

## BLADDER

### RADIOTHERAPY TREATMENT CLINICAL GUIDELINES

*Please note: these Guidelines will apply unless the patient is taking part in clinical trial, in which case the trial protocol will supersede the Guidelines.*

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## 1). SCOPE OF THE GUIDELINES

Radiotherapy for treatment of bladder cancers.

## 2). SELECTION CRITERIA / INDICATIONS FOR TREATMENT

Muscle-invasive bladder cancer:

T2/T3	<p>Treatment of muscle invasive bladder cancer. Local radical radiotherapy to bladder.</p> <p>Where possible offer a radiosensitiser as standard of care for patients suitable for daily radical radiotherapy for urothelial carcinoma of the bladder.</p> <p>Offer neoadjuvant Gemcitabine / Cisplatin chemotherapy for patients with good performance status (ECOG 0/1) and sufficient renal function.</p>
T4a	As for T3 or palliative irradiation, based on situation.
T4B / N+	<p>Palliative radiotherapy +/- chemotherapy.</p> <p>In some instances may consider to treat with radical radiotherapy to maximise local control. E.g.: Consider radical radiotherapy with radiosensitiser to the bladder with pelvic nodes.</p>

## 3). PRE-TREATMENT INFORMATION FOR RADICAL TREATMENT

Pre-treatment assessment:

### 1). History and examination:

- FBC, U+E, LFT
- Cystoscopy + biopsy (TURBT)
- Diagnostic CT/MRI scan, including CT chest and upper tract assessment
- Consider FDG PET scan if indeterminate findings on CT/MRI e.g. node positive
- If hydronephrosis present, consider need for stenting or nephrostomy pre-treatment if renal function impacted

- 2). Investigation results discussed with the patient and decision made to treat with radiotherapy. The opportunity for shared decision making and options of both radiotherapy and surgery should be discussed with the patient with CNS support.
- 3). Signed consent
- 4). Planning CT Pre-Treatment Request form completed and submitted with instructions for CT planning
- 5). Patients to start within 4 weeks of referral if radical treatment (RCR category 2, but treated as per Category 1). If patient has received neo-adjuvant chemotherapy, radiotherapy should aim to start 3-4 weeks post chemotherapy.

#### Radiosensitisers:

#### Chemotherapy

Patients for primary radical radiotherapy should be considered for inclusion of chemotherapy as a radiosensitiser – MMC&5FU is the most recommended regimen.

Cisplatin or Gemcitabine are alternative choices.

#### Carbogen + Nicotinamide

Where in use cases may be radio sensitised with carbogen and nicotinamide instead of chemotherapy as per local centre policy.

#### 4). CONSENT (EBRT)

See the [RCR national radiotherapy consent form](#) or local alternative if no current national consent form.

## 5). LOCALISATION

### Position / immobilisation

- Supine
- Empty bladder, consider rectal enema if rectum > 4cm diameter
- Head support. Arms folded across chest; immobilisation system or head, knee and ankle support

### CT planning scan

- Inferior: 5cm below ischium (or perineum) Superior: Top of L4 (top of L3 if treating Pelvic LN)
- 3mm slices
- If large bladder volume - consider rescan. If consistently large bladder volume - consider catheterisation

## 6). VOLUME DEFINITION

### Radiotherapy Planning Volumes

- Standard margins as indicated in RAIDER trial - standard arm
- Adaptive radiotherapy planning (Plan of the Day):
  - New technique being implemented with small/ medium (standard margin)/ large PTV expansions applied to generate 2-3 plans. Currently small and medium plans prepared with large plan only then if required. Best fit 'plan of the day' utilised as assessed on the day with daily CBCT IGRT
  - Clinician to indicate on Planning CT Pre-Treatment Request form that patient to be treated using adaptive and site of gross tumour volume (GTV)

### General guide

#### **GTV**

Gross disease / tumour bed: defined by fiducial marker if present, diagnostic imaging and surgical map. To encompass any extra vesical disease or pathological bladder wall thickening.

