East of England Radiotherapy Network:

Prostate Brachytherapy Protocol V3.0

Contents

EofE RTN Prostate Brachytherapy Protocol V3
Date Agreed: March 2025
Date to be reviewed: March 2026

1.0 Indications and patient population

This protocol covers treatment in the following situations:

a. **Treatment of localised prostate cancer**

I. Monotherapy for low and intermediate risk disease

II. Brachytherapy boost in combination with external beam radiotherapy for unfavourable intermediate risk disease*

III. Brachytherapy boost in combination with external beam radiotherapy for high risk (T2) disease*

b. **Treatment of Locally advanced prostate cancer**

I. Brachytherapy boost in combination with external beam radiotherapy for high-risk disease (>T3) *

c. **Treatment of locally recurrent prostate cancer after definite radical radiotherapy or brachytherapy**

I. Salvage brachytherapy following biochemical failures after external beam radiotherapy or brachytherapy.

*See EofE Radiotherapy Network protocol for indications for patients receiving EBRT boost

1.1 Curative treatment eligibility

1.1.1 Inclusion criteria

a. Treatment of localised prostate cancer

- Biopsy proven low/intermediate disease.
- Fit for general anaesthesia.
- Able to give informed consent.
- Life expectancy >10 years in low/intermediate risk disease
- Typically, CPG risk groups 1-3[1]

b. Treatment of locally advanced prostate cancer

- Biopsy proven high risk disease.
- Fit for general anaesthesia.
- Able to give informed consent.
- Life expectancy >5 years in high-risk disease
- Typically, CPG risk groups 4-5[1]

c. Treatment of locally recurrent prostate cancer after EBRT or BT

- Pathologically documented local failure
- Fit for general anaesthesia.
- Able to give informed consent.
- Life expectancy >5 years
- Disease-free interval of >2 years
- PSA at salvage therapy ≤ 10 with long doubling time (>9 months)
- T2 N0 M0, exclude locally advanced.

1.1.2 Exclusion criteria

a. Indication of poor urine function and/or outflow obstruction observed pre brachytherapy.

I. Residual bladder volume > 100ml

II. IPSS >15

a. Distant metastasis

b. The presence of a significant prosta-urethral cavity*

*Patients having undergone previous TURP/HoLEP should not be excluded provided there is an absence of urethral cavity and baseline urine function is within the normal confines *[2]*

1.1.3 Cautions

a. Pubic arch interference

I. Arch interference may cause suboptimal implantations *[3,4]*

b. Prostatic calcifications 11 & 12 (LDR only)

I. Consider HDR for patients with extensive calcifications *[5]*

c. Rectal fistula

1.1.4 Essential pre-radiotherapy investigations for curative patients

a. PSA

b. Biopsy

c. Multi parametric MRI (CT if MRI incompatible)

2.0 Localisation

The following are mandatory requirements from the recent guidance:

Interstitial brachytherapy can be delivered by TRUS based implant and planning single step technique.

Interstitial brachytherapy can be delivered by TRUS guided implant and CT/MR based planning two step technique.

Permanent Brachytherapy should be delivered by single stage TRUS based adaptive implantation technique.

3.0 Dose prescription

Intent	Modality	Dose (Gy)	Fraction and implants	Comments
a. Localised prostate cancer with Low and favourable intermediate risk features	Permanent	145	1 fraction	Iodine-125
	Interstitial	13.5x2	2 Fractions 2 implants 1 week apart*	*As recommended by [4,6] limited evidence for other regimens
b. Localised prostate cancer with Unfavourable intermediate and High-risk diagnostic features.	Interstitial	15	1 fraction	EBRT boost 46Gy in 23 fractions P/Sv +/- Nodal irradiation
	Interstitial	15	1 fraction	EBRT boost 37.5Gy in 15 fractions – P/Sv only
	Permanent	110	1 fraction	EBRT boost 46Gy in 23 fractions P/SV & Nodal irradiation [7]
c. Salvage Brachytherapy following biochemical failures after external beam radiotherapy or brachytherapy.	Interstitial	36	6 fractions	2 insertions one week apart. 3 fractions per insertion, min 6 hours between fractions. [10, 11].

4.0 Target Volumes

Use standard nomenclature as per AAPM 263 [8]

4.1 Curative radiotherapy CTV / PTV

- **CTV**

Whole gland ± seminal vesicles (determined by risk category)

- **PTV**

3mm margin constrained to rectum posteriorly and bladder neck cranially where required.

For Treatment of locally recurrent prostate cancer after EBRT or BT ('Salvage BT') the PTV should be defined as the CTV (i.e., no margins) and the PTV constraints in section 5.1 applied.

