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# Perioperative outcomes and morbidity following pelvic exenteration surgery: A Single-Center Experience

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## ABSTRACT

**Background:** Pelvic exenteration (PE) is a radical, potentially curative procedure for locally advanced and recurrent pelvic malignancies, associated with significant morbidity. This study presents the perioperative outcomes of PE surgery performed at our center.

**Material and Methods:** In this retrospective, single-center cohort study, all patients undergoing PE surgery between 1 January 2024 and 1 September 2025 were included.No specific inclusion or exclusion criteria were applied. Data, including operative and reconstruction techniques, perioperative complications and pathology outcomes, were collected and analysed; no inferential statistics were performed.

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**Results:** The cohort included 18 patients, with a mean age of 62 (range 40-76). Sixteen patients had rectal cancer cancer (recurrent in 8 (44%) and primary in 8 (44%) patients) and two patients had recurrent cervical cancer. The principal procedure was total pelvic exenteration, with or without low sacrectomy (8 (44%) and 6 (33%) patients, respectively). Other procedures included abdominosacral resection, palliative PE, high subcortical sacrectomy, extended lateral pelvic sidewall excision, and extralevator abdominoperineal resection. Urinary reconstruction was primarily via ileal conduit (16 patients (88.9%) and flap reconstruction via bilateral gluteal flap (7 patients (38.9%). Most tumours were staged as T4 (83%- 15 patients) and an R0 resection was achieved in 16 patients (89%). The mean hospital stay was 36 days (range 18-68). All patients experienced complications, graded as Clavien-Dindo II (61%- 11 patients), IIIa (3 patients (17%), or IIIb (4 patients (22%). The most common were bloodstream infections (10 patients (56%) and superficial abdominal wound infections (9 patients (50%). Re-operation was required in four patients (22%) due to the following: anastomotic leak, burst abdomen, flap haematoma with dehiscence, and postoperative intra-abdominal bleeding.

**Conclusions:** PE, while a highly morbid procedure, can achieve high rates of R0 resection in patients with advanced or recurrent pelvic disease. The high incidence of complications underscores the complexity of these cases and highlights the necessity for their management in specialised, high-volume centers with multidisciplinary support.

**Key Words:** *Pelvic; exenteration; advanced; recurrent; cancer; rectal; outcomes*

## INTRODUCTION

Pelvic exenteration is among the most extensive and technically demanding procedures in oncologic surgery, typically reserved for patients with advanced or recurrent pelvic malignancies. Initially introduced as a palliative operation in the management of gynecologic cancers [1], pelvic exenteration has evolved substantially over the past decades. Advances in preoperative imaging, patient selection, multimodal oncologic therapy, surgical technique, anaesthesia, and reconstructive surgery have expanded its indications and transformed it into a potentially curative option for selected patients with locally advanced or recurrent disease [2-5].

Despite these developments, pelvic exenteration remains associated with considerable morbidity and functional disability [2-5], underscoring the need for careful patient selection and treatment within specialised, high-volume centers supported by multidisciplinary expertise. Achieving clear resection margins is the primary determinant of long-term survival [6-8], often necessitating extended resections involving the sacrum, pelvic sidewall and adjacent pelvic viscera. Simultaneously, advances in the reconstructive techniques—particularly in urinary diversion and in pelvic floor reconstruction—have played a critical role in reducing complications, improving outcomes, and enhancing postoperative quality of life.

The present study reports a single-center experience with pelvic exenteration over a 20-month period, focusing on patient characteristics, operative and reconstructive strategies, perioperative morbidity, and pathological outcomes. By presenting these data, we aim to contribute to the growing body of evidence supporting pelvic exenteration as a viable treatment option for selected patients with advanced pelvic malignancies, even in regions where centralised pelvic exenteration services are limited or lacking, and to highlight the significance of centralisation and multidisciplinary care in enhancing outcomes.

## MATERIAL AND METHODS

This retrospective single-center cohort study included all patients undergoing a pelvic exenteration (PE) procedure, between 1 January 2024 and 1 September 2025 at our surgical department.The cohort both referred and in-house cases, with locally advanced or recurrent pelvic diseasePatient selection, for either curative or palliative treatment, required agreement from a multidisciplinary tumour board (MDT) and was based on a comprehensive assessment ofclinical, laboratory, imaging, and endoscopic findings.Our cohort included all those patients, who were discussed at the MDT, and operability with curative or palliative intent was deemed possible. Patients with metastatic disease and those in whom an R0 resection was not feasible were excluded from curative resections.

