West Midlands Radiotherapy Clinical Protocol

Urology - Bladder Cancer

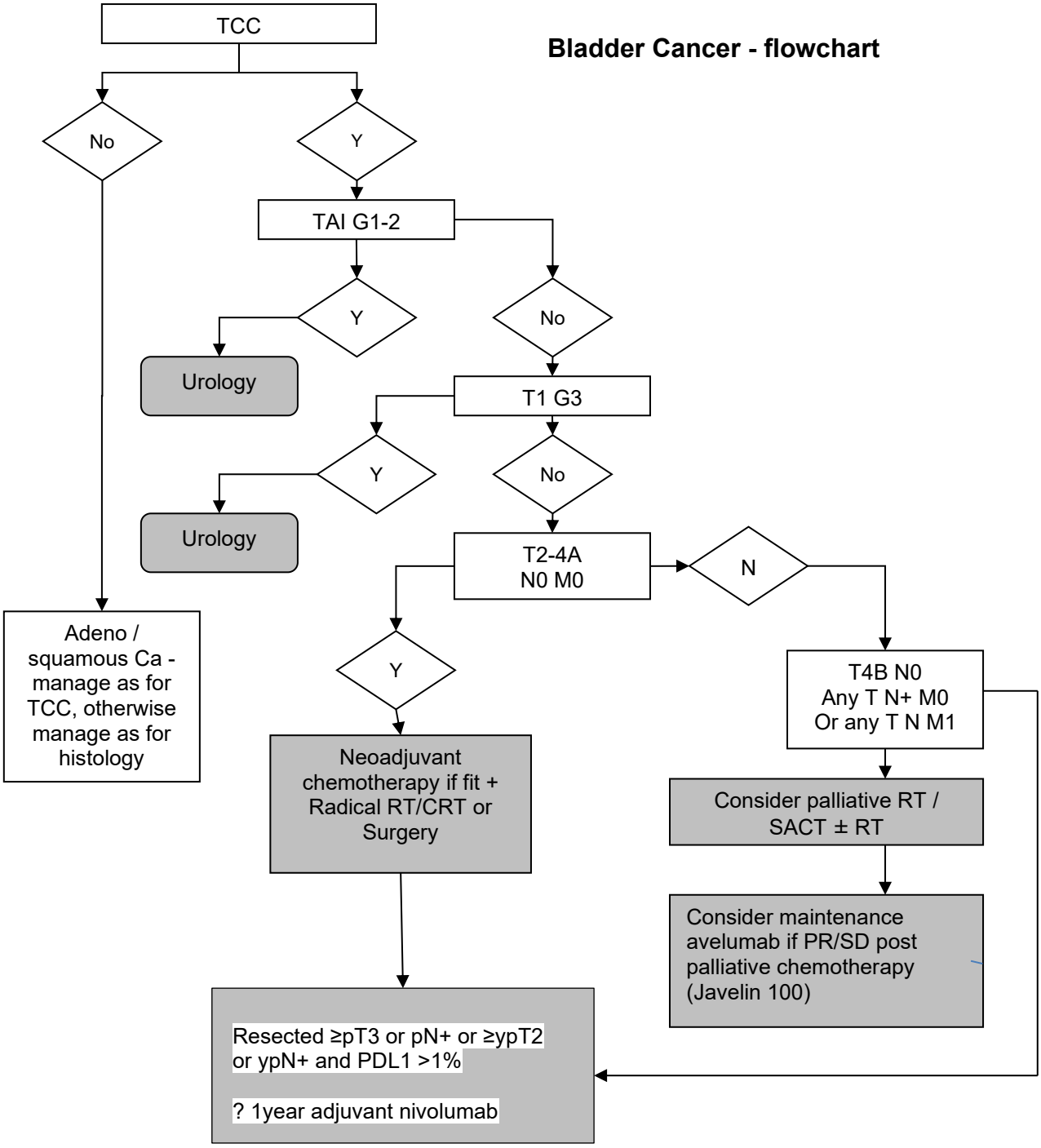
Revision history

Version	Date	Summary of changes
1.0	08.04.2022	EAG Approval
2.0	9.2.24	Ratified by EAG
3.0	14.2.25	Ratified by EAG
4.0	14.9.26	Minor amendments to the section on Transitional cell carcinoma; IMRT protocol; and dose & fractionation
Review Date:	September 2028	

Ratified by

This document was ratified by the Radiotherapy Expert Advisory Group (EAG) at its September 2026 meeting.

