

Outcomes Post Beyond Total Mesorectal Excision Plane Resections Following Setting up Complex Colorectal Cancer Service in a District General Hospital

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Rezumat

Rezultate clinice precoce ale tratamentului cancerului colorectal local avansat și recurent într-un Serviciu de Tratament al Cancerului Colorectal Complex în cadrul unui Spital General de District.

Scopul studiului: Acest studiu își propune să valideze fezabilitatea unui model "hub-and-spoke" dedicat chirurgiei exenterării pelvine (PE) în centru nostru.

Materiale și Metode: Analiza retrospectivă a pacienților care au suferit PE în cadrul centrului nostru în perioada 01/10/2017 - 31/12/2023.

Rezultate: În studiu au fost incluși 67 de pacienți care au suportat PE, 61 dintre aceștia fiind cu cancer colorectal local avansat (91.04%). Chirurgia minim invazivă a fost aplicată în 16 cazuri (Robotic 3, 4.47% / Laparoscopic 13, 19.40%), în timp, 51, au fost supuși tratamentului chirurgical prin abord deschis (75.11%). Durata medie de spitalizare a constituit 12 zile (interval: 8-20). Deși 24 de pacienți (35.82%) au dezvoltat complicații postchirurgicale CD III-IV, nu au fost înregistrate decese asociate nemijlocit actului chirurgical. Dintre cei 67 de pacienți operați cu intenție curativă, marginile de rezecție negative (R0) au fost obținute la 57 de pacienți (85.12%). Rezultatele obținute sunt comparabile cu rezultatele raportate de PelvEx Collaborative Group (85.07% versus 79.8%). La o urmărire mediană de 22 de luni, 15 pacienți (22.38%) s-au prezentat cu recidiva maladiei, rata recurenței locale

Received: 22.04.2024

Accepted: 14.06.2024

fiind de 10.44%. Supraviețuirea globală și cea fără boală la 2 ani au constituit 85.31% și respective 77.0.36%.

Concluzii: Studiul nostru sugerează că un serviciu chirurgical dedicat PE, susținut de expertiză și resurse specializate, poate obține rezultate chirurgicale bune în cadrul unui spital general de district.

Cuvinte cheie: exenterație pelvină, cancer colorectal, recurență neoplazică locoregională

Abstract

Background: This study aims to validate the feasibility of a hub-and-spoke model for pelvic exenteration (PE) surgery while upholding favorable patient outcomes.

Methods: A retrospective analysis of patients undergoing PE at our trust October 2017 and December 2023 was conducted. Descriptive statistics and Kaplan-Meier survival analysis were employed.

Results: Sixty-seven patients underwent PE during the study period, mainly for locally advanced colorectal cancer (n=61, 91.04%). Minimally invasive surgery was performed in 16 cases (Robotic 3, 4.47% / Laparoscopic 13, 19.40) while the rest of patients 51 had open surgery (75.11%). Median hospital stay was 12 days (range:8-20). While 24 patients (35.82%) developed major complications (CD III-IV) post-surgery, there were no mortalities associated with pelvic exenteration in this study. Of the 67 patients undergoing surgery with curative intent, negative margins (R0 resection) were achieved in 57 patients (85.12%). This is comparable to outcomes reported by the PelvEx collaborative (85.07% versus 79.8%). At a median follow-up of 22 months, 15 patient (22.38%) recurred with 10.44% local recurrence rate. The 2 years overall and disease-free survival were 85.31% and 77.0.36%, respectively.

Conclusion: Our study suggests that a nascent PE service, supported by specialist expertise and resources, can achieve good surgical outcomes within a district general hospital.

Key words: pelvic exenteration, colorectal cancer, locoregional neoplasm recurrence

Introduction

Colorectal cancer (CRC) is associated with significant morbidity and mortality. It is the fourth most prevalent cancer and the second most common cause of cancer-related death in the United Kingdom (UK), accounting for 1 in 10 of all cancer deaths (1). Approximately one quarter of patients with rectal cancer in the UK present with locally advanced disease, defined as tumours which invade or adhere to the mesorectal fascia or beyond (2). Historically, if left untreated, the prognosis is poor with a 5-year survival rate of 4.4% (3). Radical treatment of advanced primary rectal tumours

involves surgical resection, and of those patients, 10% will require resection beyond total mesorectal excision (TME) planes or en-bloc resection of other organs (4,5). Historically, these tumours were managed by offering defunctioning stoma followed by administration of neoadjuvant treatment without curative intent. Nowadays, these patients with locally advanced disease may be offered PE which represents a possibility to radically treat this cohort of patients (5). In selected cases this method of treatment has become the standard of care. One of the first surgeons who advocated en-bloc resection for locally advanced pelvic malignancies was Moynihan in 1926 (6), fol-

lowed by Sugarbaker in 1946 (7) and Turner (8). They were among the first to report good long-term survival after multi-visceral resections in the treatment of colorectal cancer.