PE procedures included total pelvic exenteration (TPE), with or without sacrectomy, palliative PE and abdominosacral resections. TPE involved en bloc resection of all pelvic

viscera, including the distal GI and urinary tract (distal colon, rectum, anus, urinary bladder and distal ureter) and the internal reproductive organs (uterus, ovaries, fallopian tubes, vagina, prostate, seminal vesicles). Palliative PE included more limited resections aimed at alleviating cancer-related symptoms. Sacrectomy, if needed, included low sacrectomy, below the S2 vertebra, and high subcortical sacrectomy (HiSS), which involved resecting the infiltrated midportion of the anterior sacral body en bloc with the infiltrated structures, leaving the posterior surface and lateral edges in situ. Abdominosacral resections focused on functional preservation and included a more conservative resection of infiltrated pelvic viscera or bony structures. En bloc resection of the infiltrated pelvic structures combined with either extralevator abdominoperineal excision (ELAP), extended lateral pelvic sidewall excision (ELSiE) or high subcortical sacrectomy (HiSS) were included in this category.

Clinical data were retrieved retrospectively, from the institutional database, capturing patient demographics, prior treatment interventions, operative documentation, final pathology reports and intra- and postoperative progress and complications graded according to Clavien-Dindo classification.

Histopathological assessment defined an R0 resection as a circumferential resection margin (CRM) greater than 1 mm. An R1 resection indicated microscopic residual disease, characterised by a CRM of 1 mm or less, while an R2 resection denoted the presence of macroscopic residual disease.

As the study involved only the analysis of anonymised records and non-identifiable photographic content, with no direct patient interaction, it was exempt from formal ethics committee approval per institutional and national regulations. All patients had previously provided written informed consent for their procedures after preoperative counseling on their diagnosis, surgical plan, risks, and alternatives, ensuring voluntary and autonomous participation. Quantitative data are presented as mean and median values and qualitative data as absolute numbers or percentages. Software Microsoft Excel was utilised for data collection, analysis, and table creation. No inferential statistics were performed.

## RESULTS

### Baseline characteristics

The cohort included 18 patients, mostly males (12 patients; 66%), with a mean age of 62 (range 40-76). Two patients (11%) had recurrent cervical cancer, while 16 patients had rectal cancer: eight patients (44%) with locally advanced rectal carcinoma (LARC) and eight patients (44%) with locally recurrent rectal cancer (LRRC), two of whom had a second recurrence (Table 1). All patients with LRRC had undergone low anterior resection (LAR) and all patients with cervical cancer had undergone total hysterectomy. One of the patients with secondary recurrence had also undergone abdominoperineal resection (APR) after LAR.

Seven patients with LARC and 7 patients with LRRC had received total neoadjuvant therapy (TNT), while1 patient with LARC and microsatellite instability had also received immunotherapy. Both patients with recurrent cervical cancerhad undergone adjuvant chemoradiation and brachytherapy.

On admission, 17 patients were classified as American Society of Anesthesiologists Physical Status (ASA-PS) II (94%) and one patient as ASA-PS III, while the mean preoperative serum albumin was 3.9 mg/dl (range 2.8-4.6 mg/dl).

### Operative details

Of all patients, eight (44%) underwent total pelvic exenteration (TPE) with or without sacrecttomy (8 patients; 44% and 6 patients; 33%, respectively). One patient underwent palliative pelvic exenteration, and three patients (17%) underwent abdominosacral resection, combined with high subcortial sacrectomy (HiSS) (1 patient), HiSS with extended lateral pelvic sidewall excision (ELSiE) (1 patient), or extralevator APR (A patient) (Table 2).

**TABLE 1.** Type of cancer distribution and the respective percentages in our cohort.

| Type of cancer | Number of patients (N= 18) |
|---|---|
| ***Recurrent cervical*** | 2 (12%) |
| ***Rectal cancer*** | |
| Locally advanced rectal cancer | 8 (44%) |
| Locally recurrent rectal cancer | 8 (44%) |
| 1st recurrence | 6 (36%) |
| 2nd recurrence | 2 (12%) |

**TABLE 2.** Types of procedures utilised. TPE, total pelvic exenteration; ASR, abdominosacral resection; HiSS, high subcortical sacrectomy; ELSiE, extended lateral pelvic sidewall excision; ELAPE, extralevator abdominoperineal excision

| Type of procedure | Number of patients (N= 18) | Percentage |
|---|---|---|
| TPE with low sacrectomy | 8 | 44.4% |
| TPE | 6 | 33.3% |
| Palliative TPE | 1 | 5.6% |
| ASR with HiSS | 1 | 5.6% |
| ASR with HiSS and ELSi--Ele | 1 | 5.6% |
| ASR with ELAPE | 1 | 5.6% |

Urinary reconstruction was necessary in 17 patients (94%); 16 of them underwent ileal conduit, and one patient was subjected to end-to-side uretero-ureteric anastomosis (Table 3). Plastic reconstruction was required in 12patients (67%), with bilateral gluteal flap being the most frequent option (7 of 12 patients; 58%). Other flaps used were unilateral gluteal flap (2 patients), vertical rectus abdominis (VRAM) flap (1 patient), unilateral gluteal and sartorious flap (1 patient), and bilateral gracilis flap (1 patient) (Table 3).