Bladder Cancer - flowchart



Histological Sub-Types:

- Transitional cell carcinoma: 95%
- Squamous cell carcinoma
- Adenocarcinoma
- Others (including sarcomas, lymphomas)

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Purpose

To provide a standardised protocol for planning and delivery of external beam radiotherapy for patients with bladder cancer within the West Midlands. This protocol is aligned with the Royal College of Radiologists (RCR) Dose Fractionation Guidance Version 4, January 2024 and with the Bladder Cancer RCR Consensus Statement, 2023

The RCR consensus statement published in 2023 advises that all bladder cancers should be treated as RCR category 1 tumour as treatment interruptions during daily bladder radiotherapy can have a detrimental effect on outcomes.

Information & Consent

- Each patient should be consented with individualised information of planned treatment, risks / benefits and toxicities
- Booking form and consent completed by IR(ME)R practitioner
- Patients should also receive a local patient information sheet or MacMillan information booklets

Responsibility

It is the responsibility of department management teams to ensure departmental protocols are consistent with this regional protocol and that any disagreement with the content of this protocol is raised through the West Midlands EAG.

1. INVESTIGATIONS

Blood tests:
Full blood count, urea and electrolytes, creatinine, LFTs, where clinically appropriate

Imaging:
Cross sectional imaging of thorax, abdomen and pelvis for staging, as clinically appropriate.
NB. Scans performed immediately post TURBT may over stage as perivesical change may be interpreted as tumour when actually reactive to resection.

Microbiology:
MSU should be requested if there is any evidence of urinary tract infection.

TURBT:
Information must be available from an EUA and clear detail of operative records. Tumours should be optimally debulked at cystoscopy with resection down to and including muscle. If there is no muscle in the histology specimen, re-resection may be necessary to confirm the absence or presence of muscle invasion.

Nuclear medicine:
Routine bone scanning is unnecessary in asymptomatic patients who have normal alkaline phosphatase and calcium levels.

Pathology
Histological diagnosis is essential. Biopsy specimens **MUST** include muscle to assess stage accurately.

1.2 Staging:

Management according to TNM staging (2017)[1]

Ta	Non-invasive papillary carcinoma
Tis	Carcinoma *in situ*
T1	Tumour invades subepithelial connective tissue
T2	Tumour invades muscle T2a Superficial muscle (inner half) T2b Deep muscle (outer half)
T3	Tumour invades perivesical tissue: T3a microscopically T3b macroscopically (extravesical mass)
T4	Tumour invades any of the following: prostate, seminal vesicles, uterus, vagina, pelvic wall, abdominal wall T4a Tumour invades prostate, seminal vesicles, uterus or vagina T4b Tumour invades pelvis or abdominal wall
N- Regional Lymph nodes	Defined as nodes of the true pelvis below the bifurcation of the aorta. Laterality does not affect the N classification
Nx	Nodes cannot be assessed
N0	No lymph node metastasis
N1	Metastasis in a single node in the true pelvis (hypogastric, obturator, external iliac or presacral)
N2	Metastasis in multiple regional lymph nodes in the true pelvis (hypogastric, obturator, external iliac, or presacral)
N3	Metastasis in common iliac lymph node(s)
M – Distant Metastasis	
Mx	Cannot be assessed
M0	No distant metastasis
M1a	Non-regional lymph nodes
M1b	Other distant metastases

[1] American Joint Committee on Cancer. Urinary Bladder. Amin MB, Edge S, Greene F, Byrd DR, Brookland RK, et al, eds. *AJCC Cancer Staging Manual. 8th ed. New York: Springer; 2017.*

2. MANAGEMENT

2.1 Transitional Cell Carcinoma

TA-1, G1-2, T1, G3:
Managed by Urologists. Trial of RT vs. intravesical therapy was negative, therefore no role for RT in these patients.