The most significant innovator in the field of locally advanced and recurrent pelvic neoplastic disease was Brunschwig who created the concept of PE in 1948 for gynaecological tumours initially (9). He described the technique of PE as an operation that involves en bloc removal of all infiltrated pelvic viscera. This may include the bladder and reproductive organs anteriorly, and rectum surrounded by mesorectal fat together with presacral fascia and sacrum posteriorly. If necessary, adjacent musculature, ligaments, vasculature, and bony structures are also excised (10,11). PE is an umbrella term for multiple techniques used for treatment of locally advanced or recurrent pelvic malignancy. Since the first description of PE in 1948 there has been notable advancement and improvement in technique, leading to better outcomes for patients, including patients who historically would have been considered incurable (12). In terms of operative description, currently we notice a heterogeneity in current literature which limits the interpretation of patient outcomes and collaboration between colorectal units. Although many classifications are in use, few are validated.

Beyond-TME surgery represents a surgical strategy in exenterative procedures rather than a separate standardized procedure. Unlike conventional TME, which focuses on the removal of the entire mesorectum, beyond-TME surgery entails the resection of involved pelvic compartments beyond the mesorectal plane. This tailored approach is particularly valuable in cases where rectal cancer has encroached upon adjacent organs or structures. Precise pre-operative radiological planning is the cornerstone of successful PE. Magnetic resonance imaging (MRI) has supplanted other modalities as the gold standard for assessing tumor extent within the pelvis (13-15). To effectively execute beyond-TME surgery, radiologist describes a "roadmap" guided by detailed MRI findings

where the pelvis is divided into distinct compartments, enabling surgeons to precisely identify and excise only those compartments harboring tumor involvement. This compartmentalized "roadmap approach" offers several advantages: 1. Enhanced tumor clearance: by selectively removing involved compartments, 2. Preservation of uninvolved structures: sparing uninvolved compartments minimizes surgical trauma and preserves essential pelvic structures and functions, such as urinary and bowel function (16).

An individualized radiological treatment plan, informed by patient-specific anatomical considerations, tumor burden, and comorbidities, should be established for optimal care. From our experience the mnemonic "BONVUE" serves as a valuable tool to guide the radiology team in incorporating a comprehensive evaluation of bones, organs, nerves, vessels, ureters, and potential extratumoral sites during the treatment planning process (17). This significantly increases the likelihood of achieving complete resection (R0), thereby optimizing oncological as well as functional outcomes.

Achieving clear R0 is paramount for long-term survival and serves as the most significant prognostic factor (18). However, these procedures are inherently challenging due to the potential presence of subacute obstruction, fistulation, bleeding, and infection at the time of surgery (19). Consequently, morbidity rates associated with PE often exceed 60% in some centers (20). Recognizing these complexities, PE is typically performed at specialized centers with well-established complex CRC multidisciplinary teams (MDTs). Multiple studies have corroborated the association between high-volume centers with multidisciplinary approaches and improved overall outcomes, including increased R0 resection rates (21-24).

In response to a growing demand for PE, a dedicated PE service was established at our center in October 2017. This service effectively manages the increasing number of patients requiring PE by leveraging new MDT discussions. Additionally, the establishment of a

local PE service alleviates the burden on tertiary referral centers, thereby streamlining patient care and reducing waiting times. Patients with advanced CRC are thoroughly evaluated within the framework of a newly established Complex CRC MDT.

The PE service at our center draws upon the collective expertise of colorectal surgeons, urologists, gynecologists, neurosurgeons, oncologists, and anesthesiologists, each contributing their specialized knowledge to optimize patient outcomes. Given the primary site of malignancy being colorectal, the lead surgeon role as well as primary assistant is held by a colorectal surgeon. The lead colorectal surgeons possess extensive experience in PE acquired through fellowships at high-volume centers in Australia, United Kingdom and India. Recognizing the crucial role of specialized expertise in managing complex cancer cases, our PE service strategically utilizes external resources for specific subspecialties. Radiological services are outsourced with the clinical lead for reporting radiology scans at very high volume institution. Similarly, reconstructive plastic surgery services are procured from the one of largest plastic surgery centers located in our region. This allows seamless integration of this vital skillset into the multidisciplinary care local exenteration pathway. Notably, our Colorectal group participates actively in the PelvEx Collaborative, a global network of over 100 institutions dedicated to advancing PE care. Regular attendance at PelvEx Collaborative annual meetings and research initiatives fosters continuous learning and improvement. The PE service at our center meticulously upholds the requirements for a comprehensive PE hub, as outlined by the PelvEX Collaborative group's publication. The presence of dedicated radiological support from a tertiary institution for PE surgery coupled with specialized multidisciplinary expertise from colorectal, urologic, gynecologic oncology, neurosurgical, vascular, oncologic, interventional radiology, and plastic surgery teams, along with anaesthesia, chronic pain management, and critical care specialists, empowers our

center to deliver a holistic and patient-centric approach to PE care (25).