## Postoperative outcomes

The mean and median hospital stay were 36 and 31 days Respectively (range 18-68 days), and 30-day mortality was 0%. Complications were classified according to Clavien-Dindo (C-D) classification, with major complications (grade ≥ III) occurring in 7 cases (39%): Clavien Dindo I (0%); Clavien Dindo II (11 patients; 61%); Clavien Dindo IIIa (3 patients; 17%); Clavien Dindo IIIb (4 patients; 22%); Clavien Dindo IV (0%) (Table 4). Most prevalent complications, as shown in Table 4, were bloodstreami nfections (10 patients; 56%) and surgical site infections (SSIs); SSIs included superficial abdominal would infection (9 patients; 50%) and deep abdominal wound infection (3 patients; 17%) , as well assuperficial(3 patients; 17%) and deep flap infection (5 patients; 28%) . Three patients (17%) developed organ-space infection (pelvic abscess), requiring percutaneous drainage.

Leaks occurred in 2 patients (12%); one from the small-bowel anastomosis and one from the ileal conduit.

**TABLE 3.** Urinary and plastic reconstruction techniques utilised. VRAM, vertical rectus abdominis myocutaneous flap.

| Type of reconstruction | Technique | Number of patients (N= 18) |
|---|---|---|
| ***Urinary Reconstruction*** | Ileal conduit | 16 (88.9%) |
| | End to side ureteric anastomosis | 1 (5.6%) |
| | Not needed | 1 (5.6%) |
| ***Plastic reconstruction*** | Bilateral gluteal flap | 7 (38.9%) |
| | Unilateral gluteal flap | 2 (11.1%) |
| | VRAM flap | 1 (5.6%) |
| | Bilateral gracilis flap | 1 (5.6%) |
| | Unilateral gluteal plus sartorius flap | 1 (5.6%) |
| | Not needed | 6 (33.3%) |

**TABLE 4.** Clavien-Dindo classification of perioperative complications. CNS, central nervous system; ICU, intensive care unit.

| Clavien-Dindo classification | Definition | Number of patients (N=18) |
|---|---|---|
| Grade I | Any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic and radiological interventions<br>Allowed therapeutic regimens are: drugs as antiemetics, antipyretics, analgesics, diuretics and electrolytes and physiotherapy. This grade also includes wound infections opened at the bedside. | 0 (0%) |
| Grade II | Requiring pharmacological treatment with drugs other than such allowed for grade I complications. Blood transfusions and total parenteral nutrition are also included. | 11 (61%) |
| Grade III | Requiring surgical, endoscopic or radiological intervention | 7 (39%) |
| -IIIa | *Intervention not under general anaesthesia* | 3 (17%) |
| -IIIb | *Intervention under general anaesthesia* | 4 (22%) |
| Grade IV | Life-threatening complication (including CNS complications) requiring ICU management | |
| - IVa | *single organ dysfunction (including dialysis)* | 0 (0%) |
| - IVb | *multi organ dysfunction* | 0 (0%) |
| Grade V | Death of a patient | 0 (0%) |

Additional complications were acute respiratory failure (3 patients; 17%), psychiatric disorders (3 patients; 17%), pulmonary embolism (2 patients; 11%), flap haematoma/bleeding (2 patients; 11%), postoperative haemorrhage (1 patient; 6%) and burst abdomen (1 patientl 6%). Re-operation with general anaesthesia was necessary in 4 cases (22%) due to the following: postoperative bleeding from the internal iliac artery (1 patient), ileo-ilealanastomoticleak (1 patient), burst abdomen (1 patient), and severe expanding flap haematoma (1 patient) (Table 5).

## Histopathology

The final pathology report showed that an R0 resection was achieved in 16 patients (89%). One patient had an R1 resection (6%), and an R2 resection was noted in another patient (6%), who underwent palliative TPE. Of the 16 patients with rectal cancer, 12 (75%) were staged as T4b, with the tumour invading adjacent structures, and 7 patients (44%) had tumour deposits (pN1c). Both patients with cervical cancer were classified as pT4N0. Additional biopsy data are shown in Table 6.