T2-T4a N1 or Nx M0
- Neoadjuvant chemotherapy with platinum based combination chemotherapy (3-4 cycles)
- Consider interim cystoscopy. Patients who fail to respond to chemotherapy are probably poor candidates for radical RT
- Radical cystectomy or radical radiotherapy according to patient and clinician preference. Radiotherapy preferably following BC2001 trial. (A randomised phase III study of radiotherapy with and without synchronous chemotherapy in muscle invasive bladder cancer (isrctn 68324339) https://www.birmingham.ac.uk/trials/crctu/bc2001/Radiotherapy-Guide.pdf)

Node positive disease - T2-4b N1-2 M0:
Node disease is associated with a poor prognosis due to the high risk of associated systemic metastases. According to TNM staging, node positive is regarded as metastatic disease. Treatment is often palliative but may be deemed radical in patients with good performance status if the volume of disease is small enough.

- For patients with good renal function, systemic chemotherapy should be strongly considered, with or without radical RT to the bladder primary and pelvic lymph nodes.
- Node positive patients confined within the pelvis and who have responded well to 3 cycles of chemotherapy can be considered for radical dose radiotherapy to the bladder and pelvic nodes.* (Fackrell, D. G., Ford, D., Chetiyawardana, S. BJR case reports, 2016).
- Palliative radiotherapy to sites of bulky disease in chemo non-responders or those not fit for chemotherapy.

Adjuvant Immunotherapy
- Completely resected, high-risk urothelial cancer (defined as residual cancer ≥ypT2 or ypN+ after neoadjuvant cisplatin-based chemotherapy or ≥pT3 or pN+ without previous chemotherapy) where the tumour expresses PDL-1 >1% may be eligible for 1 year of adjuvant Nivolumab (Checkmate 274)

Extensive nodal disease or systemic metastases - (any T) N2-3 M0, NX, M1
- Treatment intent is palliative. Chemotherapy combinations with cisplatin are more effective than those without (Mead GM, Russell M, Clark P, et al. *British Journal of Cancer* 1998; **78**:1067-1075, Saxman SB, Propert KJ, Einhorn LH, et al. *Journal of Clinical Oncology* 1997;**15**:2564-2569.).
- Gemcitabine plus Platinum has equivalent survival to MVAC but is much less toxic (von der Masse et al, 2002).
- At time of ratification, for patients with PD-L1 positive disease (≥5%), who are ineligible for cisplatin based chemotherapy with a PS 0-2 Atezolizumab can be used in the first line setting (ATE1_v1.3 CDF). However drugs are subject to change due to evidence and NICE guidance.

2.2 Squamous Cell Carcinoma

Squamous cell carcinoma should be treated along similar lines to transitional cell carcinoma. For non TCC pathology there is less evidence for neoadjuvant chemotherapy.
However squamous cell carcinoma is sensitive to platinum based chemotherapy (data presented at ASCO 2001).

2.3 Adenocarcinoma

Adenocarcinoma is rare in the UK although common in areas with endemic Bilharzia. Management should be on similar lines to TCCs. However, care must be taken to exclude direct spread from prostate or bowel in deciding management.
There is less evidence for neoadjuvant chemotherapy for adenocarcinoma.

2.4 Neuro-endocrine tumours

These appear to respond similarly to TCCs and platinum based combinations should be used where possible.

2.5 Sarcoma

This should be managed according to histological subtype.

2.6 Lymphoma

Primary bladder lymphoma is very rare (only 8 cases in the world literature) and therefore secondary spread should be excluded. For recommendations and guidance refer to WM Network Haematological treatment protocol. Protocols - West Midlands Cancer Alliance (wmcanceralliance.nhs.uk)

3 RADIOTHERAPY:

3.1 Intensity Modulated Radiotherapy (IMRT) Protocol for Bladder Cancer

Introduction

IMRT may be used to treat those with muscle invasive bladder cancer receiving radical therapy. Dose distribution may be improved and therefore, dose to organs at risk can be reduced.