What is New in This Paper?

Our center, with its growing capabilities, aims to demonstrate the safe and effective implementation of this complex procedure within a setting of highly skilled Complex Colorectal MDT, potentially paving the way for broader access and improved patient outcomes through reduced surgical awaiting times, collaboration and knowledge sharing. We would like to share our experience establishing a dedicated PE service at a very large district general hospital (DGH), supported by tertiary centers when needed. Our short-term outcomes demonstrates the service's feasibility in the DGH setting.

Materials and Methods

Study Design, Patient Selection and Lexicon

This retrospective single-center case series study analyzes data from consecutive patients over 18 years of age who underwent PE for locally advanced or recurrent rectal cancer at our institution between October 2017 and August 2023. Patients who underwent non-curative PE procedures were excluded. The PE surgical terminology employed adheres to the classifications outlined by the United Kingdom Pelvic Exenteration Network (UKPEN) and/or The Association of Coloproctology of Great Britain & Ireland (ACPGBI) Advanced Disease Sub-Committee PE Classification (16). This study defines a total PE as complete en-bloc resection of the lateral pelvic lymph nodes, rectum, and bladder, and the prostate (in men), and the uterus, vagina and ovaries (in women). An anterior PE is defined as resection of the bladder with or without internal reproductive organs and a posterior PE as a resection of the rectum with or without removal of the internal reproductive organs or coccyx and sacrum while preserving the ureters and bladder. This study was conducted and reported in accordance

with the Preferred Reporting Of Case Series in Surgery (PROCESS) guidelines (25). The study was registered as per local governance regulations, and data collection complied with data protection regulations. No patient identifiable data was utilized.

Data Collection

Patient demographics, operative details, pathologic and clinical data were systematically gathered from a comprehensive range of sources, including electronic healthcare records, pathology records, electronic discharge summaries, clinical correspondence, and MDT meeting notes.

2.3 Staging and Surgery

This study employed a comprehensive approach to staging, utilizing computed tomography (CT) scans, magnetic resonance imaging (MRI), and positron emission tomography (PET) scans in nearly all cases. These advanced imaging modalities provided detailed anatomical information, enabling precise tumor assessment and accurate staging. Initial scans and reports were reviewed with respect to the extent of infiltration according to the seven compartments described by Georgiou et al. (26) (*Fig. 1*). Following evaluation, patients were considered by Complex CRC MDT to determine the most appropriate neoadjuvant therapy strategy based on their individual characteristics and tumor stage. Within this study, a range of neoadjuvant therapy regimens were employed: long-course chemoradiotherapy (CRT), total neoadjuvant therapy (TNT), short-course radiotherapy. Following neoadjuvant therapy, patients undergo restaging to assess the tumor's response to treatment. This restaging typically involves repeat imaging with CT or MRI scans. At this stage, patients are again discussed at the MDT to determine the most appropriate course of action. Surgical intervention was deemed a viable option for patients with resectable disease and, in applicable cases, for those presenting with oligometastases amenable to

surgical or oncological treatment modalities. However, not all patients are eligible for surgery. Patients who had high-volume metastatic disease, unfit for surgery, lack of surgical reconstructive options or Patient preference were not offered surgical option.

Perioperative Outcomes

Perioperative outcomes, encompassing transfusion requirements and short-term surgical complications, were extracted from all correspondence within a 30-day postoperative period and categorized using the established extended Clavien-Dindo classification system (27). Additionally, length of hospital stay and 90-day mortality were documented.

