Review

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Melanoma Management

Organ-sparing central pelvic compartment resection for the treatment of vulvo-vaginal melanomas

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Practice points

- Vaginal melanoma is a rare gynecological malignancy, with the poorest survival compared with other diseases.
- Surgery is the mainstay of treatment, but 5-year survival still only between 13% and 32.3%.
- Disease involving the upper 2/3rd of the vaginal is usually treated with total pelvic exenteration.
- Central pelvic compartment resection (CPCR) is a proposed surgical alternative to total pelvic exenteration, aiming to avoid the morbidity associated with double stomas.
- Disease involving the urethra requires excision and a permanent suprapubic catheter at the time of CPCR.
- A laparoscopic approach to CPCR should be considered to reduce blood loss and expedite recovery compared with open surgery.

Vulvo-vaginal melanomas are one of the rarest gynecological oncology diseases with a poor survival compared with other malignancies. The 5-year survival varies from 13% to 32.3%. Vulvo-vaginal melanomas involving the upper 2/3rds of the vagina are usually treated with total pelvic exenteration (TPE). TPE surgery carries a 50% risk of major complications and also morbidity associated with double stomas. Central pelvic compartment resection is a novel organ-sparing surgical approach entailing radical total laparoscopic hysterectomy, bilateral salpingo-oophrectomy, laparoscopic vaginectomy and vulvectomy to reduce morbidity compared with TPE. Permanent suprapubic catheters are used if there is urethral involvement but require quality of life studies to assess their long-term outcomes.

Tweetable abstract: A study by the Cambridge GONC team suggests central pelvic compartment resection (CPCR) is a promising surgical treatment for vulvo-vaginal melanomas involving the upper 2/3rds of the vagina to reduce morbidity. #CPCR

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Vaginal melanoma is the rarest gynecological malignancy, accounting for <3% of new cancer diagnosis but also has the poorest survival [1]. The 5-year survival in vaginal melanoma varies between 13% and 32.3% in the literature [2–4]. In the UK, the overall incidence of combined new vaginal cancer diagnoses is 0.4 per 100,000 [5]. Vaginal melanoma typically presents in the 6th to 7th decades of life [6]. Similar to other cancers, lymph node status and depth of invasion are important predictors of prognosis [7].

Low survivorship of this disease may be attributable to the lack of understanding of its pathogenesis [8]. The malignancy arises from melanocytes within the vagina and usually affects the lower third of the vagina [9]. The exact mucosal melanocyte oncogenesis is unknown, but the tyrosine kinase receptor KIT gene has been implicated [10]. Of interest, there are increased copy numbers and structural alterations in vaginal compared with cutaneous melanomas suggesting a different tumour biology [11].

Surgery is the mainstay treatment in the management of genital mucosal melanomas [12]. Medical therapies include radiotherapy and immunotherapy but have not proven to be effective. From a surgical perspective, a consensus has not been reached on whether radical surgery improves survival [13].

Future Medicine

The extent of resection depends on the location and volume of disease. There is conflicting evidence on the amount of tumour free surgical margin required for local disease control, and a more conservative approach has been advocated [14]. Disease in the lower third of the vagina can be treated with wide local excision. Total pelvic exenteration (TPE) is usually reserved for disease involving the upper two thirds of the vagina [15]. Exenterative surgery is associated with significant surgical risks, with rates of major complications of up to 40.4% [16]. Despite this radical approach to providing local disease control, it does not eliminate the high risk of recurrence [17]. TPE also has a major impact on quality of life (QoL) after surgery. Radical surgical options are reserved for management of loco-regional disease control.

In the UK, melanomas are managed at tertiary cancer centers within a multidisciplinary (MDT) melanoma team. The team consists of a medical oncologist, gynecological oncologist, plastic surgeon and a psychologist. The patient has an appointed care lead – either a medical oncologist with site specific expertise, or gynecological oncologist [18]. At present, the AJCC staging for cutaneous melanomas is used for staging vulvovaginal melanomas in UK guidance [18]. Decisions surrounding surgery for vulvovaginal melanoma are discussed within the MDT, to carefully weigh the risks and benefits. Radical surgery can be considered once low volume metastatic disease has been excluded with PET-CT and MRI brain [18]. At present the most common radical surgical procedure for locally advanced vaginal melanoma is TPE.

We present a minimal access surgical technique of "central pelvic compartment resection" (CPCR) to treat stage II and III vaginal melanomas. Presently in the UK, the surgical practice is TPE in these circumstances with significant associated morbidity. Our procedure is palliative in view of the limited 5-year survival rates of 13–32.3%.

Our technique applies the concept that gynecological tumors are confined to compartments defined by their embryological origin, first modelled on cervical cancer [19]. We will describe our surgical technique in detail with results from three surgical cases using this method. The safety and outcomes of this technique will then be evaluated. Implications for future practice will also be explored.

Materials & methods

Case selection

Surgical cases referred to melanoma MDT between 2015 and 2021 at Cambridge University Hospitals and Oxford University Hospitals for stage II and III disease were selected for review. There were three cases identified over this time period. All patients in the study were counselled in clinic regarding the radical surgical options of TPE or CPCR following MDT approval for surgery. The patients were given literature to read on both procedures with time to contemplate their treatment options. None of the patients opted for vaginal reconstruction although this was discussed at the counselling. A second opinion was also sought from another gynecological oncologist at the cancer centre prior to proceeding with CPCR surgery.

Pre-operative investigations

Vulvo-vaginal mucosa patients had a full body staging CT scan prior to discussion in the first MDT meeting. All cases also underwent PET-CT and MRI brain to exclude low volume disease prior to proceeding with surgery. Molecular analysis for *BRAF* and *C-KIT* mutations was carried out. Only patients positive for either/both of these mutations received systemic therapy.

Surgery & adjuvant treatment

All patients had CPCR surgery using a combined laparoscopic and perineal approach. The laparoscopic approach was straight-stick rather than robotic.

The surgical cases were performed between 2015 and 2021 at Cambridge University Hospitals and Oxford University Hospitals. Postoperative complications were defined as early if occurring within ≤30 days or late if occurring 31–180 days after surgery. Complications were graded using a validated institutional scale.

In line with current UK guidance, sentinel lymph node biopsy and systematic lymphadenectomy were not performed in any of our cases. All patients were BRAF and C-KIT negative, hence did not receive systemic therapy. Similarly, adjuvant radiotherapy was not administered but radiotherapy was used for recurrent disease.

