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Aldridge, J., Young, C., Tiernan, J. et al. (Accepted: 2026) A standardised approach to the pathological dissection and reporting of pelvic exenteration specimens: recommendations from the UK Pelvic Exenteration Network (UKPEN). Colorectal Disease. ISSN: 1462-8910 (In Press)

A standardised approach to the pathological dissection and reporting of pelvic exenteration specimens: recommendations from the UK Pelvic Exenteration Network (UKPEN)

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Acknowledgements

NPW is supported by Yorkshire Cancer Research programme grants (L386/L394) and Cancer Research UK through the Leeds Radiotherapy Research Centre of Excellence (RRCOER-Jun24/100004). CY is supported by a Jean Shanks Pathological Society of Great Britain & Ireland grant (JSPS CLSG 2020 10 03). NPW and CY are supported by the National Institute for Health and Care Research (NIHR) Leeds Biomedical Research Centre (BRC) (NIHR203331). The views expressed are those of the author(s) and not necessarily those of the NHS, the NIHR or the Department of Health and Social Care.

Abstract
Pelvic exenterations are complex operations associated with significant morbidity and resource implications. Resection is undertaken with curative intent and achieving clear margins is paramount to successful oncological outcomes. Comprehensive pathological reporting is essential, yet there are no internationally agreed guidelines describing an optimal approach. This article presents a standardised approach to the pathological dissection and reporting of pelvic exenteration specimens, endorsed by the UK Pelvic Exenteration Network (UKPEN). This includes all relevant steps of the clinical pathway, from acknowledging the importance of pathology involvement in pre-operative radiological planning to post-operative correlation meetings. Key recommendations are exemplified with illustrative examples. Standardisation of pelvic exenteration pathology will contribute to optimal patient care, enhance multidisciplinary learning and service development, provide quality assurance and auditable standards, and facilitate national and international research.

Introduction

Pelvic exenterations are performed in specialist centres for various primary and recurrent tumours. These complex and resource intense operations carry significant morbidity and resource implications[1-10]. Optimal surgical and oncological outcomes require a multidisciplinary approach, including meticulous pre-operative planning, various surgical subspecialties, and comprehensive post-operative pathology.

Standardised pathological dissection and reporting are essential to provide comprehensive diagnostic and prognostic information[1, 11-14]. Currently, there are no agreed national or international guidelines[13, 15] although one randomised trial has described recommended standards for quality control developed through consensus that have in part been adopted in these current recommendations[16]. The UK Pelvic Exenteration Network (UKPEN) endorses a standardised pathological approach. Standardisation enables pathological-radiological-surgical correlation, which in turn ensures continuous learning and quality improvement, ultimately leading to lower R1 rates and better patient outcomes. It also facilitates national and international collaboration, shared learning and research[14].

Methods

The pathological approach to pelvic exenterations at Leeds Teaching Hospitals NHS Trust was presented at a UKPEN meeting (April, 2025). Feedback was subsequently sought from pathologists and surgeons at five UK specialist centres to understand current practice and agree a standardised approach to pre-operative planning, dissection, reporting, and multidisciplinary correlation meetings. Key recommendations are described in this article with worked examples (Tables 1 & S1). Some areas of the pathway are flexible, allowing departments to develop a localised approach.

Key recommendations

A significant number of pelvic exenterations are performed for locally advanced primary rectal adenocarcinoma. Dissection and reporting should be undertaken according to the Royal College of Pathologists (RCPath) dataset for histopathological reporting of colorectal cancer (CRC)[17]. However, the dataset does not specifically address the approach to complex multivisceral resections, or the reporting of locally recurrent cancers. For other primary tumour types, guidance can be found in relevant RCPath datasets, supplemented by the approach below.

1. Pre-operative planning

Radiologists outline the tumour margins and surgeons agree an optimal surgical roadmap during pre-operative planning[18]. The responsible pathologist should be actively involved, ideally by attending the meeting, to appreciate the disease extent, planned operative approach and anticipated issues likely to require careful post-operative correlation (such areas may appear macroscopically unremarkable and may not otherwise be sampled). Based on the surgical plan, the pathologist may recommend a labelling approach to aid orientation and sampling. In most centres it is recognised that pathologists will not be able to attend planning meetings due to resource constraints, therefore, as a minimum, comprehensive notes from the meeting should be available to the pathologist.

2. Surgical specimen orientation

The responsible surgeon should complete a standard pathology request form, including details of tumour type, disease extent, neoadjuvant treatment, operative approach (listing structures removed), areas of concern, relevant intra-operative events (e.g. surgical disruption), and surgeon contact details[15]. This information can be provided through an additional proforma if preferred (Fig1). Orientation sutures or numbered beads can be used to mark specific structures and margins of concern (Fig2)[15].

