust, BT12 6BA Belfast, Northern Ireland
*Correspondence: mark.mccomiskey@belfasttrust.hscni.net (Mark H McComiskey)
[†]These authors contributed equally.

Academic Editor: Enrique Hernandez
Submitted: 6 July 2021 Revised: 5 October 2021 Accepted: 11 October 2021 Published: 15 February 2022

Abstract

Background: Endometrial cancer is the most common gynaecological malignancy in the Western world and has a strong association with obesity. The incidence of endometrial cancer is rising and can be attributed, in part, to the ongoing obesity epidemic. The surgical management of endometrial cancer in women with class III obesity, defined as those with a body mass index (BMI) $\geq$40 kg/m^2, can be particularly challenging. **Case(s)**: We report the early experience of panniculectomy as an adjunct to endometrial cancer staging surgery in Northern Ireland (NI). We outline the generic surgical approach and report the outcomes of the first four cases undertaken. We discuss the important role that panniculectomy holds in the surgical management of endometrial cancer in women with III obesity. **Conclusion**: The initial experience, in NI, of panniculectomy as an adjunct to endometrial cancer staging surgery greatly facilitated surgical exposure and allowed adequate surgical staging to be performed. In carefully selected cases, the surgical procedure can be completed safely and effectively with greater ease.

Keywords: Obesity; Endometrial cancer; Panniculectomy; Apronectomy

1. Introduction

In Northern Ireland (NI) there are, on average, 270 cases of endometrial cancer (EC) per year with a five-year survival of around 80% [1]. In general, endometrial cancer is detected at an early stage, conferring good overall survival rates, but advanced stage and high-grade disease is associated with high levels of morbidity and mortality. Recent years have seen a steady increase in both incidence and mortality from endometrial cancer in NI, as in other Western populations. The age-standardised incidence has nearly doubled over the last 25 years and mortality has increased by 1.6% per year over a similar time period [1]. This increase in mortality is of considerable concern, especially given recent evidence from North America suggesting a similar trend where the overall 5-year survival rate for high-grade endometrial cancer has been decreasing over the last four decades, dropping from over 87% (1975 to 1977) to 83% (2008 to 2014) [2]. This increase in mortality is likely due a range of factors, but the growing obesity epidemic is a key contributor. Over 50% of new endometrial cancer cases each year are associated with obesity [3]. Given these stark figures, considerable evolution to the treatment pathway is required for endometrial cancer patients, of which a modified surgical approach, incorporating "personalised surgery" into the management algorithm, is a key component. A minimally invasive surgical (MIS) approach carries the lowest rates of peri-operative morbidity and mortality for most women. Unfortunately, this can be technically difficult in patients with class III obesity and may result in increased complication rates. Carefully selecting such patients and incorporating panniculectomy, or apronectomy, into their surgical staging would be a "personalised surgery" approach. A panniculectomy is a surgical procedure to remove excess skin and tissue, pannus,