Surgical technique

To achieve clear margins of the loco-regional melanoma, we perform a radical hysterectomy, bilateral salpingo-oophorectomy, and total colpectomy. A total colpectomy requires removal of the cervix, hence our technique

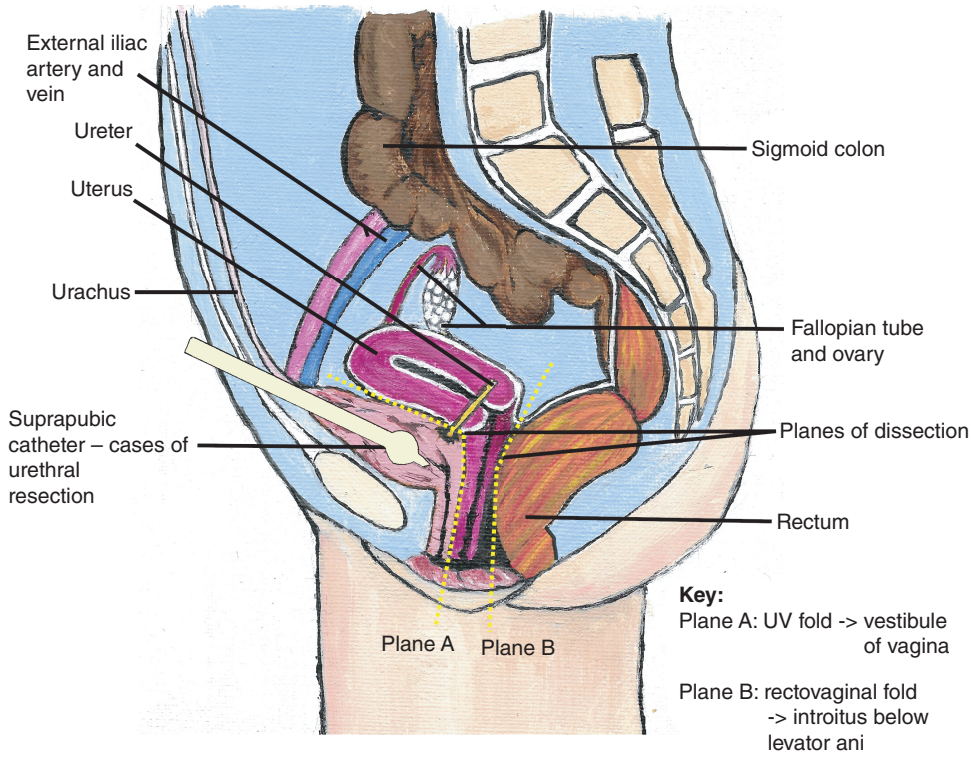

Figure 1. Sagittal view of dissection planes.

incorporates a hysterectomy. A simple or radical vulvectomy is performed depending on the vulval margins required. The patient is placed in Lloyd-Davies position and laparoscopic entry is achieved by either an open or closed approach. After initial evaluation of the abdominal and pelvic cavity for any unexpected peritoneal disease, dissection of pelvic organs commences. All anatomical spaces are opened and dissected using an advanced bipolar energy device. Initially the pelvic side walls are opened bilaterally, initiating with dissection of round ligaments, broad ligaments and medialisation of pelvic peritoneum that overlies the external iliac vessels. Initial dissection is extended up to the common iliac vessels. The para-rectal and para-vesical spaces are then opened with preservation of ureteric blood supply.

The ureters are carefully dissected without comprising their blood supply, hence ureteric stents are not required. To achieve clear margins, a complete urethral resection with a suprapubic catheter inserted at the time of surgery may be necessary. In these cases, the bladder is closed with 2/0 Vicryl sutures in two layers. For partial urethrectomy, the distal urethra is closed with 2/0 Vicryl in two layers. Our urology surgeon performed all urethral resections and also inserted the suprapubic catheters.

The uterine artery is secured at its origin. Following opening of these spaces, the vesico-cervical, vesico-vaginal and recto-vaginal spaces are dissected, shown in planes A and B in Figure 1 and plane C in Figure 2. Vesico-uterine ligaments are carefully dissected to mobilise the bladder. The bladder is reflected caudally while dissecting in the vesico-vaginal space. Care should be taken to avoid bleeding from the vaginal plexus.

Laparoscopic dissection is continued until vaginal introitus, inferior to the levator muscles with preservation of puborectalis, pubococcygeus and iliococcygeus. The urethra and urogenital diaphragm are carefully dissected to avoid damage. The remainder of the surgery is undertaken via a perineal approach to protect the external anal sphincter, vestibule and urethra. To complete surgery, a radical vulvectomy is performed with clear margins. Urethral involvement requires surgical resection of the urethra and placement of a permanent suprapubic catheter. Frozen section is an unreliable predictor of margins in melanoma according to current pathology recommendations [20]. Therefore, frozen section was not used to evaluate our urethral resection margins. A suprapubic catheter was chosen over ileal conduits and urostomy after consultation with the urology specialists at our institutions and based on patient preference. Patients were offered options of either a suprapubic catheter or neobladder when urethral involvement was found preoperatively. Vulvovaginal melanoma carries a particularly poor prognosis and therefore

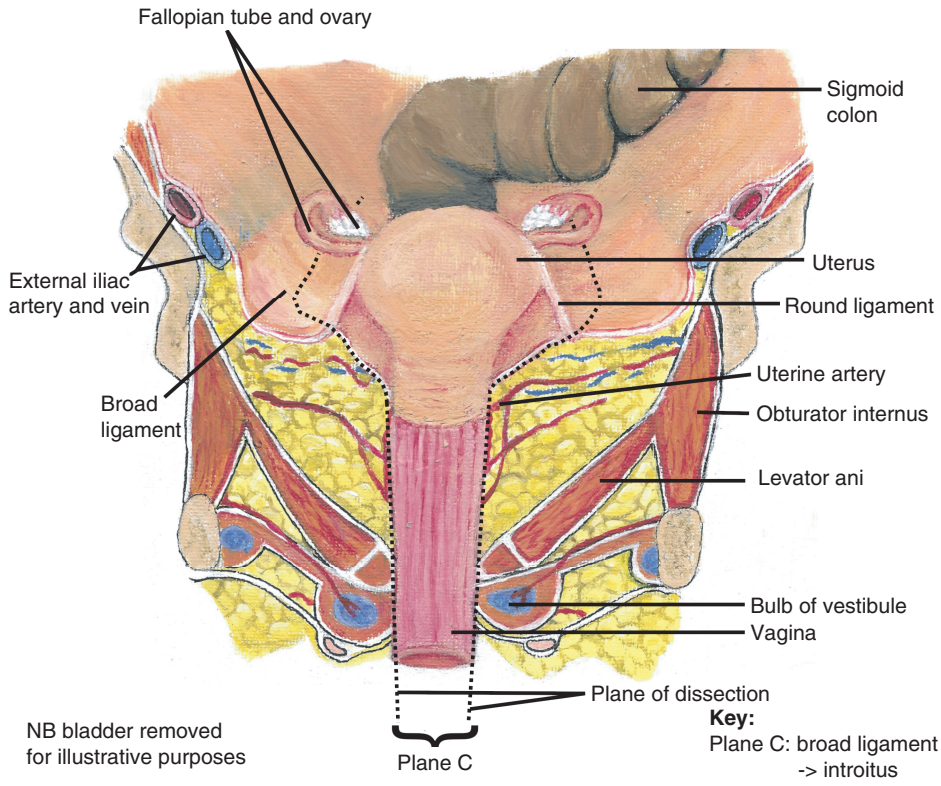

Figure 2. Frontal view of dissection planes.