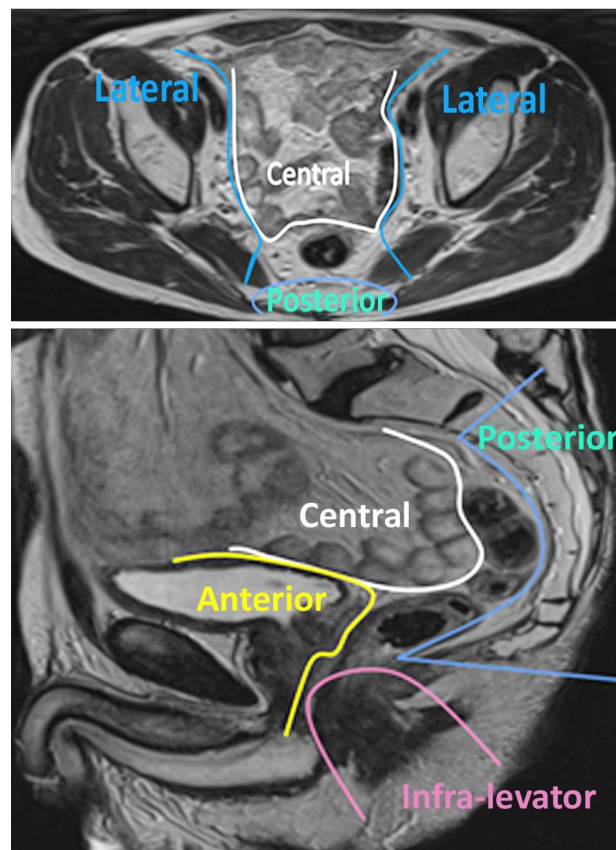


Figure 1. Pelvic MRI with delineation of the pelvic compartments in different colors Yellow-Anterior(above peritoneal reflexion and below peritoneal reflexion); Green-Posterior; Blue-Lateral; White-Central; Pink-Infralevator/Inferior (a) Axial image; (b) Sagittal image.

Morpho-pathologic Assessment

Pathologic assessment was categorized into curative R0 (microscopically and macroscopically clear margins), R1 (< 1 mm margin), and R2 (microscopically or macroscopically involved resection margin).

Follow-up and Survival Analysis

Follow-up duration was defined as the interval between the surgical procedure and the date of the most recent documented clinic visit, in patient discharge, or death. Overall survival in this study was defined as the time from surgery to mortality from any cause. Disease-free survival was defined as the time from surgery to local or distant recurrence.

Outcomes

The primary outcome studied were rate of R0. Secondary outcomes examined includes 30-day complication rate, disease-free survival, and overall survival.

Data Analysis

All statistical analysis was performed using GraphPad Prism (Version 9.4.1, GraphPad Prism Software, U.S.A). Statistical analyses included descriptive statistics (mean, median, range for continuous variables; frequency, percentage for categorical variables), Shapiro-Wilk test for normality assessment, and Kaplan-Meier survival analysis for patients treated with curative intent.

Results

Patient Characteristics

Following multidisciplinary discussion at the Local Complex CRC Meeting, 81 patients were identified as potential candidates for PE or beyond TME between October 2017 and December 2023 (*Fig. 2*).

Of these, 14 did not meet the established inclusion criteria. Subsequently, the study

analyzes data from 67 patients: 61 with locally advanced disease and 6 with recurrent pathology (*Fig. 3*). This 74-month study period encompasses both phases of the UK's COVID-19 lockdown, which explains the observed decline in operative volume.

Patient baseline characteristics are detailed in (*Table 1*). The cohort encompass 37 males (55.22%) with a median age of 64 years (range: 34-73 years). The majority of PE surgery were carried out for primary locally advanced rectal tumors (n = 61, 91.04%). Out of 61 cases operated for locally advanced disease one case had synchronous lesions as colonic neuroendocrine rectal squamous cell carcinoma. Primary tumour localisation was rectal cancers (n=45, 67.16), left colonic cancer (n=17, 25.37%) and anal cancers (n=4, 5.96%) The majority of the tumors were adenocarcinoma (n=54, 80.59%) with mucinous histology type observed in 11.94% (n=8) of the patients, squamous cell carcinoma consisted 5.97% (n=4) and one case of malignant melanoma (1.49%). The majority of the cancers were low rectal cancers, tumors situated up to 5 cm from anal verge in 33 cases (49.25%). Curable distant metastasis was present in 16.42% of the patients. All patients except for 18 received pre-operative radiation.

Neoadjuvant Therapy

A substantial majority of patients (n=49, 73.13%) underwent neoadjuvant treatment prior to definitive surgical intervention, with only 26.86% of patients not receiving this preparatory therapy (*Table 1*). The most common reasons for not receiving neoadjuvant treatment were poor overall health, prior radiation therapy, and an urgent need for surgery.

Operative Details

Open exenteration was performed in 76.11% of the patients, while minimally invasive was performed in 23.88% of the patients. There were three conversions to open surgery (1.6%), 2 with laparoscopic approach and 1 with