*Patients with node positive disease (N1) or those felt to be high risk, could be considered for radical or prophylactic dose to pelvic nodes. Such extensive radiotherapy is not suitable for all patients but, in a select few, may prove to be a suitable and successful treatment option (Fackrell, D. G., Ford, D., Chetiyawardana, S. BJR case reports, 2016).

Consider radical radiotherapy with radiosensitiser to the bladder with pelvic nodes [for] patients with non-metastatic urothelial cancer who are deemed node-positive on diagnostic imaging as per 2023 RCR consensus statement 4.5

This could also be suitable for selected N2 with complete response after neoadjuvant chemotherapy at discretion of responsible clinician.

All these patients will need a discussion at specialist MDT.

Consider adaptive radiotherapy where available to accommodate bladder volume

changes.

Pathway

1) **Radiotherapy bookings**: Request IMRT/VMAT on the radiotherapy request form.

2) **Immobilisation:**.
   Supine. Hands on chest, with appropriate immobilisation, for example: combifix or kneefix and heel stocks.
   Empty rectum & bladder emptied immediately before CT scan.
   Empty rectum prior to treatment. Consider the use of Micro enema and/or Movicol & Semiticone as preferred. Empty bladder (according to local protocol) before treatment
   A maximum rectal diameter of 4cm is allowed before a rescan should be considered.

3) **Planning scan: (**with IV contrast for patients having pelvic node treatment**)**
   Planning scan with<=3mm CT slices should be performed with appropriate immobilisation as mentioned above. Scans will be taken from the bottom of the L1/L2 vertebral space and continue up to 1cm below the ischial tuberosities.

3.1.1 Dose and Fractionation:

For bladder alone

- 55Gy in 20 fractions over 4weeks (preferred standard radical schedule for most patients)
- 64Gy in 32Fractions over 6 – 6.5weeks (reserved for select clinical scenarios)

For bladder and nodes

- 64Gy in 32 fractions is delivered to the bladder and positive nodes.
- 53Gy in 32 fractions is delivered to bilateral pelvic lymph nodes prophylactically.

(refer to appendix 3)

Treatment technique and dose prescription

Radical radiotherapy should be delivered using inverse planned IMRT with online image-guided radiotherapy (IGRT).

Volumes will be defined according to ICRU Report 50 and 62. Dose prescription and recording for IMRT will conform to the Principles of ICRU 83.

IMRT will be prescribed to the median dose point on the dose volume histogram (DVH) such that the prescription dose is received by 50% of the PTV (D50%).

- Maximum dose is defined as D2%.
- Minimum dose is defined as D98%.

Treatment interruptions

RCR category 1.

Gaps should be managed as per the RCR Timely delivery of radical radiotherapy: guidelines

for the management of unscheduled treatment interruptions: Fourth edition. See: rcr-publications_the-timely-delivery-of-radical-radiotherapy-guidelines-for-the-management-of-unscheduled-treatment-interruptions-4th-edition_january-2019.pdf

3.1.2 Contouring Guidance:

Contouring will conform to the Principles of ICRU 50 and 62.
CTV (Clinical Target Volume):
The whole bladder is used as the bladder CTV. The clinical target volume (CTV) contour includes the whole bladder and areas of extravesicle spread. The CTV should include 1.5cm of prostatic urethra in males or 1cm of urethra in females, if tumour is present at the base of the bladder or if Carcinoma in situ (CIS) is present. The gross tumour volume (GTV) is not required to be contoured as a separate structure.