the urology specialists viewed the surgery as palliative. Therefore, the MDT consensus decision was made for a permanent suprapubic catheter in cases of urethral involvement to reduce morbidity associated with a urostomy. All procedures were performed by the same gynecological oncology surgeon.

Post operative follow-up

All patients were closely followed up after surgery as per the UK melanoma guideline every 3 months for the first 3 years and 6 monthly thereafter.

Literature search strategy

A systematic literature search on surgical treatment of vaginal melanoma was conducted with the PubMed and Embase databases (search date 2023-04-27; time restriction to last 35 years; 1988–2023) using the search terms ("melanoma" [MeSH Terms] OR "melanoma" [All Fields]) AND ("vagina" [MeSH Terms] OR "vagina" [All Fields]) AND ("surgery" [MeSH Terms] OR "surgery" [All Fields]). The primary purpose of this review was to determine the survival in women undergoing surgery for vaginal melanoma. A total of 183 citations were identified for the purpose of this review. Studies with duplicates, no surgery, less than five patients and review articles were excluded. The full texts were retrieved for 8 studies which were analysed for this review. All eight studies on surgical survivorship for vaginal melanoma were retrospective case series. Figure 3 depicts the literature search algorithm on surgical survivorship for vaginal melanoma.

Similarly, a systematic literature search on minimal access pelvic exenterations was conducted with the PubMed and Embase databases (search date 1 May 2023; time restriction to last 23 years; 2000–2023) using the search terms ((pelvic exenteration) OR (pelvic exenteration [MeSH Terms])) AND ((minimal access surgical procedures) OR (minimal access surgical procedures [MeSH Terms])) AND ((gynecological oncology) OR (gynecological oncology [MeSH Terms])). The primary purpose of this review was to identify surgical complications (early and late) in women who underwent gynecological oncology pelvic exenterations via a minimal access surgical approach. A total of 51 citations were identified for the purpose of this review. All types of minimal access gynecological oncology pelvic exenterations were considered given vulvo-vaginal melanoma is a rare pathology with limited minimal access

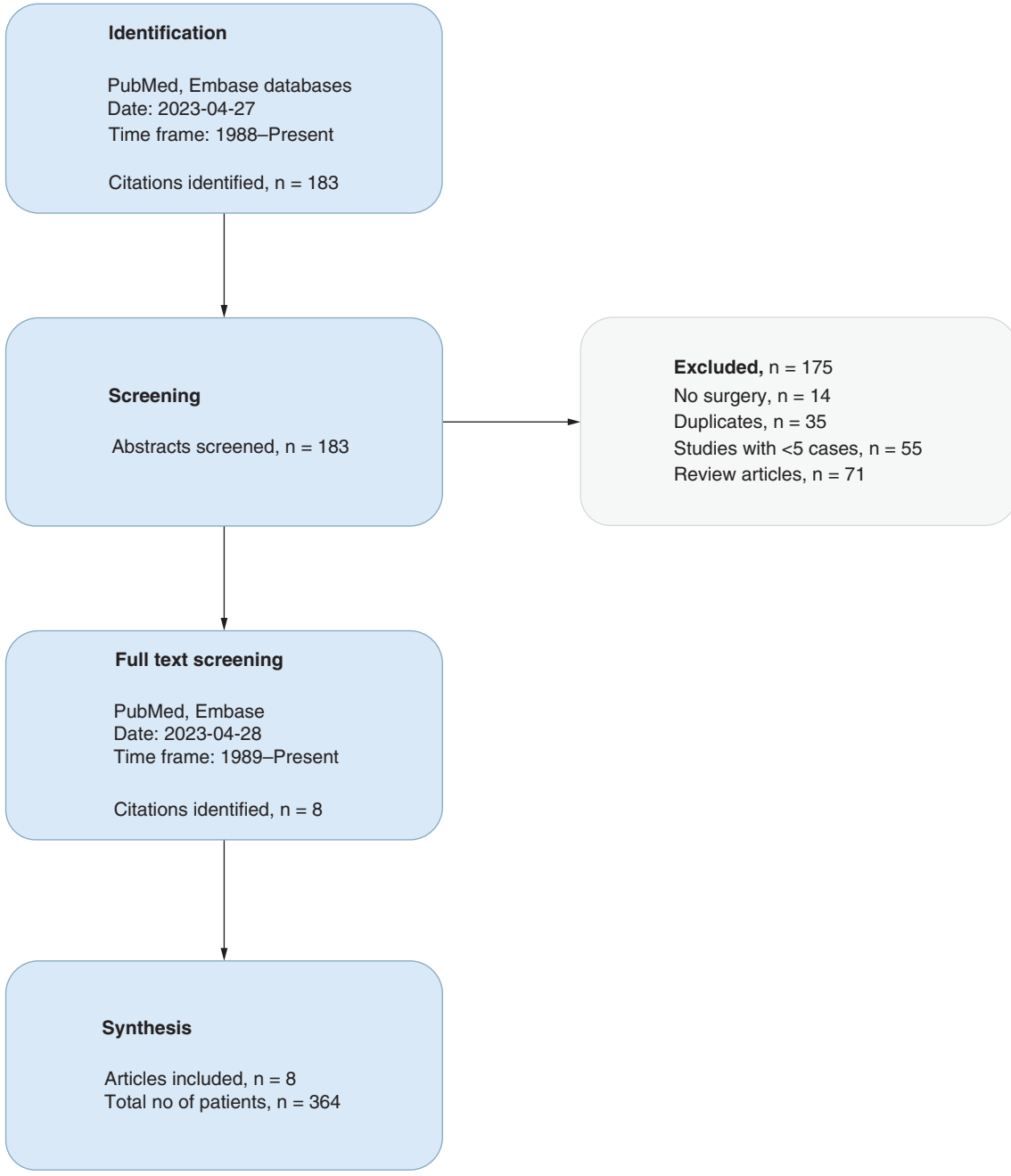

Figure 3. Flow diagram for literature search on surgical survivorship for vaginal melanoma.

cases in the literature. Duplicate studies and studies with less than five patients, irrelevant studies and studies where surgical complications were not identified as early/late were excluded. The full texts were retrieved for 6 studies which were analysed. All 6 of these studies were retrospective case series. Figure 4 depicts the literature search algorithm for surgical complications following a minimal access approach to gynecological oncolology pelvic exenterations.