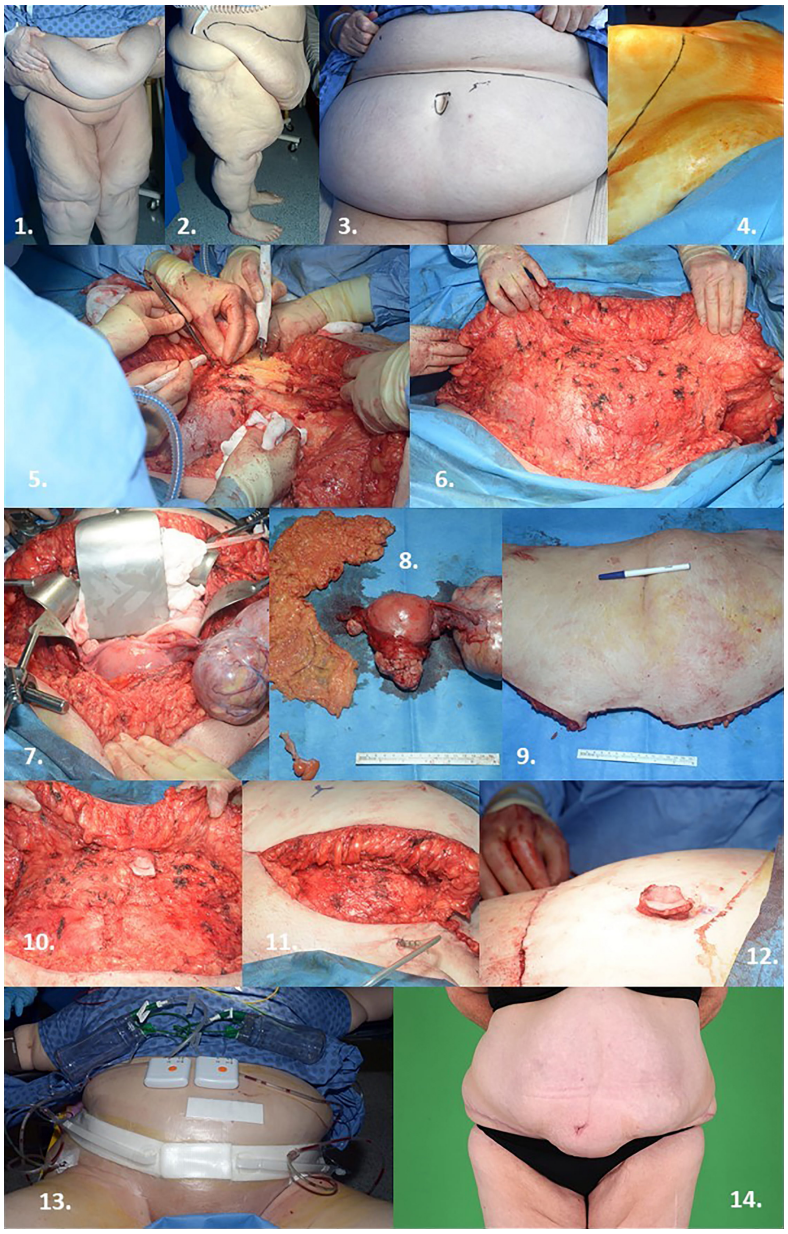

Fig. 1. The NI approach to surgical staging incorporating panniculectomy. (1,2,3) The patient is admitted on the day of surgery and undergoes pre-operative marking by the Plastic Surgery team along with pre-procedural photography. Full venous thromboembolism prophylaxis is employed, namely graduated compression stockings, peri-operative sequential compression devices and sub-cutaneous low molecular weight heparin for twenty-eight days post-operatively. A general anaesthetic is administered by an experienced anaesthetist (MS). (4) The patient is positioned in lithotomy with trendelenberg tilt. This position allows greater surgical access to the lower abdomen and aids with retracting bowel from the pelvis during the procedure. (5,6) The abdominal apron is mobilised from the underlying rectus sheath using monopolar diathermy. The umbilicus is spared. The superficial epigastric vessels and associated perforators are preserved. Routine perioperative antibiotic prophylaxis is administered. (7,8,9) The rectus sheath is opened in the midline as with a standard midline laparotomy. A full assessment of the abdomen is performed to establish disease distribution. Then, if indicated, large bowel is carefully mobilised to allow a total omentectomy to be performed. The bowel is then packed into the upper abdomen and a table-fixed retractor (e.g., Bookwalter^{TM}, Thompson^{TM}, Omni-Tract®, etc.) is positioned to allow clear access to the pelvis. A total abdominal hysterectomy and bilateral salpingo-oophorectomy is completed. Finally, additional staging procedures (e.g., peritonectomy, pelvic and para-aortic nodal dissection, appendicectomy, etc.) are performed as indicated by disease distribution, pre-operative histopathological grade and pre-operative radiological staging. (10) The rectus sheath is closed with Loop PDS II® 0 suture (Ethicon Inc.) as routine. (11) The abdominal adipose layer is apposed with interrupted Vicryl® 2/0 (Ethicon Inc.) sutures and bilateral ¼ inch Redivac® drains are inserted. (12) The umbilicus is re-sited and, finally, the skin is closed with continuous subcutaneous Monocryl® 3/0 suture (Ethicon Inc.). (13) Two large PICO® dressings (Smith and Nephew) are applied to the wound. (14) Following six months of follow-up, post-procedural photographs are taken for the patients record.

from the lower abdomen. The pannus is sometimes referred to as an "apron"; hence the term apronectomy. The addition of this technique can significantly improve surgical access and may also have longer-term health benefits. This case series reports the initial experience of this intervention at the Northern Ireland Gynaecological Cancer Centre.