(Benjamin R Hindson, Sandra L Turner, Jeremy L Millar, Farshad Foroudi, N Kumar Gogna, Marketa Skala, Andrew Kneebone, David RH Christie, Margot Lehman, Kirsty L Wiltshire, Keen-Hun Tai, Australian & New Zealand Faculty of Radiation Oncology Genito-Urinary Group: 2011 consensus guidelines for curative radiotherapy for urothelial carcinoma of the bladder. J Med Imaging Radiat Oncol. 2012 Feb;56(1):18-30)

PTV (Planning Target Volume):

PTVs are geometric expansions of the CTVs accounting for internal motion and set-up error. All CTVs will have a corresponding PTV with suggested naming convention and margins listed below. PTV margins should be verified for each centre following local IGRT audit. Deviations from the centre-specific PTV margin may be permitted following Peer Review and MPE discussion.

Options include

1. PTV= CTV+1.5cm (Circumferential expansion)

Or

2. Follow **RAIDER trial protocol** (NCT02447549)

Table to show: Expansions for standard arm

CTV to PTV expansion margin(cm)	Lateral	Anterior	Posterior	Cranial	Caudal
	0.8	1.5	1.2	1.5	0.8

For planning purposes, when PTVs overlap the higher dose is reported. Additional volumes created by modifying the PTV may be required for optimisation purposes but should not be reported on.

Target	PTV	Suggested margin
Bladder	PTV_XX*	CTV (Bladder) + 0.8cm – 1.5cm**
Prophylatic Nodes	PTVn_XX	CTVn + 0.5cm
Positive Node(s)	PTVn_XX	CTVn + 0.5cm-1.0cm***

*XX indicates dose level in Gy

**As included in RAIDER trial protocol and based upon primary disease location and local IGRT strategy
***Depending upon location of positive node relative to primary target (bladder) and local (IGRT) strategy.

CTVn: Pelvic nodes are outlined as per the PIVOTAL planning document. The volume extends from L5/S1 to the S3/4 junction. See Appendix 1.

3.1.3 Organs at Risk (OAR) Dose Constraints

OARs adjacent to the PTV(s) should be outlined with names consistent with the international consensus guidelines endorsed by RTTQA (Mir et al, Radiother Oncol 2020;150:30-39).

Plans should meet relevant dose restrictions (see appendices 2, 3 and 4).

Plan Check and Approval as per the departmental policy.

3.2 Peer review

Peer review should be undertaken in line with the West Midlands regional guidance agreed in December 2025 which identifies which cases should be subject (as a minimum) to peer review. Please refer to the West Midlands Peer Review guidance (December 2025).

3.3 Concurrent chemoradiotherapy

Chemotherapy with MMC and 5FU may be delivered for radio-sensitization. However, thrombocytopenia is reported at an increased rate in those where pelvic nodes are treated and in particular with concurrent chemotherapy. Care should be taken to select appropriate patients and FBC monitored closely.

Less strongly evidenced alternative regimes may include single agent cisplatin[*] and single agent low-dose gemcitabine[#] (NCCN cat. 2b), Carbogen and nicotinamide.[**]

([*]JA Efstathiou, DY Spiegel, WU Shipley , etal: Long-term outcomes of selective bladder preservation by combined-modality therapy for invasive bladder cancer: The MGH experience Eur Urol 61: 705– 711,2012

Tester W, Caplan R, Heaney J, Venner P, Whittington R, Byhardt R, True L, Shipley W. Neoadjuvant combined modality program with selective organ preservation for invasive bladder cancer: results of Radiation Therapy Oncology Group phase II trial 8802. Journal of Clinical Oncology : Official Journal of the American Society of Clinical Oncology, 01 Jan 1996, 14(1):119-126

[#]Coen JJ, Zhang P, Saylor PJ, et al. Selective bladder preservation with twice-daily radiation plus 5-flourouracil/cisplatin (FCT) or daily radiation plus gemcitabine (GD) for patients with muscle invasive bladder cancer: Primary results of NRG/RTOG 0712—A randomized phase 2 multicenter trial [Abstract]. J Clin Oncol 2018;36:6_suppl, 408.