5.0 Organs at risk

- Aim for the use of standard nomenclature as per Global Harmonization Group consensus guidelines: https://www.thegreenjournal.com/action/showPdf?pii=S0167-8140%2820%2930294-2

Structure name	Description
Rectum	Whole organ
Urethra	Prostatic urethra
PenileBulb	Penile Bulb, optional
Bladder	Bladder base/neck optional

5.1 Constraints

Temporary (HDR) [4,7]

Structure name (examples given below)	Constraint	Optimal	Mandatory
CTV	$V_{100\%}$ $V_{150\%}$ $D_{90\%}$		≥95% ≤40% ≥100%
PTV	$V_{100\%}$ $V_{150\%}$ $D_{90\%}$	≥95% ≤40% ≥100%	
Rectum (Values in Gy are for 15Gy Boost values, can be applied in % to 13.5 Gy monotherapy plans)	V100% D_{2cc}	 ≤75Gy EQD2 [≤10.6 Gy (70.6%) if 46Gy/23# EBRT ≤11.6 Gy (77.3%) if 37.5Gy/15# EBRT]	0cc <12 Gy (80%)

Structure name (examples given below)	Constraint	Optimal	Mandatory
Urethra (Values in Gy are for 15Gy Boost values, can be applied in % to 13.5Gy monotherapy plans)	$D_{10\%}$ $D_{30\%}$ $D_{0.1cc}$ $V_{150\%}$	≤120Gy EQD2 [≤17.5 Gy (116.7%) if 46Gy/23# EBRT Or 37.5Gy/15#] ≤105Gy EQD2 [≤15.7 Gy (104.9%) if 46Gy/23# EBRT ≤16.4 Gy (109.4%) if 37.5Gy/15# EBRT] <137Gy EQD2 [<17.1 Gy (114.1%) if 46Gy/23# EBRT <17.4 Gy (116.1%) if 37.5Gy/15# EBRT]	≤17.8 Gy (118.7%) if 46Gy/23# EBRT ≤18.4 Gy (122.7%) if 37.5y/15# EBRT <18.75 Gy (125%) 0cc
PenileBulb (if requested by Dr)	$V_{75\%}$	≤1cc	
Bladder (if requested by Dr)	$V_{75\%}$	≤2cc	

***Confirm if Organ tolerance is sacrificed for PTV coverage or Vice Versa**

Permanent 145Gy monotherapy [4,7]

Structure name (examples given below)	Constraint	Optimal	Mandatory
CTV	V_{100} D_{90} V_{150}	≥99% 170-185Gy 55-60%	≥98% >145Gy ≤65%
Rectum	D_{2cc} $D_{0.1cc}$		≤145Gy <200Gy
Urethra	D_{10} D_{30}		<150% <130%

Permanent 110Gy Boost [4]

Structure name (examples given below)	Constraint	Optimal	Mandatory
CTV	V_{100} D_{90} V_{150}	≥99% 125 - 140Gy 55-60%	≥98% >145Gy ≤65%
Rectum	D_{2cc} $D_{0.1cc}$		≤110Gy <150Gy
Urethra	D_{10} D_{30}		<150% <130%

6.0 Planning Process/Implant Technique

Due to the variation in brachytherapy modalities delivered across the network, implant and planning techniques are inherently varied. Recent guidance [3] does not recommend superiority in one implant and planning technique. Consideration of the fact that implant and planning techniques may be dependent on service capability should be taken.

7.0 Peer Review/ Contour QA

Cross network peer review poses the following challenges:

- Time factor: Cross site peer review may hinder timely treatment and thus reduce treatment effectiveness.
- Across the ODN there are sites with single handed consultant practice

The following has been agreed by the members of the ODN to mitigate these challenges:

- On site peer review for contouring should be in place If possible
- Cross site routine plan review to be done via an annual audit*

*Cross site QA contouring may be required if large discrepancies in practice are found.

National PID (post implant dosimetry) review should be used where possible (via ProKnow)

8.0 Mandatory Quality assurance

Permanent

- Post implant Scan, CT/MRI with dosimetry. Consistent timing post implant, slice thickness ≤3mm is necessary. Measure D90%, V100%, V150% and Rectal D2cc.