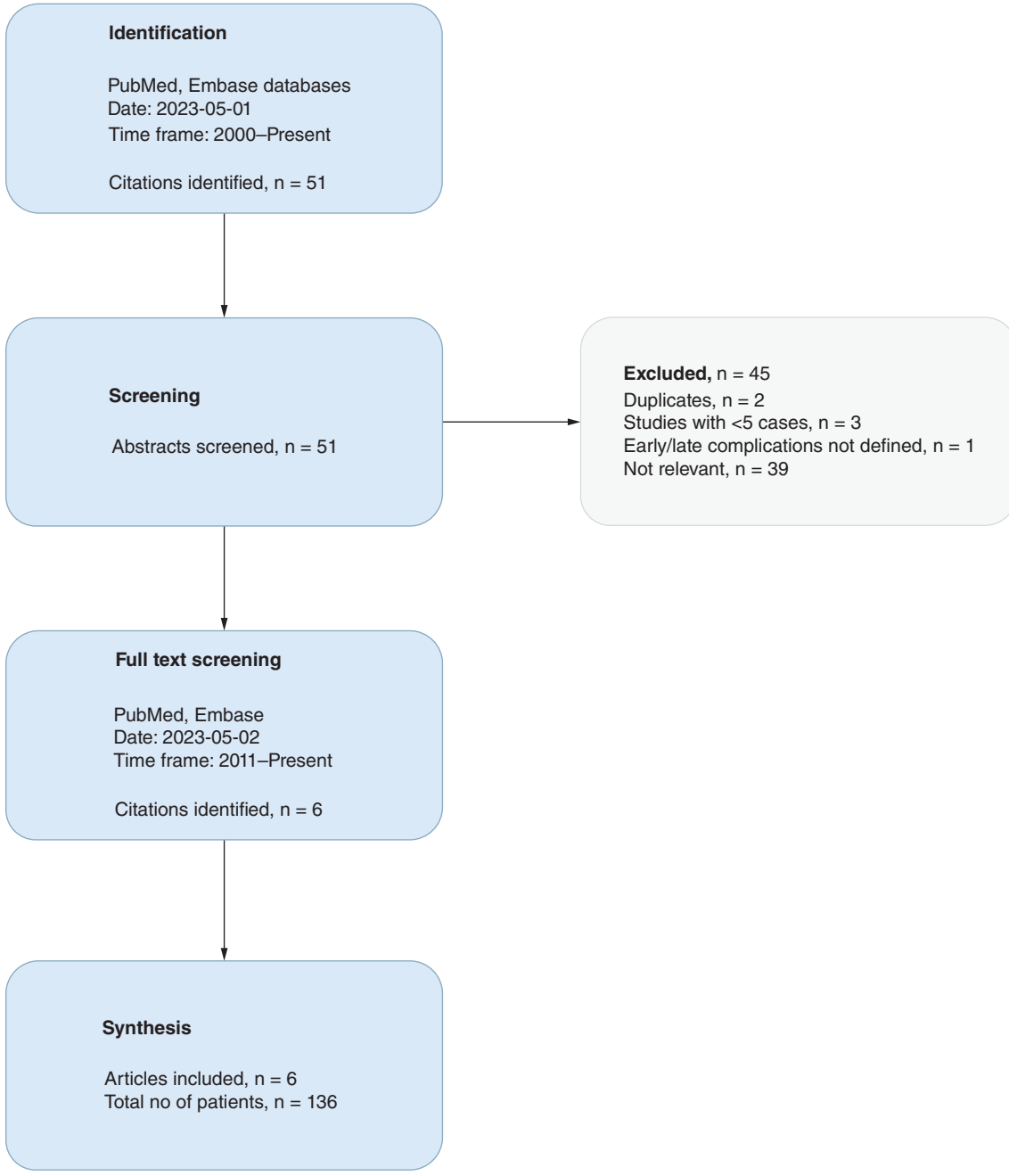

Figure 4. Flow diagram for literature search on surgical complications following minimal access approach to gynecological oncology pelvic exenterations – all types and pathologies.

Results

Review of clinical cases & technique

Case 1

A 69-year-old lady with hypertension presented with a four-month history of heavy vaginal bleeding. On clinical examination there was evidence of vulvo-vaginal melanoma involving the entire urethra, vulva and with vaginal skip lesions. The disease was stage IIc (T4b, N0, M0) with no low volume metastasis identified on imaging.

The patient elected for CPCR which was performed in February 2015 at Oxford University Hospitals. A radical vulvectomy with rhomboid flap reconstruction was performed. To achieve clear surgical margins, the complete urethra was also resected, hence the need for a permanent suprapubic catheter. Intraoperatively, the

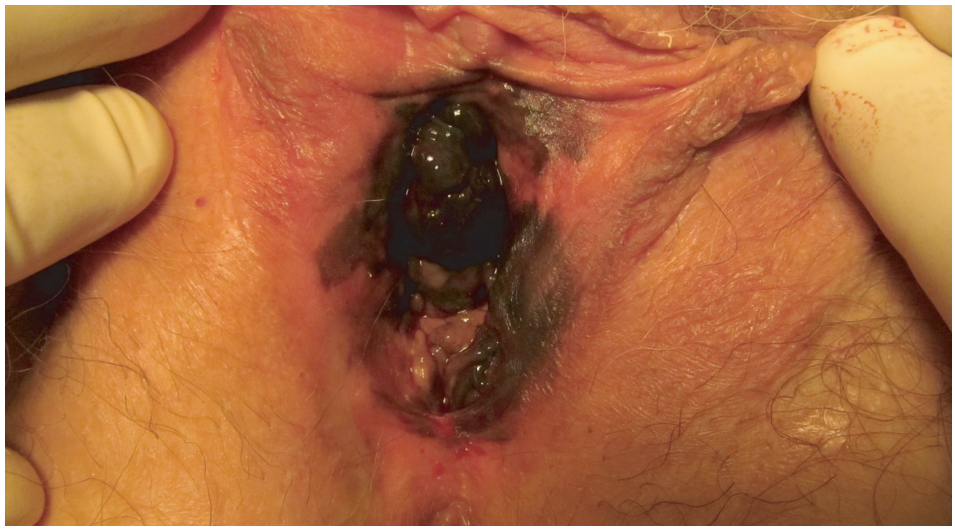

Figure 5. Vulvo-vaginal melanoma seen during clinical examination – case 3.

vaginal melanoma was found to be close to the cervix, requiring a radical hysterectomy. However, final histology showed that the cervix was not involved.