2. Surgical technique: step-by-step

The procedure has been carefully planned and refined into the following process (see Fig. 1).

3. Wound management: key points

The post-operative wound care management is of paramount importance to help minimise peri-operative morbidity and, consequently, ensure the patient promptly returns to baseline activities of daily living and, ultimately, receives adjuvant therapy in a timely manner. In general, wound management is a multi-disciplinary approach. The patients are managed on a gynaecology ward with experience in managing gynaecological malignancy and there are daily consults from the Plastic Surgery team and the Wound Care Specialist Nurses. The following are key parameters to the post-operative care package:

(a) PICO® dressings (Smith and Nephew) remain in place for a minimum of 7 days. There is considerable care taken on initial siting to ensure a good, consistent vacuum seal.

(b) Two drains are sited to the anterior abdominal wall. These are left in place until there is minimal output over a 24-hour period. In general, that is also around 7 days.

(c) All patients receive intra-operative antibiotic prophylaxis and do not receive post-operative prophylaxis. If there are post-operative concerns regarding infection, then antibiotics are prescribed following consultation with the Microbiology Clinical team.

(d) If wound dehiscence occurs then patients are managed with antimicrobial therapy, debridement and supportive care as indicated. The use of extended negative pressure wound therapy is on a case-by-case basis and depends on size of dehiscence and extent of any surgical debridement required.

4. Case series

The first four cases of combined panniculectomy and surgical staging for endometrial cancer are presented in this series (Table 1).

The median age was 56 (range: 54–59 yrs) and the mean weight and body mass index (BMI) were 139.88 kg (range: 129.5–155) and 52.7 (range: 49.1–61) respectively. Three of four patients had a pre-operative histological diagnosis and full staging imaging (MRI pelvis and CT Chest/Abdomen/Pelvis). Pre-operative tissue diagnosis and MRI pelvis was not feasible in one patient due to previous surgery. She was managed as a malignancy based on symptoms, CT findings and elevated serum CA125 levels. All cases had a range of obesity-related co-morbidities. All cases underwent pre-operative discussion at the Northern Ireland Gynaecological Cancer Centre (NIGCC) multidisciplinary team meeting.

All procedures were performed jointly with Gynaecological Surgical Oncological and Plastic and Reconstructive Surgical expertise (in line with the previous description). In the NIGCC a decision on the extent of surgical staging is taken by the MDT following pre-operative work-up. Systematic lymphadenectomy is only performed in patients in the following circumstances: (a) high histological grade, (b) radiological evidence of FIGO stage >IB, or (c) evidence of lymphadenopathy at surgical staging. The mean operating time was 216.5 minutes (range: 198–241) and the median length of post-operative stay was 11.5 days (range: 10–25) (see Table 2). The mean weight of the panniculectomy specimen was 9.55 kg (range: 6.2–14.8) and the mean perioperative haemoglobin drop was 22.75 g/L (range: 6–35). The final pathology confirmed endometrioid adenocarcinoma in all cases (see Table 2). All patients were offered adjuvant therapy in keeping with local practice. One patient declined. One patient received systemic anti-cancer therapy because of a synchronous ovarian endometrioid adenocarcinoma.

There were no major or minor intra-operative complications (see Table 3). All patients required antibiotic therapy in the initial post-operative period for pyrexia of unknown origin/suspected wound infection. One patient had a protracted length of hospital stay due to a urinary tract infection and wound healing issues requiring a return to theatre for wound debridement. One patient was readmitted for management of a superficial wound infection at day 14 postoperatively. All patients had achieved complete wound healing by the six-month follow-up review visit.