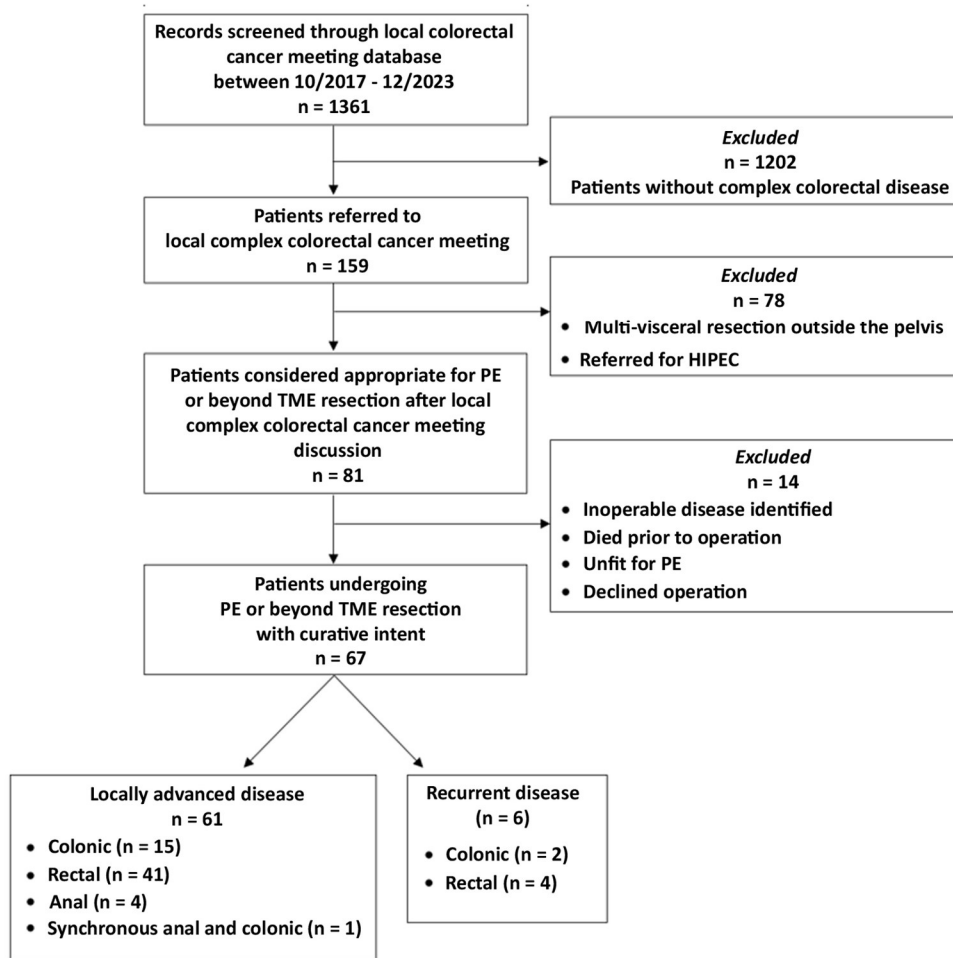


Figure 2. Patient selection for consideration of pelvic exenteration (PE) in our Trust

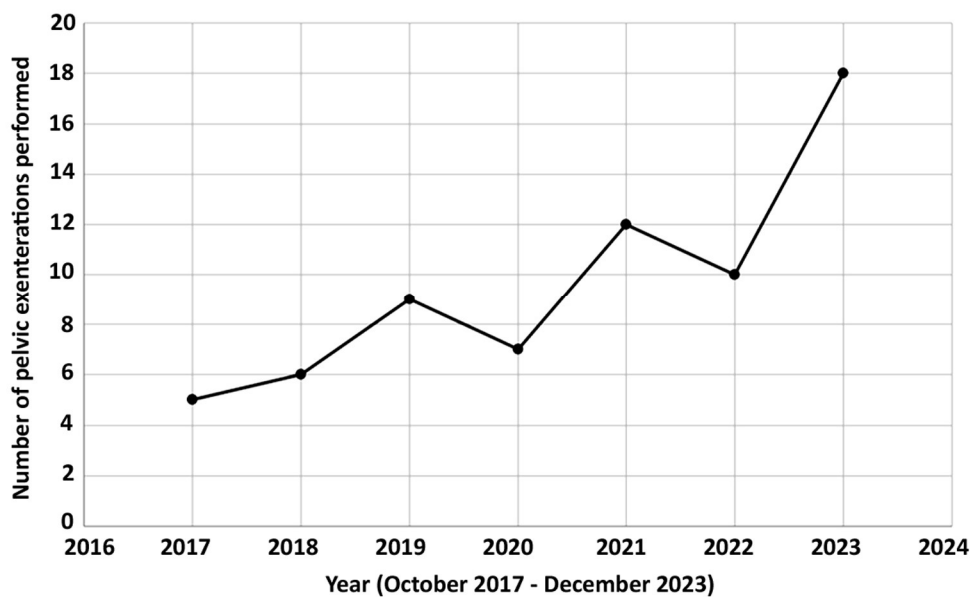


Figure 3. Pelvic exenterations performed at Barking, Havering and Redbridge University NHS Trust