For adaptive radiotherapy planning GTV requires to be contoured on planning CT to assist radiographers with plan of the day allocation

### **CTV**

Contour encompassing tumour / tumour bed (GTV), whole bladder and any extra vesical spread. If tumour present at base or distant CIS present CTV to include 1.5cm of prostatic urethra in men or 1cm of urethra in women.

### **PTV - standard margin: preferred**

	CTV to PTV expansion (cm)				
	Lateral	Anterior	Posterior	Superior	Inferior
PTV (Bladder standard)	0.8	1.5	1.2	1.5	0.8

### **PTV – standard margin: alternative**

PTV = CTV+1.5cm (Circumferential expansion)

### **PTV – adaptive margins (in adaptive planning)**

	CTV to PTV expansion (cm)				
	Lateral	Anterior	Posterior	Superior	Inferior
PTV (Small)	0.5	0.5	0.5	0.5	0.5
PTV (Medium)	0.8	1.5	1.2	1.5	0.8
PTV (Large)	1.5	2.0	1.5	2.0	1.0

PTV margins may be centre specific, based on local monitoring of CTV coverage.

## 6). ORGANS AT RISK

As per RAIDER protocol

Region of Interest / Organ at Risk	Dose Objective Whole Bladder 55Gy /20 fraction absolute constraints		
Rectum	V25	80%	
	V41.7	60%	
	V50	50%	
	V54.2	30%	
	V58.3	15%	
Femoral Heads	V41.7	50%	
		Optimal	Mandatory
Other Bowel	V37.5	116cc	139cc
	V41.7	104cc	127cc
	V45.8	91cc	115cc
	V50	73cc	98cc
	V54.2	23cc	40cc
	V58.3	0	10cc

Region of Interest / Organ at Risk	Dose Objective Whole Bladder 64Gy /32 fraction absolute constraints		
Rectum	V30	80%	
	V50	60%	
	V60	50%	
	V65	30%	
	V70	15%	
Femoral Heads	V50	50%	
		Optimal	Mandatory
Other Bowel	V45	116cc	139cc
	V50	104cc	127cc
	V55	91cc	115cc
	V60	73cc	98cc
	V65	23cc	40cc
	V70	0	10cc

For radiotherapy to node positive disease

### **Volume definitions**

CTVs:

- *CTV1 = Whole bladder*

Delineated by the outer bladder wall and includes extravesical disease. The inferior limit of the bladder includes 1.5cm of prostatic urethra in all male patients, and 1cm length of urethra in females where there is a bladder base tumour or diffuse CIS.

- *CTV2 = Pelvic lymph nodes*

This includes the following nodal areas: the pre-sacral chain to bottom of S3, the pre-sciatic nodes, the external iliac nodes and the internal iliac nodes, including the hypogastric-obturator complex).

- *CTV3 = Bladder tumour bed*

The bladder tumour bed is the site of original disease as seen on pre-chemotherapy imaging.

- *CTV4 = Involved pelvic lymph nodes*

Involved pelvic lymph nodes are determined at radiologist review of pre-chemotherapy imaging, and include all pathologically enlarged lymph nodes determined by CT size criteria ( $\geq 10$ mm in short axis diameter).

### **Organs at risk**

- *Rectum*

The circumference of the rectum should be outlined in its entirety, to include the faecal contents. Outlining should extend from the anus (usually at level of the ischial tuberosities or 1cm below the lower margin of the PTV – whichever is more inferior) to the rectosigmoid junction. The rectosigmoid junction can usually be identified on the CT slice where the bowel turns anteriorly and to the left. The overall length of the rectum is typically 10-12cm.

- *Bowel*

The entire bowel visible on relevant levels of the planning scan will be outlined and included in the analysis. The outlining will include the small bowel, the large bowel and the sigmoid colon, down to the level of the rectosigmoid junction. The superior extent of outlining should be 2cm beyond the superior extent of the PTV2.

- *Right and left femoral heads*

The femoral heads are outlined to the bottom of the curvature of their heads.