The total surgical time was 360 minutes with a blood loss of 400 mls. The histology demonstrated clear surgical margins, with the closest margin being 8 mm (3 o'clock margin of vagina). On day 5 postoperatively she developed a urinary tract infection (UTI) which was treated with oral antimicrobial therapy. She was discharged 5 days after surgery. Four weeks after discharge the patient developed bladder spasms from the suprapubic catheter. This resolved at 9 months post operatively after titrating the medical therapy (oxybutynin).

At six months postoperatively she developed a left groin node metastasis. This was treated with an en bloc groin dissection and external beam radiotherapy. At 36 months postoperatively she developed a second recurrence with brain metastasis. The melanoma oncologist treated this with further radiotherapy. She died at 82 months postoperatively of abdominal metastatic disease.

Case 2

A 58-year-old lady with hypertension presented with a two-month history of vaginal bleeding and vaginal odour to Oxford University Hospitals. On examination there was evidence of vulval and vaginal skip lesions with almost complete involvement at both anatomical sites. The distal third of the urethra was also involved. The disease was stage IIb (T3b, N0, M0) with no low volume metastasis found.

The patient selected CPCR over TPE. The CPCR procedure was performed in May 2017. A radical vulvectomy with rhomboid flap reconstruction was performed. The complete urethra was also resected to allow for appropriate surgical margins. A suprapubic catheter was inserted intraoperatively. Intraoperatively, the vaginal melanoma was found to be close to the cervix, requiring a radical hysterectomy. However, final histology showed that the cervix was not involved.

The procedural time was 330 minutes with a total blood loss of 200 mls. The histology demonstrated clear surgical margins, with the closest margin being 10 mm (9 o'clock margin of vagina).

Postoperatively the patient had an uncomplicated recovery and was discharged home on day 2. At 11 months postoperatively she developed brain metastasis which was treated with radiotherapy. The patient died at 18 months postoperatively.

Case 3

A 58-year-old lady presented with a five-month history of light vaginal bleeding and vaginal pruritus to Cambridge University Hospital. She had no underlying medical co-morbidities. Clinical examination demonstrated complete involvement of the vagina, vulva and cervix (Figure 5). The disease was stage IIb (T3b, N0, M0) with no low volume metastasis found.

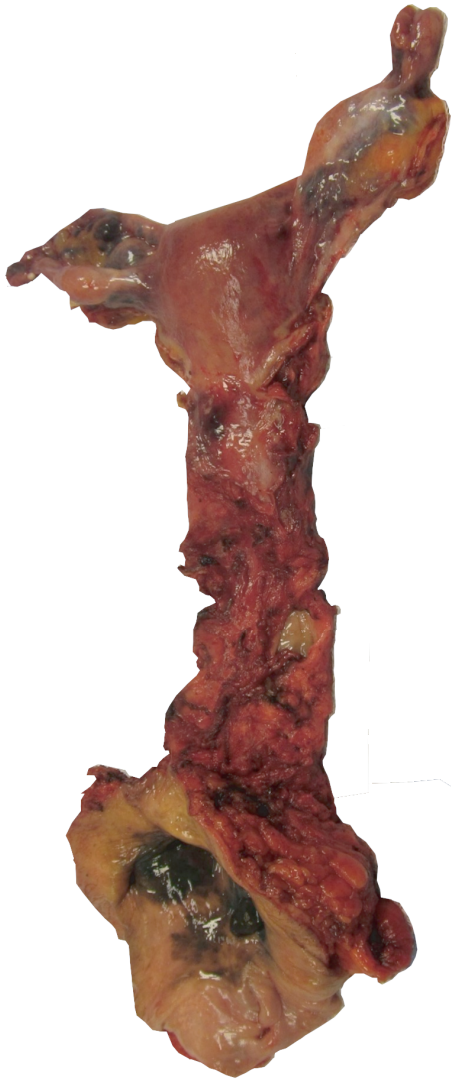

Figure 6. En bloc specimen using central compartment exenteration technique – case 3.

The patient was counselled in clinic about CPCR with sparing of the proximal urethra. A simple vulvectomy was performed as there was minimal vulval disease at the intoitus. The patient underwent surgery in November 2021. The surgical time was 300 minutes with a blood loss of 150 mls. The histology demonstrated clear surgical margins, with the closest margin being 4 mm (6 o'clock posterior margin vagina). The en bloc specimen is shown in Figure 6. The postoperative laparoscopic view of the pelvis is shown in Figure 7.

Following surgery, there were no immediate postoperative complications and the patient was discharged on day 2. On day 21 she re-presented in acute urinary retention. A decision was made for a permanent suprapubic catheter after discussion with the urology team. This was inserted under local anaesthetic by the urology team. To date there has been no recurrent disease with current overall survival of 16 months.

Summary of case series

In our case series, all three patients had a CPCR for vulvo-vaginal melanoma. Table 1 summarises our patient demographics and surgical data including the closest margin. The age range was 58–69 years old. All vulval excision margins were >20 mm for all three cases. The operative time was 300–360 minutes and decreased in a temporal manner. The blood loss ranged from 150 to 400 mls and also decreased in a temporal manner. There were no intraoperative complications in our case series. The length of stay (LOS) ranged from 2 to 5 days. Our postoperative complications were a UTI on day five and urinary retention on day 21 in patient 1 and 3, respectively. None of the patients were given adjuvant radiotherapy given the clear surgical margins as per UK guidance [18]. None of the patients were given adjuvant systemic therapy given their negative mutation testing.