Choudhury A, Swindell B, Logue JP et al. Phase II Study of Conformal Hypofractionated Radiotherapy with Concurrent Gemcitabine in Muscle Invasive Bladder Cancer. J Clin Oncol 2011; 28: 1-6

Kent E et al. Combined-modality therapy with gemcitabine and radiotherapy as a bladder preservation strategy: results of a phase I trial. J Clin Oncol. 2004 Jul 1;22(13):2540-5

** Hoskin P et al. Radiotherapy With Concurrent Carbogen and Nicotinamide in Bladder Carcinoma. J Clin Oncol. 2010 Nov (28) DOI: 10.1200/JCO.2010.28.4950. Radiotherapy_With_Concurrent_Carbogen_and_Nicotinamide_in_Bladder_Carcinoma?

Choudhury A et al. Hypofractionated radiotherapy in locally advanced bladder cancer: an individual patient data meta-analysis of the BC2001 and BCON trials. Lancet Oncol 2021; 22: 246–55

Treatment regimen: Carbogen + nicotinamide (CON)
Nicotinamide 40-60mg/kg oral daily 1-2 hours before RT
Carbogen (2% CO2, 98%O2) during treatment
Carbogen must be closed system, with a one way valve & bacterial filter.
Breathe for 10 minutes before and during RT

3.4 Adjuvant Nivolumab

See section 2.1

3.5. PALLIATIVE TREATMENTS

AIM: to deliver an effective dose irradiation with minimal side effects as simply and quickly as possible.

PTV = CTV (Bladder) + 15mm planned with CFRT or simple Virtual SIM.

Use of VMAT/IMRT in addition to conformal or virt sim where clinically appropriate.

The following doses can also be used for local control where patient not suitable for radical dose:

21Gy in 3 fractions over 1 week has been shown equivalent to 35Gy in 10 fractions in MRC trial and should be regarded as standard. (Int J Radiat Oncol Biol Phys 2000 May 1; 47 (2): 379-88).

Other dose fractionations include:

20Gy in 5#

Or 8 Gy single #, for frail patients to provide symptomatic relief.

30 -36Gy in 5 -6# weekly fraction, delivered by IMRT (HYBRID – Evaluating New Radiation Technology in Patients with Unmet Needs. R.Huddart, F.McDonald, R.Lewis & E.Hall. https://doi.org/10.1016/j.clon.2013.04.008)

Planning:
Bladder to be emptied before lying on the simulator or CT bed.
Patient position: supine, kneefix or similar local immobilisation may be utilised

4. VERIFICATION

Patients are to be treated with an empty bladder and rectum (as per CT scan).

- All radical treatments will be verified with daily MV/CBCT with online correction
- Local protocols must be available describing action levels and concomitant imaging doses.
- If the bladder volume is consistently larger/smaller than on the planning CT a re-plan (including the acquisition of a new planning CT) should be considered. Local protocols describing the decision making process should be available.
- Palliative cases planned using virtual simulation to be imaged as per local policy.

UHB: Until further notice, nodal patients will be treated on Tomotherapy and are therefore scanned with each fraction.

5. PATIENT CARE DURING RADIOTHERAPY

Patients should be seen on a regular basis during radiotherapy.
Dysuria/frequency may be caused by acute radiation effects, but UTI must always be excluded. Transient diarrhoea is frequently seen, usually after the second treatment week, and can be controlled with appropriate dietary advice / Codeine Phosphate - 30-60 mg 6 hourly if the patient is not allergic, or Loperamide. These drugs should be continued for up to or beyond 2 weeks after completion of radiotherapy, until symptoms improve.

6. FOLLOW UP

Patient should be seen in line with local policies eg.4-6weeks after radiotherapy,
Cystoscopic and radiological follow up as per NICE guidance (Bladder Cancer, Diagnosis and Management. https://www.nice.org.uk/guidance/ng2/chapter/1-recommendations#treating-muscle-invasive-bladder-cancer-2)
On completion of treatment a summary of the radiotherapy dose and side effects are documented.
Potential future acute and late side effects are detailed.

- Patients should be provided with the contact details of the department if there are any queries relating to the treatment and can also be provided with the contact of the Acute Oncology Service outside of hours where available.
- Patients will be reviewed post treatment as per local guidelines.