**TABLE 5.** Type of perioperative complications occurred. SSIs, surgical site infections.

| Type of complication | Number of patients |
|---|---|
| Bloodstream infection | 10 (56%) |
| SSIs | |
| *Superficial abdominal wound infection* | 9 (50%) |
| *Deep flap infection/ dehiscence* | 5 (28%) |
| *Organ Space SSIs (Pelvic collection)* | 3 (17%) |
| *Superficial flap infection* | 3 (17%) |
| *Deep abdominal wound infection* | 3 (17%) |
| Return to the operation theatre | 4 (22%) |
| Respiratory Failure | 3 (17%) |
| Psychiatric disorders | 3 (17%) |
| Anastomotic leak | 2 (12%) |
| *Ileal conduit leak* | 1 (6%) |
| *Small bowel anastomosis leak* | 1 (6%) |
| Flap haematoma/ bleeding | 2 (11%) |
| Pulmonary embolism | 2 (11%) |
| Burst Abdomen | 1 (6%) |
| Post-operative intraabdominal bleeding | 1 (6%) |

**TABLE 6.** Pathology report of surgical specimens. TNM stages with no patient representation were omitted. EMVI, Extramural Venous Invasion; LVI, Lymphovascular invasion; TD, tumour deposits; PNI, perineural invasion; 1patients with cervical cancer; 2 patients with rectal cancer.

| Pathology report | Number of patients (N= 18) |
|---|---|
| R status | |
| R0 | 16 (89%) |
| R1 | 1 (6%) |
| R2 | 1 (6%) |
| EMVI | |
| EMVI+ | 2 (11%) |
| EMVI- | 16 (89%) |
| LVI | |
| LVI+ | 5 (28%) |
| LVI- | 13 (72%) |
| TD | |
| TD + | 8 (44%) |
| TD- | 10 (56%) |
| PNI | |
| PNI+ | 2 (11%) |
| PNI- | 16 (89%) |
| T status | |
| pT3 | 3 (17%) |
| pT41 | 2 (11%) |
| pT4a2 | 1 (6%) |
| pT4b2 | 12 (67%) |
| N status | |
| pN0 | 10 (56%) |
| pN1a | 1 (6%) |
| pN1c | 7 (39%) |
| M status | |
| pM0 | 17 (94%) |
| pM1c | 1 (6%) |

## DISCUSSION

Pelvic exenteration (PE) has undergone substantial evolution over recent decades, shifting from a primarily palliative operation in gynecologic practice to a potentially curative intervention with excellent outcomes for selected patients with advanced pelvic malignancies [3,4].

Our study examined all patients who underwent a pelvic exenteration procedure in our institution in a 20-month

period, focusing on the operative and reconstructive details and the perioperative morbidity associated with the procedures.

PE, although first described for gynaecologic malignancies, it is now widely and increasingly used for both rectal and non-rectal advanced pelvic malignancies, including urological, gynecological and anal cancers and sarcomas [9]. In our study, apart from patients with recurrent cervical cancer, half the other patients had advanced primary (N=8) and the other half recurrent rectal cancer (N=8).

The most frequently utilised procedure in our patients was a total pelvic exenteration (TPE). Based on preoperative MRI interpretation or intraoperative findings, involved or threatened sacrum and presacral tissues were resected en bloc, below the level of S2 vertebra. In three cases, a more organ-preserving approach—abdominosacral resection (ASR)—was selected. Two adjunctive techniques were utilised: high subcortical sacral resection (HiSS), which preserves pelvic stability and avoids neurological complications associated with dissection along the lateral sacral edges [10] and extended lateral pelvic sidewall excision (ELSiE), which can significantly increase R0 resection rates if the pelvic sidewall is involved [11,12].

In addition to pelvic exenteration performed with curative intent, palliative PE, aimed at relieving intractable cancer-related symptoms, was performed in one patient. It is feasible and regarded safe when practiced in specialised centers, but durable symptom palliation with corresponding improvement or maintenance of quality of life has not been demonstrated, leaving the palliative role of this operation highly controversial in this complex patient population [13].