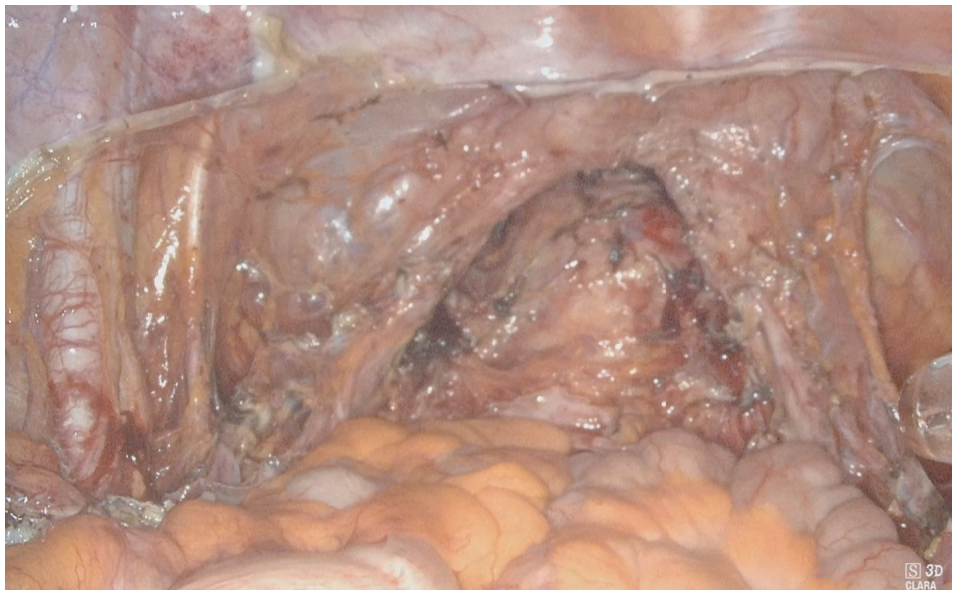

Figure 7. Postoperative laparoscopic view of pelvis – case 3.

Table 1. Patient demographics and surgical outcomes.

Parameter	Patient No.					
	1		2		3	
Age (years)	69		58		58	
BMI (kg/m^2)	27		25		23	
Co-morbidities	Hypertension		Hypertension		Nil	
Organ involvement	Urethra	Complete	Urethra	Distal 1/3rd	Urethra	Distal 10 mm
	Vulva	Complete with skip lesions	Vulva	Complete with skip lesions	Vulva	Complete
	Vagina	Complete with skip lesions	Vagina	Complete with skip lesions	Vagina	Complete with skip lesions
	Cervix	Not involved	Cervix	Not involved	Cervix	Complete
Depth of invasion (mm)	>9		>9		9	
Stage (T, N, M)	IIc (T4b, N0, M0)		IIb (T3b, N0, M0)		IIb (T3b, N0, M0)	
Date of surgery (mm-yyyy)	02-2015		05-2017		11-2021	
Closest margin (mm) (anatomical position)	8 (3 o'clock margin of vagina)		10 (9 o'clock margin of vagina)		4 (6 o'clock posterior margin vagina)	
Surgical time (mins)	360		330		300	
Bloods loss (mls)	400		200		150	
Length of stay (days)	5		2		2	
Early post-op complications (Clavien-Dindo grade)	Yes (Grade II)		No		Yes (Grade IIIa)	
Late post-op complications	No		No		No	
Progression-free survival (months)	6		11		–	
Overall survival (months)	82		18		16 (alive)	

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Table 2. Literature review on surgical survivorship of vaginal melanoma.

Study	n	Median age (years)	No. treated with surgery	No. treated with radical surgery	Progression-free survival (months)	Median overall survival (months)	No. with margin involved	Ref.
Cobellis *et al.*	15	55	13	11	8.5	19	Not stated	[21]
Ferraioli *et al.*	16	61.6	9	3	11.8 (2–49)	30.4 (11–144)	3	[23]
Frumovitz *et al.*	37	60.6	33	4	11.4	19.1	6	[24]
Huang *et al.*	31	58	22	Not stated	Not stated	20.1	Not stated	[4]
Janco *et al.*	14	Not stated	14	6	6	25.2	Not stated	[25]
Kirschner *et al.*	201	68.3	141	52	Not stated	14	Not stated	[2]
Miner *et al.*	35	62	24	12	12	25	2	[22]
Reid *et al.*	15	66	13	3	Not stated	30	2	[26]

Review of the literature

The literature of vulvovaginal melanomas is limited to retrospective case series due to the rarity of the disease. While mucosal melanomas are mainly treated with surgery, overall survival is poor. The overall survival in the literature is from 14 to 30.4 months (Table 2). The age ranged from 55 to 68 years old. Radical surgery does not appear to improve the overall survival outcome, demonstrated by the case series with a larger cohort of radical surgery by Cobellis *et al.*, Kirschner *et al.*, Miner *et al.* which report overall survivals of 14–25 months [2,21,22].

Mucosal melanomas demonstrate a pattern of early loco-regional recurrence despite clear surgical margins. Progression-free survival is only 11.8–12 months in two the case series despite achieving clear surgical margins in the majority of these cases [22,23].

Literature on minimal access pelvic exenterations for gynecological malignancies is also limited to retrospective case studies. Survival data from these studies involve cervical and endometrial disease in the majority of cases which is not directly comparable to vaginal melanoma with its low survivorship. However, patient demographics and surgical complications of these studies need to be evaluated.

There was a total of 119 anterior pelvic exenterations (APEs), four posterior pelvic exenterations (PPEs) and 13 TPEs. The minimal access experience with PPE and TPE within the literature is more limited compared with APE. The individual minimal access pelvic exenteration case series studies in Table 3 show collated tumour site data. There were more pelvic exenterations (PEs) for the treatment of cervical cancer compared with other gynecological oncology malignancies with 111 cases of the total of 136 surgical cases (82%) [27–30]. The ages ranged from 50 to 72 years old in these studies. The operative time ranged from 305 to 600 minutes. The blood ranged from 135 to 400 ml. The length of stay highly variable, ranging from 6.5 to 26.5 days. The early surgical complications included 19 infection related, 11 related to urinary diversion system, eight related to bowel and five associated with wound complications. In contrast, the late complications were largely associated with the stomas with six infection-related, 12 related to the urinary diversion system, 10 bowel-related and two associated with wound complications.

CPCR in relation to the literature

Limiting the extent of radical surgery based on embryological origins has been used with some success in locally advanced cervical cancer. Hockel reports recurrence rates of 7.8% over 24 months in a cohort of 116 open surgical cases for advanced cervical cancer [19]. Our initial experience with locally advanced vaginal melanoma would suggest that a similar concept could be applied for treatment of this disease. CPCR through the route of minimal access surgery appears to be feasible and is associated with low intraoperative blood loss, rapid recovery and short hospital stays.

There was a short progression-free survival with a range of 6 to 11 months despite complete surgical resection margins in our three cases. This is comparable to the PFS of 6 to 12 months for vaginal melanoma within the literature (Table 2). Our early recurrences were in the groin and brain, similar to the regional/distal metastatic sites described within the literature [17]. Both patients subsequently died from their metastatic disease. Our OS of 16 to 82 months aligns with the OS of 14 to 30.4 months within the literature but more cases are required for an accurate comparison. OS and PFS are typically low in locally advanced melanoma of the female genital tract. The high rates of recurrent metastatic disease and low long term survival rates were behind the goal of reducing surgical morbidity without sacrificing local control. We suggest that the focus of surgical decision making should be on preserving function and quality of life for women affected by this challenging condition.