Table 1. Characteristics of patients included in the study

Characteristic	Number (percent)
No. of patients	67
Age in years	64 (57.50-73)
Sex	
Men	37 (55.22)
Women	30 (44)
BMI in kg/m ²	24 (21-29.57)
Race	
White	49 (73.13)
Others	18 (26.86)
Comorbidities, ASA PS classification	
1	2 (2.98)
2	27 (40.29)
3	35 (52.23)
4	3 (4.47)
Performance status, ECOG scale	
0	50 (74.62)
1	14 (20.89)
2	2 (2.98)
3	1 (1.49)
Site	
Anal	4 (5.96)
Rectal	45 (67.16)
Colonic	17 (25.37)
Synchronous colonic and anal	1 (1.49)
cT	
2	2 (2.98)
3	28 (41.79)
4	37 (55.22)
cN	
0	7 (56.66)
1	27 (56.66)
2	33 (43.33)
cM	
0	56 (83.58)
Liver	5 (7.46)
Lung	1 (1.49)
Brain	1 (1.49)
Extra pelvic lymph nodes	4 (5.97)
Distance from anal verge in cm	
0-5	33 (49.25)
5-10	10 (14.92)
11-15	7 (10.44)
16-20	17 (25.37)
Histology	
Adenocarcinoma	54 (80.59)
Mucinous adenocarcinoma	8 (11.94)
Squamous cell carcinoma	4 (5.97)
Malignant melanoma	1 (1.49)
Neo-adjuvant therapy	
None	18 (26.86)
Short course chemo-radiotherapy	4 (5.97)
Long course chemo-radiotherapy	45 (67.16)

Values are presented as number only, median(interquartile range), or number (%). ECOG, Eastern Cooperative Oncology Group; ASA PS, American Society of Anesthesiologists physical status.

robotic (*Table 2*). All surgical procedures performed were classified as per new lexicon proposed by Burns et al. (16).

The median operative duration was 390 minutes (6 hours and 30 minutes), encompassing an interquartile range (IQR) of 300 to 543.5 minutes. A minimally invasive approach was adopted in 18.75% of cases (3 out of 13). Intraoperative transfusion requirements were present in 42 cases, ranging from 2 to 16 units.

30-Day Complications Rate and Histopathology Results

Postoperative outcomes and histopathological analysis are presented in *Table 3*. The median hospital length of stay was 12 days (range 8-20 days). Major complications (Clavien-Dindo score \geq III) occurred in 35.82% of patients ($n = 24$). These included deep surgical site infections (pelvic collections, 14.92%), urinary leaks (4.47%), perineal flap failures (7.46%), small bowel obstructions (4.47%), and anastomotic leaks (4.47%). Reintervention was necessary in 24 patients, with 13 radiological and 11 surgical procedures.

No mortality was observed within 30 days postoperatively. Of the 67 patients treated with curative intent, 85.12% ($n = 58$) achieved an R0 resection, while 13.43% ($n = 7$) had an R1 resection. 2 R2 resections were identified in our cohort. Further histological details are provided in *Table 3*.

Overall Survival Disease Free Survival

At a median follow-up of 22 months, 15 patients (22.38%) experienced disease recurrence, with a 10.44% local recurrence rate. Overall and disease-free survival rates at 2 years were 85.31% and 77.036% respectively. Kaplan-Meier curves are presented in *Figs. 4, 5*.

Discussion

Locally advanced or recurrent rectal cancer poses significant challenges to colorectal services in the UK and internationally, due to the need for specialist radiological input, the