7. CLINICAL TRIALS

All suitable patients should be considered for entry into clinical trials.

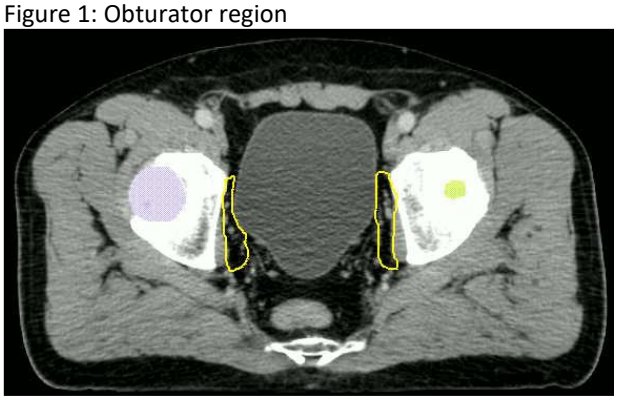
Open and recruiting trials can be seen at National Institute for Health Research | NIHR and at Clinical trials - West Midlands Radiotherapy Network

Appendix 1.
Guidance for the volume of pelvic nodes (taken from the PIVOTAL protocol)

Pelvic vessels are outlined as structure 'vessels' on each axial CT slice in continuity. Outlining should begin superiorly at the mid-point of the most anterior part of the L5/SI vertebral interspace (identified on the sagittal view of the planning CT scan). The vessels should be readily identified due to the presence of i.v. contrast.

As contouring proceeds inferiorly, the external iliac vessels extend anteriorly; they should continue to be outlined until the level of the top of the femoral head is reached. At this point, the vessel contour will move inside the bony pelvis. The vessels are contoured as inferiorly as possible, however, it is difficult to see the obturator vessels, and this area is dealt with separately (figure 1). The lowest vessel contour stops 1cm superior to the pubic symphysis.

Figure 1: Obturator region



The vessel contours are then expanded using the radiotherapy planning software program to create a new structure CTVn. A margin of 7mm is applied in lateral and anterior-posterior directions only. (*NB Superior and inferior expansion is not performed)*. At the time of volume expansion, the bowel avoidance volume (obtained by adding a 3mm isotropic margin to the total bowel outline, see section 4.3), rectum and bladder should be excluded from the new contour CTVn.

Pre-sacral region

The lymph node volume CTVn now requires editing. The pre-sacral lymph node area will need to be added to the volume, this extends from L5/S1 to the S3/4 junction, and is determined by the sagittal scan view. To do this a 12mm 'rollerball' is drawn along the anterior surface of the sacrum to connect the lateral parts of the volume. Care should be taken to exclude any bony protrusions (e.g. osteophytes) which are not part of the body of the sacrum, and the volume does not extend posteriorly to include the sacral exit foramina.

There may be a vessel crossing the midline, in which case the CTVn volume should be edited to connect the lateral volumes, incorporating this vessel, using a 12mm rollerball anterior to the bone surface. (i.e. not extending more than 12mm anterior to the bone)

If there is bowel in this pre-sacral space it should be specifically excluded from the volume. In this case the outline follows the posterior wall of the bowel avoidance volume.

- **Connecting internal and external iliac volumes**

As the volume continues inferiorly on each side of the pelvis the external iliac vessels extend anteriorly and the internal iliac vessels extend posteriorly. On some of the more inferior slices on both sides of the pelvis, the CTVn contour will comprise 2 discrete areas (anterior and

posterior). These should be joined to form one volume by connecting each volume (again taking care to exclude muscle and bone) using a 18mm rollerball along the medial surface of the bony pelvis, and ensuring that laterally the volume abuts muscle or bone. The 3mm bowel avoidance volume, rectum and bladder volumes should all be excluded.