4. Discussion

Over the course of the last ten years the number of endometrial cancer-related deaths have increased by ~30% [1]. This is in stark comparison to several other cancers where the incidence and mortality rates have plateaued or decreased in the last decade. The reasons underlying this increase are multifactorial, but the growing obesity epidemic is likely a contributing factor. It has been estimated that 60% of new endometrial cancer cases each year may be attributable to obesity [3]. Interestingly, recent preclinical research has shown that adipose tissue is an important source of secreted paracrine factors, which increase endometrial cancer cell proliferation and may also enhance tumour angiogenesis [4].

Table 1. Key clinical features of patient cohort.

Case	1	2	3	4
Age	54	59	56	56
Parity	2	0	3	0
Menopausal status	Postmenopausal, no HRT	Postmenopausal, never HRT	Postmenopausal, never HRT	Postmenopausal, never HRT
Weight	129.5 kg	138 kg	155 kg	137 kg
BMI	53	47.7	61	49.1
Presenting complaint	Abdominal pain, post-menopausal bleeding (PMB)	PMB	PMB	Abdominal pain, PMB
Diagnostics	Pipelle Biopsy: G1 EEAC CA125: 228 u/mL HbA1c: 66 mmol/mol MRI A/P: Endometrial Tumour, no lymphadenopathy, predicted FIGO Stage I. Complex ovarian mass. CT A/P: 10 cm complex ovarian mass, no peritoneal disease.	Hysteroscopic Biopsy: G3 EEAC CA125: 27 HbA1c: 42 MRI A/P: Endometrial tumour, no lymphadenopathy, FIGO Stage IB	Hysteroscopic Biopsy: G3 EEAC MRI A/P: Endometrial tumour, no lymphadenopathy, FIGO Stage 1A	CA125: 72 CT A/P: 18 cm complex left adnexal mass MRI: Not feasible
Past medical history	Type II DM Ischaemic Heart Disease Asthma Sleep apnoea Arthritis Hyperthyroidism Fatty liver	Type II DM Hypertension	Hypothyroidism	Ankylosing spondylitis
Past surgical history	Nil	Tonsillectomy	Tonsillectomy	Gastric bypass surgery Open cholecystectomy Hiatus hernia repair
Smoking status	Non-smoker	Ex-smoker (stopped 20 yrs)	Ex-smoker (stopped 20 yrs)	Non-smoker
MDM recommendations	Panniculectomy + Staging Surgery (TAH, BSO, appendicectomy, total omentectomy)	Panniculectomy + Staging Surgery (TAH, BSO, omental biopsy)	Panniculectomy + Staging Surgery (TAH, BSO, paraumbilical hernia repair)	Panniculectomy + Staging Surgery (TAH, BSO, total omentectomy)

Table 2. Peri-operative and histopathological data.

Case	1	2	3	4
Procedure performed	Panniculectomy with re-siting of umbilicus, TAH, BSO, total omentectomy, appendicectomy	Panniculectomy with re-siting of umbilicus, TAH, BSO, omental biopsy	Panniculectomy with re-siting of umbilicus, TAH, BSO, repair para-umbilical hernia	Panniculectomy with re-siting of umbilicus, TAH, LSO, total omentectomy
Pannus weight (kg)	9	8.2	6.2	14.8
Procedure time (mins)	201	198	241	226
HDU post-op	Y (24 hrs)	N	N	N
Perioperative Hb Drop (g/L)	19	6	35	31
Duration urinary catheter (days)	4	1	2	7
Duration drains (days)	Left: 6 Right: 2	Left: 2 Right: 6	Left: 6 Right: 5	Left: 6 Right: 6
Length of stay (post-operative days)	11	10	25	12
Final histopathology	Synchronous independent endometrioid adenocarcinoma of uterus and left ovary (Uterine: FIGO IA, grade 2, ovarian: FIGO IA, grade 3)	FIGO IB, Grade 2 endometrial endometrioid adenocarcinoma	FIGO IA, grade 3 endometrial endometrioid adenocarcinoma	Synchronous independent endometrioid adenocarcinoma of uterus and left ovary (Uterine: FIGO 1A, grade 1; ovarian: FIGO IIB, grade 2)
Adjuvant treatment	Declined	Pelvic EBRT (45 Gy, 20#) HDR VVBT (8 Gy, 2#)	HDR VVBT (21 Gy, 3#)	Chemotherapy (6 Cycles Carboplatin & Paclitaxel)

Table 3. Complications.