Table 3. Literature review of surgical complications with minimally invasive pelvic exenteration.

Study	No. cases	Tumor sites		Type of exenteration		Median age	Median blood loss (ml)	Operative time (min)	Length of stay (days)	Complications				Ref.
	Early									Late				
Type										n	Type	n		
Bizzarri *et al.*	23	Cervical	10	Anterior	18	64	400	540	10	Infection	3	Infection	4	[27]
		Endometrial	9	Total	5					Urinary diversion	2	Urinary diversion	4	
		Vaginal	3									Bowel	1	
		Urothelial	1											
Jain *et al.*	14	Cervical		All anterior PE		52.5	135	305	6.5	Infection	1	Infection	1	[28]
										Urinary diversion	1	Urinary diversion	1	
										Bowel	4	Bowel	5	
Karkia *et al.*	6	Cervical	1	Anterior	2	63	400	600	8	Infection	1	None		[24]
		Endometrial	2	Posterior	3					Urinary diversion	1			
		Vaginal	1	Total	1									
		Vulval	1							Wound problems	1			
		Bartholin's	1											
Martínez *et al.*	14	Cervical	7	Anterior	8	72	400	339	26.5	Urinary diversion	5	Urinary diversion	4	[29]
		Uterine	1	Posterior	3					Bowel	4	Bowel	0	
		Vulvar	4	Total	3									
		Urethral	1							Wound problems	4	Wound problems	2	
		Rectal	2											
Nguyen Xuan *et al.*	5	All cervical		Anterior	3	58.5	Not stated	402	11.5	Infection	5	Urinary diversion	1	[25]
				Posterior	1							Bowel	1	
				Total	1							Wound problems	1	
Puntambekar *et al.*	74	All cervical		All anterior		50	160	180	6	Infection	9	Infection	1	[30]
										Urinary diversion	2	Urinary diversion	2	
												Bowel	3	

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Discussion

The established option of TPE is associated with high rates of morbidity associated with the double stomas [24]. The TPE procedure also results in a total change in body image and associated psychological distress from permanent double stomas [25]. Similarly, APE is also associated with morbidity related to late stoma complications from the urinary diversion system, evidenced by the large case series by Puntambekar *et al.* [30]. In comparison, the CPCR surgical technique can preserve gastrointestinal function without compromising the surgical margins. With CPCR we are also able to eliminate stoma complications, thus reducing the cost of surgical aftercare.

Our CPCR technique appears to have a reduced length of stay compared with minimal access studies within the literature (Table 3). While our study has a small sample size, our LOS was 2–5 days compared with 6–26.5 days in the literature (Table 3). The reduction in length of stay with the CPCR technique will result in a reduction in the total cost of the surgical admission compared with exenteration procedures. The reduced LOS seen in CPCR may be related to no early stomal complications and smaller areas of dissection compared with exenterations, leading to a faster recovery.

The laparoscopic approach to gynecological surgery is now well established as a means of reducing morbidity, particularly related intraoperative blood loss, postoperative pain and LOS and is now the mainstay of the management of endometrial cancer [26]. As a result, most UK gynecological oncology centres have significant experience in pelvic laparoscopic surgery and would be well placed to adopt the CPCR technique. Although our experience is with straight-stick, the surgical time required for CPCR bodes well for the application of robotic surgery. A UK centre has already adopted this robotic approach for pelvic exenterations in the treatment gynecological oncology malignancies [31].

A weakness with the CPCR technique is the potential risk of complications associated with the use of permanent suprapubic catheters for cases involving urethral resection. The suprapubic catheter tract and tube carries a risk of urinary infection from colonisation as evidenced by early UTI in case 1 of our study. In comparison to urinary diversion, there is an increased risk of obstructive uropathy arising from catheter blockage. This could lead to an acute kidney injury (AKI) with recurrent episodes also predisposing to chronic kidney disease (CKD). Also, if the catheter dislodges, there are potential delays associated with re-insertion if the tract closes. A long-term suprapubic catheter also has an aftercare cost associated with the recommended 12-week catheter change schedule in the community.

When reviewed in clinic, our postoperative patients have not reported serious long-term complications or poor quality of life associated with suprapubic catheters. We suggest that future studies apply quality of life tools, such as the SF-36 to better understand the effect of suprapubic catheters on quality of life [32].

Conclusion

Vulvo-vaginal melanoma is a rare gynecological oncology disease. From our review of cases, our palliative CPCR procedure appears to reduce morbidity compared with pelvic exenterations. The disease carries a poor survivorship thus warranting a less radical approach aimed at preserving quality of life.

A laparoscopic approach has meant minimal blood loss and early hospital discharge in our case series. A larger cohort of patients undergoing this minimally invasive technique of CPCR for vulvo-vaginal melanoma is needed to better evaluate long term complications and survivorship. The long surgical time associated with this CPCR is ideally suited to robotic surgery to reduce surgeon fatigue. A robotic approach should be considered for any future studies.

Future Perspective

Surgery is likely to continue serving as the primary treatment for vulvo-vaginal melanomas. We are confident that minimal access surgery with robotics will emerge as the prevailing method for conducting central pelvic compartment resection given their widespread adoption at UK cancer centres. Robots are particularly suited to these lengthy procedures, where they offer unmatched precision and reduce fatigue of the surgeon.

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No writing assistance was utilized in the production of this manuscript.

Ethical conduct of research

The authors state that they have obtained verbal and written informed consent from the patient/patients for the inclusion of their medical and treatment history within this case report.