The pathologist should review the pre-operative planning report, operation notes and request form to facilitate specimen orientation. They should understand the structures removed, tumour location and margins/structures of concern, prior to dissection. In certain cases it may be helpful for the pathologist to attend theatre after specimen extraction or for the surgeon to attend the initial part of specimen dissection.

3. Specimen receipt and opening

The specimen should ideally be received fresh, provided that transfer is prompt, and can be refrigerated overnight if required. In some centres it may be necessary to transfer the specimen in formalin, especially where there is a danger that specimens will remain unfixed for more than 12-24 hours. Refreshing formalin may be helpful.

Hollow structures should be opened to allow permeation of formalin, taking care to avoid damage to margins. Where it is necessary to open through a margin or slice into the specimen to aid fixation, the area should first be inked to ensure that the true margin is identifiable. Opening should ideally be performed by the pathologist undertaking the subsequent dissection; if this isn't possible, all incisions should be clearly documented with diagrams/photographs as required.

Small and large bowel should be opened through the antimesenteric peritoneal surface to the level of the peritoneal reflection, avoiding tumour. A tissue or foam 'wick' should be introduced into the non-opened segment to facilitate formalin permeation. Any purse string sutures at the distal margin should be removed and a 'wick' introduced. Staple lines should be opened, being mindful of tumour location. The bladder can be opened postero-superiorly and the uterus antero-superiorly, through the serosal surfaces, avoiding tumour, and a 'wick' introduced into each. Additional structures/organs should be opened as appropriate.

4. Whole specimen photography

The specimen should be photographed from the anterior, posterior, left and right aspects. Close-ups should be taken of areas of concern/interest. The images should include a metric scale, orientation labels and any surgical orientation markers should be visible (Fig2). Fresh specimen images (prior to distortion induced by formalin fixation) are optimal, however, additional formalin fixed images taken at the time of dissection can be helpful and may be the only option in some centres.

5. Macroscopic description

After a minimum of 48hrs formalin fixation, the specimen can be described. A comprehensive description of the specimen is essential to facilitate correlation with pre-operative imaging and microscopy. This includes measurement of the whole specimen, and the individual structures and organs present. If en bloc pelvic sidewall

(lateral lymph node tissue) is present, this should be described. Reference should be made to the orientation markers.

Visible tumour should be described, including the site, dimensions, relationship to en bloc structures and distance to margins. The presence of perforation should be noted, including the location, size and whether this involves the tumour. If large bowel is present, the planes of excision should be documented[17, 19-21]. Surgical defects should be measured and described, including whether they have been re-approximated in theatre. Additional abnormalities should be described.

6. Specimen inking and removal of bony structures

Different approaches to specimen inking to aid orientation and margin identification are acceptable, provided that specific core principles are followed. Preferably the responsible pathologist performs this task. Occasionally the surgeon may ink the specimen in theatre, although ink can render some structures difficult to identify. The entire non-peritonealised circumferential resection margin (CRM) should be inked using a locally agreed colour-scheme (Fig3). This facilitates case review for multidisciplinary team (MDT) meetings and internal quality assurance, and is helpful if the macroscopic dictation is lost. Ink should be dried prior to slicing.

The edges of any surgical defects should be inked in a different colour to denote that they are not true margins. Additional structures may require inking to facilitate identification on slicing and microscopy; this should be clearly recorded.

If bony structures are removed from the specimen prior to dissection, the opposing surfaces should be inked to denote that these are not resection margins. Alternatively, a bone-saw may be used, negating the need to dissect bony structures from the specimen.

7. Sampling prior to cross sectional slicing

Margin shaves should be taken prior to cross-sectional slicing, including bowel margins, perianal skin and tubular structures (e.g. ureters, vas deferens, urethra, and major arteries/veins). Sutures/numbered beads marking areas of concern usually represent wide regions, therefore shaves of these areas are inappropriate; instead, they should be sampled after cross sectional slicing.

Longitudinal bowel margins less than 30mm from tumour should be sampled in full (either full face or cruciate)[17]. In cases of squamous cell carcinoma with perineal skin excision, the entire skin margin may need embedding and mapping in the block key/annotated specimen photograph.

8. Cross sectional slicing, photography and description

The specimen should ideally be sliced at 4-5 mm intervals throughout the entire tumour bed and at least 20mm either side; it is therefore essential that the specimen is well-fixed and a fresh blade used. The distal and/or proximal slice can be thicker to facilitate cruciate blocks. Marker beads that detach on slicing should be laid alongside the relevant slice. It may not be possible to achieve a 4-5 mm slicing interval, especially in poorly fixed specimens, and slice thickness variation should therefore be documented to allow correlation with radiology.