Table 2. Operative details

Surgical approach			
	Open	51 (76.11)	
	Laparoscopic	13 (19.40)	
	Robotic	3 (4.47)	
Conversion to open		3/16 (18.75)	
Surgery classified as per Burns et al.			
Pelvic compartments	Procedure performed		
POSTERIOR	P1 Presacral	24 (4.47)	
	P2 HiSS-High subcortical sacrectomy	2 (2.98)	
	P3 Low Sacrectomy \leq S3	10 (14.92)	
	P4 High Sacrectomy \geq S2	3 (4.47)	
	P5 Sacrectomy requiring stabilisation	0	
ANTERIOR	A1 Partial cystectomy	13 (19.40)	
	A2 Ureteric resection with reimplantation	13 (19.40)	
	A3 Total cystectomy or radical cystoprostatectomy	9 (13.43)	
	A4 Cystectomy with pubic bone resection	0	
	A5 Cystectomy with complete urethrectomy	2 (2.98)	
CENTRAL	C1 Rectum or TAH/BSO	28 (41.79)	
	C2 Rectum +/-TAH/BSO/partial vaginectomy or seminal vesicle/partial or complete prostatectomy	36 (53.73)	
	C3 Rectum + TAH/oophorectomy + total vaginectomy	2 (2.98)	
VESSELS	SV1 Lymphadenectomy	21 (31.34)	
	SV2 Distal branches of internal iliac artery	3 (4.47)	
	SV3 Proximal internal iliac artery and vein	5 (7.46)	
	SV4 External iliac artery or vein +/- internal iliac artery or vein	0	
NERVES	SN1 Obturator nerve	0	
	SN2 Single nerve root	0	
	SN3 Multiple nerve roots S2 and below	1 (1.49)	
	SN4 Multiple nerve roots S1 and below	1 (1.49)	
	SN5 Complete sciatic nerve including lumbosacral trunk resection or more extensive notch clearance	0	
PELVIC FLOOR	PM1 Levator Ani	18 (26.86)	
	PM2 Levator Ani, sacral ligaments and muscles +/- Ischial spine	13 (19.4)	
	PM3 Iliacus/ iliopsoas resection/Iliac crest resection	0	
RECONSTRUCTION	Perineal reconstruction using Biological mesh	8 (11.94)	
	Perineal reconstruction using VRAM flap	4 (5.97)	
	Perineal reconstruction using IGAM flap	7 (10.44)	
	Perineal reconstruction using Gracilis flap	13 (19.4)	
	Perineal reconstruction using VY flap	6 (8.95)	
	Urinary reconstruction end to end anastomosis	2 (2.98)	
	Urinary reconstruction Boari flap	4 (5.97)	
	Urinary reconstruction Bricker ileal conduit	10 (14.92)	
	Common iliac lymphadenectomy	29 (43.28)	
	Para-aortic infrarenal lymphadenectomy	9 (13.43)	
	Groin lymphadenectomy	5 (7.46)	
	Surgical duration in min.		390 (300-543.5)
	Estimated blood loss in ml.		500 (200-1250)
Blood transfusion requirements in units			
	No	25	
	Yes	42 (2-16)	

Values are presented as number only, median (interquartile range), or number (%) or nuber (range).

Table 3. Postoperative surgical, pathological and oncological patient outcomes

Characteristic	Number
Hospital stay in days post-surgery	12 (8-20)
Complications reported as per Clavien-Dindo classification	
3	16 (23.88)
4	8 (11.94)
Leak	
Urinary	3 (4.47)
Intestinal	3 (4.47)
Deep surgical site infection	10 (14.92)
Small bowel obstruction	3 (4.47)
Flap dehiscence	5 (7.46)
Tumour size in mm	35 (21-50)
Pathological T-stage	
T0	5 (7.46)
T1/2	12 (17.91)
T3	26 (38.80)
T4	23 (34.32)
Pathological N-stage	
N0	41 (61.19)
N1	19 (28.35)
N2	5 (7.46)
Nodal yield	17 (13-23)
Lymphovascular invasion	22 (32.83)
Perineural invasion	12 (17.91)
Tumor regression grade (n= 45)	
1	9 (20)
2	19 (42.22)
3	15 (33.33)
4	2 (4.44)
Positive CRM (R1 resection)	7 (10.44)
R2	2 (4.44)
Adjuvant treatment	35 (52.23)

Values are presented as number only, median (interquartile range), or number (%) or median (range).

complexity of the surgery, the broad range of surgical specialties involved and access to specialist postoperative care. This cohort study demonstrates that with appropriate access to specialist advice and expertise, appropriate skill set and training a nascent centre can safely carry out complex curative exenterative surgery, with comparable patient outcomes to larger volume centres.

The PelvEx Collaborative Group conducted a retrospective international cohort study which analysed outcomes for 1291 patients undergoing PE across multiple centres over a 10-year period (28). Patients in our study were the same age as in the PelvEx study median age of 64 years. For patients

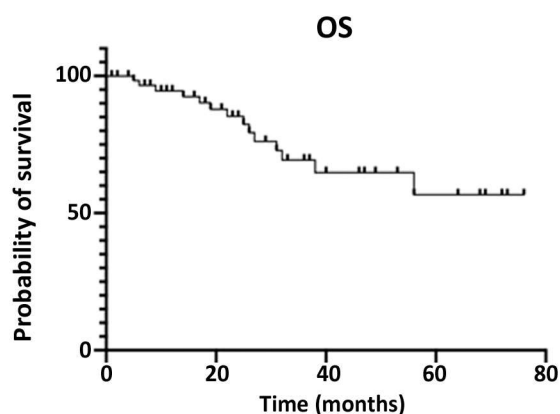


Figure 4. Kaplan-Meier analysis of overall survival (OS) after pelvic exenteration performed in BHRUT

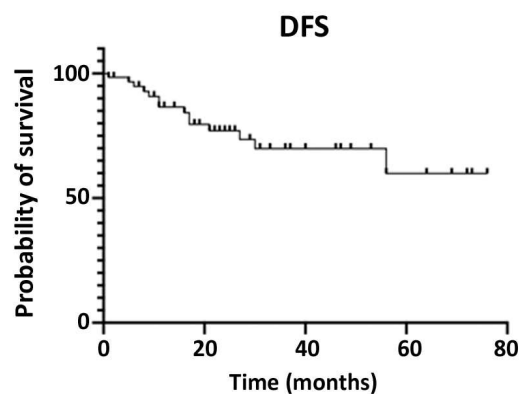


Figure 5. Kaplan-Meier analysis of disease free survival (DFS) after pelvic exenteration performed in BHRUT

with known nodal status, no significant difference in proportions was noted for those with and without nodal involvement. A significantly smaller proportion of patients at our centre received neoadjuvant treatment compared to the PelvEx data due to the relatively late presentation and the presence of fistulation/perforation in our patients.