References

Papers of special note have been highlighted as: • of interest; •• of considerable interest

1. Paravathaneni M, Edlukudige Keshava V, Baralo B, Thirumaran R. Primary Vaginal Malignant Melanoma: A Case Report and Review of Literature. *Cureus* 12(9), e10536 (2020).
2. Kirschner AN, Kidd EA, Dewees T, Perkins SM. Treatment approach and outcomes of vaginal melanoma. *Int. J. Gynecol. Cancer* 23(8), 1484–1489 (2013).
3. Ragnarsson-Olding B, Johansson H, Rutqvist LE, Ringborg U. Malignant melanoma of the vulva and vagina. Trends in incidence, age distribution, and long-term survival among 245 consecutive cases in Sweden 1960–1984. *Cancer* 71(5), 1893–1897 (1993).
4. Huang Q, Huang H, Wan T, Deng T, Liu J. Clinical outcome of 31 patients with primary malignant melanoma of the vagina. *J. Gynecol. Oncol.* 24(4), 330–335 (2013).
5. National Cancer Registration and Analysis Service. Cancer Registration Statistics, England (2020). www.cancerdata.nhs.uk/incidence_and_mortality
6. Piura B. Management of primary melanoma of the female urogenital tract. *Lancet Oncol.* 9(10), 973–981 (2008).
7. Gadducci A, Carinelli S, Guerrieri ME, Aletti GD. Melanoma of the lower genital tract: prognostic factors and treatment modalities. *Gynecol. Oncol.* 150(1), 180–189 (2018).
8. Lorenz A, Kozłowski M, Lenkiewicz S, Kwiatkowski S, Cymbaluk-Płoska A. Cutaneous Melanoma versus Vulvovaginal Melanoma-Risk Factors, Pathogenesis and Comparison of Immunotherapy Efficacy. *Cancers (Basel)* 14(20), (2022).
9. Gökaslan H, Sişmanoğlu A, Pekin T, Kaya H, Ceyhan N. Primary malignant melanoma of the vagina: a case report and review of the current treatment options. *Eur. J. Obstet. Gynecol. Reprod. Biol.* 121(2), 243–248 (2005).
10. Beadling C, Jacobson-Dunlop E, Hodi FS *et al.* KIT gene mutations and copy number in melanoma subtypes. *Clin. Cancer Res.* 14(21), 6821–6828 (2008).
11. Furney SJ, Turajlic S, Stamp G *et al.* Genome sequencing of mucosal melanomas reveals that they are driven by distinct mechanisms from cutaneous melanoma. *J. Pathol.* 230(3), 261–269 (2013).
12. Ditto A, Bogani G, Martinelli F *et al.* Surgical Management and Prognostic Factors of Vulvovaginal Melanoma. *J. Low Genit Tract. Dis.* 20(3), e24–e29 (2016).
13. Suwandinata FS, Bohle RM, Omwandho CA, Tinneberg HR, Gruessner SE. Management of vulvar melanoma and review of the literature. *Eur. J. Gynaecol. Oncol.* 28(3), 220–224 (2007).
14. Lewin J, Egbe A, Ellery P *et al.* Female Genital Tract Melanoma: 10 Years of Experience at a Single Tertiary Center. *J. Low Genit Tract. Dis.* 25(2), 142–145 (2021).
15. Di Saia PCW. *Clinical gynecological Oncology (7th Edition).* Mosby Elsevier, Philadelphia, PA, USA (2007).
16. Ter Glane L, Hegele A, Wagner U, Boekhoff J. Pelvic exenteration for recurrent or advanced gynecologic malignancies – Analysis of outcome and complications. *Gynecol. Oncol. Rep.* 36, 100757 (2021).

17. Puri S, Asotra S. Primary vaginal malignant melanoma: a rare entity with review of literature. *J. Cancer Res. Ther.* 15(6), 1392–1394 (2019).
18. Smith HG, Bagwan I, Board RE *et al.* Ano-uro-genital mucosal melanoma UK national guidelines. *Eur. J. Cancer* 135, 22–30 (2020).

•• **Comprehensive UK guidelines for the management of vulvo-vaginal melanoma patients.**

19. Höckel M. Cancer field surgery for locoregional tumor control of cervical carcinoma. *J. Cancer Metastasis Treat* 7, 64 (2021).

• **Article exploring the fundamental concept of embryological compartments and their application in cervical cancer treatment.**

20. Deerwester M, Smoller B. Skin melanocytic tumor – Genital and mucosal melanocytic tumors Mucosal melanoma (genital, oral, sinonasal) (2023). www.pathologyoutlines.com/topic/skintumormelanocyticmucosalmelanoma.html
21. Cobellis L, Calabrese E, Stefanon B, Raspagliesi F. Malignant melanoma of the vagina. A report of 15 cases. *Eur. J. Gynaecol. Oncol.* 21(3), 295–297 (2000).
22. Miner TJ, Delgado R, Zeisler J *et al.* Primary vaginal melanoma: a critical analysis of therapy. *Ann. Surg. Oncol.* 11(1), 34–39 (2004).
23. Ferraioli D, Lamblin G, Mathevet P *et al.* Genital melanoma: prognosis factors and treatment modality. *Arch. Gynecol. Obstet.* 294(5), 1037–1045 (2016).
24. Bladou F, Houvenaeghel G, Delpéro JR, Guérinel G. Incidence and management of major urinary complications after pelvic exenteration for gynecological malignancies. *J. Surg. Oncol.* 58(2), 91–96 (1995).
25. Harji DP, Griffiths B, Velikova G, Sagar PM, Brown J. Systematic review of health-related quality of life in patients undergoing pelvic exenteration. *Eur. J. Surg. Oncol.* 42(8), 1132–1145 (2016).
26. Galaal K, Donkers H, Bryant A, Lopes AD. Laparoscopy versus laparotomy for the management of early stage endometrial cancer. *Cochrane Database Syst. Rev.* 10(10), CD006655 (2018).
27. Bizzarri N, Chiantera V, Ercoli A *et al.* Minimally Invasive Pelvic Exenteration for Gynecologic Malignancies: A Multi-Institutional Case Series and Review of the Literature. *J. Minim Invasive Gynecol.* 26(7), 1316–1326 (2019).
28. Jain V, Debnath S, Rawal S. Salvage robotic anterior pelvic exenteration for cervical cancer: technique and feasibility. *J. Robot. Surg.* 15(6), 945–953 (2021).
29. Martínez A, Filleron T, Vitse L *et al.* Laparoscopic pelvic exenteration for gynecological malignancy: is there any advantage? *Gynecol. Oncol.* 120(3), 374–379 (2011).
30. Puntambekar S, Lawande A, Desai R, Puntambekar S, Joshi GA, Joshi SN. Initial experience of robotic anterior pelvic exenteration at a single institute. *Int. J. Gynaecol. Obstet.* 126(1), 41–44 (2014).

• **The largest cohort study examining surgical outcomes in 74 patients undergoing minimally invasive anterior exenteration for cervical cancer treatment.**

31. Karkia R, Tailor A, Ellis P *et al.* Minimally invasive pelvic exenteration for gynecological malignancy: a single-centre case series and review of the literature. *Eur. J. Obstet. Gynecol. Reprod. Biol.* 274, 56–61 (2022).
32. Ware JE Jr, Sherbourne CD. The MOS 36-ltem Short-Form Health Survey (SF-36): I. Conceptual Framework and Item Selection. *Med. Care* 30(6): 473-83, (1992).