Slices should be laid out in a standardised manner, ideally in the axial/CT plane, for radiological correlation and review by colleagues. Slices should be photographed with a metric scale and orientation labels (proximal, distal, anterior, posterior, left and right) (Fig4). Images should include an overview of all slices and close ups of each slice containing tumour and areas of concern/interest, which may include photographing the opposing face.

The number of slices and orientation-layout should be recorded (proximal to distal or vice versa). A record should be made of which slices contain key organs/structures, marker beads or surgical defects.

Tumour(s) and tumour bed locations should be described, including the relationship to areas of concern identified at pre-operative planning. Tumour dimensions should be documented, with the quadrants and structures involved, and distances to all key margins. If multiple tumours or associated deposits are identified, these should be described separately. Finally, any additional incidental findings should be described.

9. Specimen sampling

Tumour should be extensively sampled, ideally in whole mount/mega blocks to facilitate correlation with macroscopic photographs and radiology. In general, sampling protocols should align to the relevant primary cancer RCPath dataset, however, additional sampling may be indicated in the context of neoadjuvant treatment and in particular potential complete tumour regression. A meticulous block key should describe the slice sampled (and position within the slice) for each block. Sampling should include the deepest level of invasion of primary cancer, involvement of all en bloc organs/structures, and all margins within 10mm of the tumour/tumour bed. At least one standard-sized block of tumour should be taken for immunohistochemistry and/or molecular pathology[17].

All lymph nodes should be embedded, with the apical node identified separately[17]. It is acceptable to combine multiple nodes from the same territory in a single block and only embed part of each node. Nearby inked margins should be included. Lymph nodes harvested from the pelvic sidewall or other non-mesorectal drainage beds should be embedded separately.

One representative block of non-involved organs should be taken, and any background lesions sampled. After sampling, the slices may be wrapped sequentially with numbered paper towel to facilitate re-visiting the specimen if required.

10. Post-decalcification of detached bony structures

Following decalcification, detached bony structures should be orientated and sliced from superior to inferior at 4-5mm intervals. Any lesions should be described and photographed. The microscopy of the main specimen, if already reported, will inform sampling.

If un-involved by tumour, one representative section may be taken. If lesions are identified, the distance to the inked margin should be measured and thorough sampling performed with a description of the slices sampled. Consideration should be given to wrapping the bony slices sequentially.

11. Microscopic reporting

For primary cancers, the appropriate RCPath dataset should be completed to include pathological TNM staging[22]. Pelvic exenteration specimens may present specific staging challenges compared to single organ resections. Although not discussed specifically in the RCPath dataset, TNM staging clarifies that for rectal adenocarcinoma, tumour extension beyond the anatomical rectum (i.e. through the embryological package surrounded by mesorectal fascia, into adjacent soft tissue structures) should be staged as (y)pT4b[22]. Assessment may be facilitated by an elastin stain, which highlights the fascial planes. Recurrent CRC should not be staged.

11.1. Tumour

The report should confirm the tumour type, differentiation grade, and depth of invasion and/or size[17]. En bloc organs and structures should be listed with a record of whether they are involved by tumour or fibrosis/acellular mucin. If tumour approaches a site of bony detachment, this should be noted, with the final report to follow post-decalcification. Multiple tumours should be described separately.

11.2 Mechanisms of spread

The presence/absence of venous, lymphatic and perineural invasion should be documented along with the deepest extent (intra- or extra-mural)[12, 17, 23-25].

11.3 Lymph nodes

The number of regional and non-regional lymph nodes should be recorded separately, noting location (e.g. right/left pelvic sidewall). The number and location of involved nodes should be documented[3, 6, 12]. If involved nodes with extracapsular spread or capsule disruption lie close to the CRM, the distance to margin should be measured. The presence of extranodal tumour deposits should also be recorded[17, 26].

For lymph node staging in primary rectal adenocarcinoma, TNM considers the following sites as non-regional and therefore distant metastases: common iliac, external iliac and inguinal (with the exception that inguinal nodes are regional for tumours below the dentate line)[22]. The internal iliac nodes are regional[22]. As specimens with en bloc pelvic sidewall rarely have the individual stations subdivided, it is recommended that all pelvic sidewall lymph nodes are considered regional unless non-regional sites are specifically marked[22].

11.4 Distant metastases

The presence of distant metastases (including non-regional lymph nodes) should be recorded.