For patients who were treated radically, the proportion of clear resections was comparable between our centre and that reported by the PelvEx collaborative (86.56% versus 79.8%) (28). Patients in our study had a shorter median post-operative length of stay with smaller variance (median: 12, IQR: 12 days) compared to those in PelvEx data (median: 16, IQR: 14 days). A smaller percentage of patients in our study experienced severe 30-day post-operative complications (35.82% versus 37.8%). Survival outcomes between our study and those reported by PelvEx could not be directly compared. Median disease-free survival was not reported in the PelvEx study, whereas median overall survival was not reached in our cohort of patients.

Negative margin rates were excellent at our centre, and were comparable to other centres internationally. Patient survival and disease-free survival were also good. Our centre demonstrated shorter median length of hospital stay than other centres, and low rates of serious 30-day complications.

Access to specialist radiological expertise was critically important in the process of performing exenterative surgery at our centre. Teleconferencing with the specialist centre enabled cross-sectional imaging to be reviewed remotely for all stakeholders, for staging and surgical planning during MDT meetings.

We acknowledge the limitations of this study. Our experience of exenterative surgery is growing therefore multivariable detailed analysis is not feasible. The length of follow-up in our study was relatively short, meaning that longer-term patient outcomes could not be assessed. Many of the other limitations are inherent to the design of a retrospective cohort study, such as the possibility of reporting bias. More data is required regarding the safety and feasibility of decentralisation of exenterative surgery via a tier system (soft-tissue exenteration, soft tissue/bony lateral side wall, distal and high sacrectomy) and depending on available local resources and expertise.

Although centralisation of cancer services allows regions to build expertise and through volume of work, difficulties in delivering these services post COVID-19 pandemic has resulted in capacity being exceeded, as demonstrated by increasing waiting times. Outsourcing services to smaller centres, may offload pressure and allow more timely access to surgery. Our unit has successfully grown from soft tissue exenteration to include soft-

tissue side-wall exenteration distal sacrectomy also high sacrectomy as well as extended lateral sidewall excision and referring bony resection requiring stabilization to tertiary centres in London . Currently there are no formal training pathways to facilitate development of the skillset for exenteration surgery, although these are being considered by the PelvEx and UKPEN. Training and expertise are needed to support new centres, and their outcomes must be monitored assiduously. The heterogeneity of patient characteristics, neoadjuvant therapy use, surgical procedures definitions, and tumor histology among different studies makes direct comparison of local outcomes challenging.

Conclusions

This study, conducted at a low-volume DGH, demonstrates the feasibility and safety of PE surgery for pelvic malignancies when supported by a collaborative MDT and meticulous preoperative planning. The achieved short-term outcomes are comparable to published data, and high R0 resection rates suggest favourable long-term oncological outcomes. This finding underscores the value of a dedicated, specialized multidisciplinary approach for managing locally advanced and recurrent pelvic malignancies in centres where all the expertise is available.

Author Contributions

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draft preparation, V.B., A.M., P.K., S.K. and N.R.; writing – review and editing, V.B., A.M., P.K., R.P., A.G., R.W., A.K., S.G., G.P.S.B., B.S., W.K., R.B., M.H., J.H., D.B., S.K. and N.R.; visualization, V.B., A.M., P.K., S.K. and N.R.; supervision, R.P., A.G., R.W., A.K., S.G., G.P.S.B., B.S., W.K., R.B., M.H., J.H., D.B., S.K. and N.R.; project administration, V.B., A.M., P.K., S.K. and N.R.; All authors have read and agreed to the published version of the manuscript.

Conflicts of Interests and Source of Funding

The authors declare no conflicts of interest. This research received no external funding

Institutional Review Board Statement

Ethical review and approval were waived for this study due to the fact that this study was an audit.

Informed Consent Statement

This study was approved by the Divisional Governance committee and complied with all local guidelines on information and research governance. The hospital R&I Department of Barking, Havering and Redbrdige University Hospitals NHS Trust exempted this study from ethics approval since the study was not considered Research by NHS Health Research Authority.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author

Acknowledgments

All authors are grateful for the input and guidance provided by all members of the general surgery department in the Barking, Havering and Redbridge University Hospitals NHS Trust, London, United Kingdom.

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