### **Outlining protocol for CTV<sub>2</sub> (pelvic lymph nodes)**

Lymph Node Groups:

- Pre-sacral: down to lower border of S3
- Obturator
- Internal Iliac
- External Iliac

Nodes are contoured using vessels as a surrogate, outlined superiorly from lower border of L5, with inferior border at the top of the femoral heads (stop at external iliac). Vessels are expanded by 7mm in axial directions, then adjusted to edit out bone and muscle.

From inferior border of L5 to the inferior border of S3, the expanded vessel contour is joined along the anterior surface of the sacrum using a 12mm rollerball.

Use 18mm rollerball to connect internal and external iliac volumes along the inner bony pelvis (edit off muscle). Use 18mm rollerball along inner obturator and stop 1cm above top of symphysis pubis, again editing off muscle.

For advice on radiotherapy to pelvic Lymph nodes see supplementary material from IMPART trial:

["The Intensity-Modulated Pelvic Node and Bladder Radiotherapy \(IMPART\) Trial: A Phase II Single-Centre Prospective Study"](#)



## 8). DOSE AND FRACTIONATION

### Muscle invasive bladder cancer (node negative)

#### Preferred:

- 55Gy in 20 fractions over 4 weeks
- 52.5Gy in 20 fractions over 4 weeks
- 60-64Gy in 30-32 fractions over 6-6.5 weeks

#### Alternative:

In those patients where daily fractionation not appropriate / for local control may consider:

- 30-36Gy in 5-6 weekly fractions

### Node positive bladder cancer

#### Preferred:

- 64Gy in 32 fractions over 6.5 weeks with 48-53Gy in 32 to the pelvic LN groups (as per the IMPART study)
- Boost to involved LN 57-64Gy in 32 fractions as per OAR tolerance

#### Alternative:

- 55Gy in 20 fractions over 4 weeks with 42-44 Gy in 20 fractions to the elective LN groups.
- Boost to involved LNs per 50-55Gy in 20 fractions as per OAR tolerance

## 9). VERIFICATION

Daily cone beam imaging on set.

## 10). ON-TREATMENT REVIEW

As per local policy.

## 11). FOLLOW UP / LATE EFFECTS

As per local policy.

## 12). PALLIATIVE TREATMENT FOR SYMPTOMATIC CONTROL

### Indications

- T4 or node positive
- Metastatic disease

### Dose Schedules

- 30-36Gy in 5-6 fractions treated weekly – 3D planned volume required
- 21Gy in 3 fractions alternate days – 3D planned volume required
- 30Gy in 10 daily fractions (can be parallel opposed fields to MPD)
- 20Gy in 5 daily fractions daily (can be parallel opposed fields to MPD)
- 8Gy single fraction (can be parallel opposed fields to MPD)

### 13). REFERENCES

- The Royal College of Radiologists. *Bladder cancer: RCR consensus statements*. London: The Royal College of Radiologists, 2023.
- James N, Hall E, Jenkins P, et al. Radiotherapy with or without chemotherapy in muscle invasive bladder cancer. *New England Journal of Medicine*. 2012; 366:1477-88
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- Enemy B, Lyman J, Brown A, et al. Tolerance of normal tissue to therapeutic irradiation. *Int J Rad Oncol Biol Phys*. 1991 May;21(1):109-22
- The Royal College of Radiologists. *On Target 2: updated guidance for image-guided radiotherapy*. London: The Royal College of Radiologists, 2021. ([web link](#))
- RAIDER ( A Randomised phase II trial of Adaptive Image guided standard or Dose Escalated tumour boost Radiotherapy in the treatment of transitional cell carcinoma of the bladder) Protocol – radiotherapy planning and delivery guidelines, version 2 11/08/2015
- MPTan, VHarris, K Warren-Oseni et al .The Intensity-Modulated Pelvic Node and Bladder Radiotherapy (IMPART) Trial: A Phase II Single-Centre Prospective Study. *Clin Onc Vol32 Iss 2 Feb 2020 (93-100)*

## 14). CHANGE/GOVERNANCE PROCESS FOR THE REGIONAL SW RT ODN GUIDELINES

To access all available SW RT ODN Clinical Guidelines, [please click here \(SWAG CA website\)](#).