- **Obturator region**

Using a 18mm rollerball, a volume is created by drawing along the medial surface of the bony pelvis bilaterally. This creates 2 parallel volumes on the pelvic side walls which encompass the obturator lymph nodes. Manual editing should then be performed to exclude muscle/ bowel avoidance volume/ bladder/ rectum. This region starts at the level of the top of the femoral heads.
On all slices, any ‘small white dots’ in close proximity to blood vessels/ CTVn can be incorporated into the volume at the clinicians discretion.

Appendix 2.

Intensity Modulated Radiotherapy (IMRT) Protocol for Bladder Cancer including Nodal Irradiation.

Bladder 55Gy / 20# Plan Assessment Form

Patient Name: Plan ID:

Hospital Number: Treatment Site:

TARGETS

		PTV55		
% Volume	**% Dose**	**Dose Required (Gy)**	**Dose Achieved (Gy)**	**comments**
99%	>90%	49.5		
95%	>95%	52.3		
50%	100%	55.0		
5%	<105%	57.8		
2%	<110%	60.5		

ORGANS AT RISK

	Dose-volume constraint	**Limit**	**Plan achieved**	**comments**
RECTUM	V25 Gy	80%		
	V 41.7 Gy	60%		
	V 50 Gy	50%		
	V 54.2	30%		
	V 58.3	15%		

FemurHead Neck_L	V 41.7 Gy	50%		
FemurHead Neck_R	V 41.7 Gy	50%		

	Dose-volume constraint	**Limit Optimal**	**Limit Mandatory**	**Plan achieved**	**comments**
BOWEL (loops) Sigmoid, small & large	V37.5 Gy	116 cc	139 cc		
	V 41.7 Gy	104 cc	127 cc		
	V 45.8 Gy	91 cc	115 cc		
	V 50.0 Gy	73 cc	98 cc		
	V 54.2 Gy	23 cc	40 cc		
	V 58.3 Gy	0 cc	10 cc		
	V 61.7 Gy	0 cc	0 cc		

Planned	**Checked**	**Approved**

Date		

Appendix 3.
IMRT - Node irradiation in Bladder Cancer – Plan Assessment Form

Patient Name: Plan ID:

Hospital Number: Technique: VMAT / Tomo

Target:

		PTV 64 (Bladder)		PTV 64 (Node)		PTV 53 (prophylactic)	
Volume (%)	**Dose (%)**	**Dose Required (Gy)**		**Dose Required (Gy)**		**Dose Required (Gy)**	
99%	>90%	57.6		57.6		47.7	
95%	>95%	60.8		60.8		50.35	
50%	=100%	64		64		53	
5%	<105%	67.2		67.2		55.65	
2%	<110%	70.4		70.4		58.3	

OAR	Dose (Gy)	Mandatory	Optimal	Planned	Comments
RECTUM	30		80% vol		
	40		65% vol		
	50	60% vol	50% vol		
	60	50% vol	35% vol		
	65	30% vol	30% vol		
	70	15% vol	15% vol		
	75	5% vol	3% vol		
BOWEL	45	158 cc	78 cc		
	50	110 cc	17 cc		
	55	28 cc	14 cc		
	60	6 cc	0.5 cc		
	65	0 cc	0 cc		
L Fem Head	50	25% vol	5% vol		
R Fem Head	50	25% vol	5% vol		

Planned	Checked	Approved

Appendix 4.
RAIDER Trial Radiotherapy Planning Guidelines

Table 5a OAR Dose Constraints for 32-fraction schedule

	Whole bladder prescribed to 52Gy (tumour volume dose 64/70Gy) Absolute constraints		
Rectum	V30Gy V50Gy V60Gy V65Gy V70Gy	80% 60% 50% 30% 15%	
Femoral Heads	V50Gy	50%	
Bladder outside PTV2	V60Gy V65Gy	80% 50%	
Other Bowel		Optimal	Mandatory
	V45Gy	116cc	139cc
	V50Gy	104cc	127cc
	V55Gy	91cc	115cc
	V60Gy	73cc	98cc
	V65Gy	23cc	40cc
	V70Gy	0cc	10cc
	V74Gy	0cc	0cc

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