Case	1	2	3	4
Intra-operative complications	Nil	Nil	Nil	Ovarian cyst rupture
Post-operative complications	D8: *Wound infection*/superficial dehiscence -Mx: 2/7 PO Co-Amoxiclav (patient declined further)	D3: Pyrexia of unknown origin -Mx: 2/7 IV Teicoplanin/Metronidazole /Gentamicin; then 5/7 PO Metronidazole/Clindamycin	D1: Paralytic ileus -Mx: Conservative D5: *Wound infection*/superficial dehiscence -Mx: 6/7 IV Flucloxacillin; then 1/7 PO Flucloxacillin D9: Non-viable umbilicus -Mx: RTT, surgical debridement D18: Urinary tract infection -Mx: 3/7 IV Gentamicin, 7/7 PO Co-Amoxiclav	D3: Pyrexia of unknown origin -Mx IV Tazocin D4: Constipation -Mx: Enema
Readmission in <30 days	Yes -D14 *wound infection*/superficial dehiscence -Wound swab: Coliforms -Mx: IV/PO co-amoxiclav, daily dressings -Discharged D20	No	No	No
If infection: Culture site/result	Wound swab: Staph aureus	Wound swab: No growth Blood culture: No growth	Wound swab: Anaerobic cocci MSSU: E Coli Blood culture: No growth	Blood culture: No growth

Obesity is a significant public health threat in the UK. The prevalence rates have increased significantly over the last thirty years and rose, between 1972 and 2002, by over 300% and 500% amongst 10-year-old boys and girls, respectively [5]. It has been projected that, if the trend continues, 60% of the UK population will be obese by 2050 [5].

Obesity is a well-established risk factor for the development of endometrial cancer, also carrying one of the greatest health threats to patients post-treatment. A standardised meta-analysis of multiple cancer types ranked the association of obesity with cancer risk highest for endometrial cancer, with a relative risk of 1.59 per 5 kg/m^2 incremental increase in BMI [3]. It has also been demonstrated that, in comparison to women without endometrial cancer, women with endometrial cancer have a significant increased risk of mortality from other obesity-driven health problems (e.g., type II diabetes, heart disease, and hypertension) [6]. Prospective analyses have shown that obesity class III is associated with a significantly increased risk of death from endometrial cancer [6].

The clinical management of endometrial cancer comprises surgical staging, sometimes followed by adjuvant treatment (i.e., chemotherapy, external beam radiation) dictated by a range of factors, including tumour stage, grade, cervical involvement, lymphovascular space invasion and the presence of lymph node and other extrauterine metastases. It has been shown that when MIS is employed, there is reduced post-operative complications without any impact on endometrial cancer overall survival [7–10].

However, the surgical management of endometrial cancer in women with obesity class II and III can be technically difficult. MIS is problematic in this group of patients with a high rate of conversion to laparotomy and therefore, many patients are not offered laparoscopic surgery. This high rate can be attributed to a range of factors. They commonly fit into two categories: surgical and anaesthetic. The abdominal wall visceral fat can make laparoscopic port placement difficult and can also hinder adequate movement of the laparoscopic instruments. The significant abdominal weight can cause further splinting of the diaphragm during trendelenburg tilt, a pre-requisite of laparoscopic pelvic surgery, which contributes to intra-operative ventilatory problems.

It has been shown that higher BMI results in higher peri-operative complication rates in both laparoscopy and laparotomy. The evolution of robot-assisted laparoscopic surgery carries the potential of a reduction in peri-operative complication rates but requires considerable investment in equipment and expertise by an institution to offer such a service [11,12]. It has been shown that rates of postoperative pyrexia and surgical site infection (SSI) increase with increasing BMI [13]. In this study the mean pannus weight was 9.55 kg; it would be reasonable to assume there was a reduction in BMI post-operatively. However, one of the limitations of this study is that we do not have complete post-operative BMI data to fully assess the impact of a reduction in BMI on the rates of postoperative pyrexia and SSI in patients undergoing panniculectomy.