Reconstruction of the urinary system in our patients primarily involved the creation of a non-continent diversion with an ileal conduit. It involved the creation of an isolated ileal loop with one end being used for ureteric anastomosis and the other being exteriorised as a stoma contralaterally to the colostomy. Other frequent urinary diversion techniques that are being used after a TPE include the colonic conduit, double barrel wet colostomy, and bilateral permanent nephrostomies [14-19]. The ileal conduit, compared with the colonic conduit, has been associated with similar urological and major (Clavien Dindo ≥III) complications rate, and overall 30-day and in-hospital mortality, but with a higher rate of postoperative ileus (~21% versus 7%) and an risk of an ileo-ileal anastomotic leak (~3%), since it involves an additional anastomosis [14]. The colonic conduit, on the other hand, appears to have higher rates of abdominal or perineal surgical-site infections (~31% versus 14%) [14]. Another study found comparable urinary leak rates but fewer total urinary-related complications in the colonic conduit patients (~19% versus 40%) [15].

The double-barrel wet colostomy (DBWC), a modern alternative to the classical wet colostomy described by Brunschwig [1] and largely abandoned due to high morbidity [16], although adding the difficulty for both patients and stoma carers in the postoperative management of combined fecal and urinary discharge, has been shown in comparative studies to have outcomes similar to those of the ileal conduit [16-19].

Plastic reconstruction of the pelvic floor and the perineal defect is often required after a pelvic exenterative procedure. Myocutaneous or fasciocutaneous flaps, biological or synthetic meshes, omentum or combination strategies are being used, although there is no strong evidence to suggest one option over another and the choice is highly individualised and tailored to the patient's needs and expectations [20,21]. Commonly used flaps include the Vertical Rectus Abdominis Myocutaneous (VRAM) flap, gluteal-based flaps, including the Inferior Gluteal Artery Perforator (IGAP), the Inferior Gluteal Artery Myocutaneous (IGAM) and the V-Y advancement flap, and thigh-based flaps, including the gracilis, sartorius and the anterolateral thigh flap [20-25]. The VRAM flap is considered a good option due to its capacity to restore large defects, but this comes at the cost of increased donor area morbidity, while the anterolateral thigh flap is a good option, primarily if two stomas are to be created bilaterally, since it can cover large defects and avoids abdominal wall weakening but at the cost of a high dehiscence rate [20]. In our cohort, we primarily used a modified bilateral gluteal V-Y advancement flap, resembling a "hammock" flap, to provide stable coverage and obliterate pelvic dead space. This flap has been shown to be a reliable and acceptable novel technique, particularly in irradiated fields, which can obliterate dead space with satisfactory functional and aesthetic outcomes and minimise donor-site morbidity [26].

Perioperative morbidity in our study was acceptable and in line with the literature [8,27,28], with most patients (61%) experiencing minor (Clavien-Dindo(C-D)<III )and 39% major (C-D ≥ III) complications, while there were no grade IV or grade V complications. Median and mean hospital stay in our institution were 31 and 36 days respectively, significantly longer than the corresponding values (median~11-16 days; mean 14.5-19.9 days) reported in larger studies [2,8,27,28]. This may be partly explained by the fact that methods and techniques are not standardised and automatised among medical personnel, and delays occur upon inter-specialty collaboration.

Centralisation and the creation of reference centers are of utmost importance for improving outcomes and minimising morbidity among pelvic exenteration patients

[29]. Although such centers exist worldwide, they are scarce or even not existent in many smaller countries, such as Greece, where a recent survey among surgeons who practice pelvic exenteration reveals severe and widening disparities across the country [30].

This study is limited by its retrospective case-series design, small sample size, absence of standardised surgical techniques and postoperative follow-up protocols, and lack of comparative data, which precludes drawing definitive conclusions. Nevertheless, the findings demonstrate that pelvic exenteration is feasible with acceptable morbidity when performed in dedicated high-volume institutions. Establishing such centers as referral hubs, and adding teaching, collaboration, and research opportunities to the "triad" of careful patient selection, appropriate decision-making, and refined surgical technique—the dictum of success for pelvic exenteration surgery as highlighted by Kontovounisios 2024 [29]—would likely lead to improved outcomes and a reduced morbidity profile.

## CONCLUSION

Pelvic exenteration represents a complex but increasingly refined surgical strategy that offers a potential curative option for selected patients with advanced and recurrent pelvic malignancies. The findings of this study demonstrate that, despite being technically demanding and necessitating extensive multivisceral resections and complex reconstructions, pelvic exenteration can be performed with acceptable perioperative morbidity and high rates of R0 resection in a specialised, high-volume setting. Although limited by its retrospective structure and small sample size, this study highlights the feasibility and safety of pelvic exenteration when undertaken by experienced multidisciplinary teams. Centralisation of care and the establishment of dedicated reference centers are essential steps toward standardizing practice, reducing morbidity, and improving overall patient outcomes.

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