11.5 Resection margins

All margin shaves should be reported as involved or not. Adequate clearance at the CRM is key to a successful outcome[3, 6, 12, 15, 20]. The margin status should be described in detail, both to predict individual patient outcome and to facilitate learning and guide subsequent pre-operative planning and surgery. The minimum distance between tumour and all relevant margins should be recorded, along with the location of the closest point of tumour to each margin. Additional levels may be indicated where tumour is close to a margin. The distance should be recorded to the nearest millimetre if the margin is not involved. If pre-operative planning identified margins of concern

and/or these were labelled on the specimen, the distance of tumour, fibrosis or acellular mucin to these margins should be recorded to allow pathological-radiological-surgical correlation.

The definition of an involved margin depends on tumour type, site and whether primary or recurrent; this should be guided by the relevant RCPath dataset. In the event of a microscopically involved margin (pR1), a statement should be made whether this is due to primary tumour, tumour deposit, perineural invasion, venous invasion, lymphatic invasion, or an involved lymph node. For an involved lymph node at the margin, it is important to document whether there is extracapsular spread and whether the node is intact. For each site of margin involvement, the exact location should be stated according to the slice involved and position on the slice, to aid correlation with radiology and intra-operative findings.

In primary CRC, an involved CRM is defined as tumour ≤1 mm from a margin[17]. There has been a recent international change in the definition of margin involvement for tumour encapsulated within a lymph node, as evidence suggests a lower risk of recurrence in this scenario[27]. If an involved lymph node has an intact capsule with no evidence of extracapsular spread, the margin should be classified as not involved, even if intranodal tumour is ≤ 1mm from the margin[28-31]. If the lymph node has been transected and tumour directly involves the inked margin (0 mm), or if there is extranodal spread and the extracapsular tumour lies ≤1 mm from a margin, the margin is considered involved. If an involved lymph node is transected with tumour >1 mm from a margin, this is best regarded as not involved, although there is no good supporting evidence for this.

There is no internationally accepted definition for an involved margin in locally recurrent CRC. There is limited and conflicting evidence[32], however the largest study from an internationally renowned group suggests that the 1 mm rule is not appropriate and that 0 mm is a better predictor of overall survival[33]. For this reason, many centres internationally now apply the 0 mm rule in this context[31]. In the absence of formal national or international guidance, individual MDTs will need to make a decision about how they will define R1 in their service, and this should be clearly communicated to the local clinical team and detailed in the report. This topic would clearly benefit from further research and national/international recommendation to allow comparability of cases across centres.

Where there is any doubt (initially reported as pRX), the status of the margin should be confirmed at the post-operative MDT meeting alongside the operative records and radiology. Diathermy artefact can help to distinguish a genuine surgical margin from an artefactual defect occurring during specimen extraction/processing. Elastin stains may also be helpful.

11.6 Regression grading

Regression grading is required after neoadjuvant therapy in primary CRC[17], however it is not validated in recurrent disease. Some surgeons however, may find it helpful for the pathologists to document histological features of regression with a 'proxy' regression grade to facilitate further research in the area.

11.7 Other features
If additional organs demonstrate incidental pathology, this should be documented with input from the relevant pathology subspecialties, as required.

12. Post-operative clinicopathological correlation meetings

Pelvic exenteration resections are usually discussed in disease-specific post-operative MDT meetings. Within these busy meetings, there is rarely time to perform in-depth correlation of radiology, surgery and pathology. It is recommended that all cases with unexpectedly involved margins are discussed in detail, ideally in separate, less frequent correlation meetings, including radiology, pathology and the responsible surgeons, although resource constraints may mean that this is not possible in many centres. The focus should be understanding the cause of margin involvement and determining whether it has occurred due to: i) incorrect radiological planning; ii) incorrect surgical execution or iii) an unavoidable/unknown margin. Viewing the radiology alongside the macroscopic photographs and histological slides (ideally laid out in the same plane) allows for in-depth discussion, facilitating learning and development. Such meetings ensure clinical governance for an optimised exenteration service and foster cross-specialty relationships and understanding.

Conclusion

Pelvic exenterations are extremely complex operations associated with significant morbidity and resource implications, requiring a detailed, accurate and standardised pathological approach. This article presents best practice recommendations, endorsed by the UKPEN, for such an approach, encompassing the involvement of pathologists in pre-operative planning and post-operative correlation. Close collaboration between radiologists, surgeons and pathologists is key to delivering a safe and effective service with embedded learning and improvement. It is essential that pathology resources are adequate to realise this, with sufficient time to follow these guidelines, despite the capacity constraints facing many departments.

Word count: 3006 (excluding abstract)

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