Laparotomy (midline or transverse suprapubic), and intra-operative conversion to laparotomy, has significant challenges with restricted surgical access resulting in longer operating times, increased intra-operative complications, increased blood loss, and failure to adequately stage or cytoreduce the disease [14]. These patients are also at increased risk of the cluster of well-established post-operative complications; wound infection, wound dehiscence, urinary tract infection, vaginal vault collection, thromboembolic events, respiratory tract infection and cardiac problems. One limitation of this study is that we do not have complete data to assess

Other centres have proposed performing a panniculectomy at the start of the surgical procedure to facilitate adequate operative exposure. This technique has been shown to be safe in patients with class III obesity, with no significant increase in major peri-operative complications [15,16]. A multi-disciplinary surgical team approach further increases patient safety. A gynaecological surgical oncology team jointly working with a plastic surgery team brings together the necessary experience and skills to ensure the patient gets the best care, and consequently, the best chance of a good outcome. This does require considerable planning to ensure adequate theatre time and the presence of both specialist surgical teams at the same time. The procedure carries a high risk of wound complications and requires careful post-operative care by specialist teams to minimise this and reduce the time interval to adjuvant treatment for those women that require it. Further refinement of the surgical technique will also have an impact on peri-operative complications; it is technically possible to perform standard laparoscopic staging surgery following panniculectomy. This would reduce the trauma to the anterior abdominal wall and potentially result in more rapid wound healing.

Clearly, careful patient selection is the key for this intervention. Women with higher grade, higher stage, or synchronous malignancies are the ideal candidates. This is because those women with early stage, low grade disease can be managed conservatively using the Mirena IUS and a weight management programme, which may incorporate bariatric surgery, without impacting on cancer survival [17]. In some circumstances these interventions may cause cancer regression but in general they allow for the cancer surgery to be delayed until the woman is at a weight where the surgical intervention carries less peri-operative risk.

5. Conclusions

The early experience in NI of panniculectomy as an adjunct to endometrial cancer staging surgery confirms the data presented in the literature. It greatly facilitated surgical exposure and allowed adequate surgical staging to be per-

formed. Our success in this initial case series has created the potential for comparable management in future cases. In carefully selected cases, the surgical procedure can be completed safely and effectively with greater ease. Ongoing refinement of this approach in NI will result in a further reduction in perioperative morbidity.

Given the clear evidence of a linear increase in both endometrial cancer and obesity, we must be conscious that there is a real need for a major public health campaign to help reverse the UK's obesity epidemic and, ultimately, reduce the incidence of endometrial cancer [5,6]. An intervention such as this will take time to have the desired effect so, in the interim, the addition of panniculectomy to the surgical staging of endometrial cancer may facilitate safe hysterectomy for carefully selected women with class III obesity.

Author contributions

JPB and MHM designed the research study. JPB, SA, GVB, HA and EFC performed the research. SM, SS, and SPD helped design the surgical methodology. DG, SM, HN and MS provided guidance on recording and interpretation of peri-operative complications. PC oversaw medical photography. WGM performed pathological analysis and advised on manuscript development. JPB, SA, IJGH and MHM analysed the data. JPB and SA wrote the manuscript. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

Ethics approval and consent to participate

All subjects gave their informed consent, on regionally-approved consent forms, for inclusion in the case series and subsequent publication. Formal ethical approval was not sought as it was not deemed necessary given this was a review of clinical practice outcomes and informed consent had been sought.

Acknowledgment

We would like to express our gratitude to all those who helped us during the writing of this manuscript. Thank-you to the peer reviewers for their opinions and valuable suggestions.

Funding

This research received no external funding.

Conflict of interest

The authors declare no conflict of interest. JPB is the Review Board member of this journal, given his role as Review Board member, JPB was not involved in the peer-review of this article and has no access to information regarding its peer-review.

References

[1] Registry National Informatics Centre. Uterus Body Cancer. Queen's University: Belfast. 2017.

[2] Mullins MA, Cote ML. Beyond Obesity: the Rising Incidence and Mortality Rates of Uterine Corpus Cancer. Journal of Clinical Oncology. 2019; 37: 1851–1853.

[3] Renehan AG, Tyson M, Egger M, Heller RF, Zwahlen M. Body-mass index and incidence of cancer: a systematic review and meta-analysis of prospective observational studies. Lancet. 2008; 371: 569–578.

[4] Linkov F, Kokai L, Edwards R, Sheikh MA, Freese KE, Marra KG, *et al*. The role of adipose-derived stem cells in endometrial cancer proliferation. Scandinavian Journal of Clinical and Laboratory Investigation. Supplementum. 2014; 244: 54–58.

[5] Musingarimi P. Obesity in the UK: a review and comparative analysis of policies within the devolved administrations. Health Policy. 2009; 91: 10–16.

[6] Fader AN, Arriba LN, Frasure HE, von Gruenigen VE. Endometrial cancer and obesity: epidemiology, biomarkers, prevention and survivorship. Gynecologic Oncology. 2009; 114: 121–127.

[7] Mahdi H, Jernigan AM, Aljebori Q, Lockhart D, Moslemi-Kebria M. The impact of obesity on the 30-day morbidity and mortality after surgery for endometrial cancer. Journal of Minimally Invasive Gynecology. 2015; 22: 94–102.

[8] Janda M, Gebski V, Davies LC, Forder P, Brand A, Hogg R, *et al*. Effect of Total Laparoscopic Hysterectomy vs Total Abdominal Hysterectomy on Disease-Free Survival among Women with Stage i Endometrial Cancer: a Randomized Clinical Trial. Journal of the American Medical Association. 2017; 317: 1224–1233.

[9] Mourits MJE, Bijen CB, Arts HJ, ter Brugge HG, van der Sijde R, Paulsen L, *et al*. Safety of laparoscopy versus laparotomy in early-stage endometrial cancer: a randomised trial. The Lancet Oncology. 2010; 11: 763–771.

[10] Walker JL, Piedmonte MR, Spirtos NM, Eisenkop SM, Schlaerth JB, Mannel RS, *et al*. Laparoscopy compared with laparotomy for comprehensive surgical staging of uterine cancer: Gynecologic Oncology Group Study LAP2. Journal of Clinical Oncology. 2009; 27: 5331–5336.

[11] Zhao Y, Liu Z, Yu L, Liu S, Yan H, Zhang Y, *et al*. Robotic surgery in obese patients with early-stage endometrial cancer. Videosurgery and other Miniinvasive Techniques. 2020; 15: 171–175.

[12] Kitson SJ, Crosbie EJ. Endometrial cancer and obesity. The Obstetrician & Gynaecologist. 2019; 21: 237–245.

[13] Winfield RD, Reese S, Bochicchio K, Mazuski JE, Bochicchio GV. Obesity and the Risk for Surgical Site Infection in Abdominal Surgery. The American Surgeon. 2016; 82: 331–336.

[14] Crosbie EJ, Estabragh ZR, Murphy J, Ahmed AS, Slade RJ. Apronectomy combined with laparotomy for morbidly obese endometrial cancer patients. Surgical Oncology. 2011; 20: e187–e193.

[15] Tillmanns TD, Kamelle SA, Abudayyeh I, McMeekin SD, Gold MA, Korkos TG, *et al*. Panniculectomy with simultaneous gynecologic oncology surgery. Gynecologic Oncology. 2001; 83: 518–522.

[16] Hopkins MP, Shriner AM, Parker MG, Scott L. Panniculectomy at the time of gynecologic surgery in morbidly obese patients. American Journal of Obstetrics and Gynecology. 2000; 182: 1502–1505.

[17] Barr CE, Ryan NA, Derbyshire AE, Wan YL, MacKintosh ML, McVey RJ, *et al*. Weight loss during intrauterine progestin treatment for obesity-associated atypical hyperplasia and early stage cancer of the endometrium. Cancer Prevention Research. 2021. (in press)