- Periodic feedback of PID

Temporary

- AAPM Task Group 128 QA test for Prostate Brachy US
- Standard Outputs IPEM report81

9.0 Side effects (from RCR consent form if available)

9.1 Possible early or short-term side-effects	
Expected (50-100%)	**Initial Management (if appropriate)**
Tiredness	
Urinary Frequency	
Common (10-50%)	**Management (if appropriate)**
Bowel Frequency	
Looser stools	
Less common (Less than 10%)	**Management (if appropriate)**
Cystitis	RTOG acute urinary toxicity grade • Grade 1: urination or nocturia frequency twice pre-treatment habit • Grade 2: urination or nocturia that is less frequent than every hour. Dysuria, urgency, bladder spasms may be reported • Grade 3: urination with nocturia hourly or more frequently; with dysuria, pelvic pain, and bladder spasm. Gross haematuria with/without clots may be reported. • Grade 4; haematuria requiring transfusion and acute bladder obstruction Dietary advice: encourage good oral hydration. Antispasmodics: consider antispasmodics for bladder spasms. Analgesia: consider oral analgesia for dysuria. Infection screening: check urine dip +/- MSU, consider antibiotics if appropriate.
Rectal Pain/ Discomfort	
Tenesmus	
Bleeding	
Rare (Less than 1%)	**Management (if appropriate)**
Urinary retention	Standard management
Urinary incontinence	Standard management

9.2 Possible late or long-term side-effects	
Common (10-50%)	**Initial Management (if appropriate)**
Urinary frequency	Consider tamsulosin/ anti-muscarinic agents as appropriate
Bowel urgency	Please refer to the Practical management of the Gastrointestinal Symptoms of Pelvic Radiation Disease[1] Consider investigation of conditions such as: • Bile Acid malabsorption using SeHCAT test • Small Intestinal Bacterial Overgrowth
Looser stools	
Retrograde ejaculation	
Loss of orgasm	
Erectile dysfunction	Offer oral medication. Consider referral to erectile dysfunction clinic.
Less common (Less than 10%)	**Management (if appropriate)**
Cystitis	
Incomplete emptying	
Urinary stricture	
Bowel frequency	Please refer to the Practical management of the Gastrointestinal Symptoms of Pelvic Radiation Disease[2] Consider investigation of conditions such as: • Bile Acid malabsorption using SeHCAT test • Small Intestinal Bacterial Overgrowth
Rectal pain	
Bleeding	
Abdominal discomfort	
Rare (Less than 1%)	**Management (if appropriate)**
Urinary incontinence	
Bowel/bladder damage	
Secondary malignancy	
Rectal Fistula	Requires discussion with the surgical team.

[1] MAC15090 Guidance on Practical Management of GI Symptoms (macmillan.org.uk)
[2] MAC15090 Guidance on Practical Management of GI Symptoms (macmillan.org.uk)

10.0 References

1. Using the Cambridge prognostic groups for risk stratification of prostate cancer in the national Prostate cancer Audit (2021). *NPCA,* Using the Cambridge Prognostic Groups for risk stratification of prostate cancer in the National Prostate Cancer Audit:
2. Salembier C, Henry A, Pieters BR, Hoskin P. A history of transurethral resection of the prostate should not be a contra-indication for low-dose-rate (125) prostate brachytherapy: results of a prospective Uro-GEC phase-II trial. JContemp Brachytherapy 2020; 12:1–5.

3. Hoskin PJ, Colombo A, Henry A, Niehoff P, Paulsen Hellebust T, Siebert FA, et al. GEC/ESTRO recommendations on high dose rate afterloading brachytherapy for localised prostate cancer: an update. Radiother Oncol 2013;107: 325–32.

4. Henry A, Pieters BR, Sibert FA, Hoskins P. GEC-ESTRO ACROP prostate Brachytherapy guidelines. Radiother Oncol 2022;167: 244-251

5. Vigneault E, Mbodji K, Carignan D, Martin AG, Miksys N, Thomson RM, Aubin S, Varfalvy N, Beaulieu L. The association of intraprostatic calcifications and dosimetry parameters with biochemical control after permanent prostate implant. Brachytherapy 2019;18(6): 787-792. https://doi.org/10.1016/j.brachy.2019.06.007

6. Morton G, McGuffin M, Chung HT, Tseng CL, Helou J, Ravi A, et al. Prostate high dose-rate brachytherapy as monotherapy for low and intermediate risk prostate cancer: efficacy results from a randomized phase II clinical trial of one fraction of 19 Gy or two fractions of 13.5 Gy. Radiother Oncol 2020; 146:90–6.

7. Morris et al. Androgen suppression combined with elective nodal, and dose escalated radiation therapy (the ASCENDE-RT trial). IJROBP 2017; 98(2) 275-285

8. https://www.aapm.org/pubs/reports/RPT_263.pdf

9. The Royal College of Radiologists. Radiotherapy target volume definition and peer review – RCR guidance. London: The Royal College of radiologists, 2017. Ref No BFCO (17)2.

10. Chen *et al*. Salvage HDR brachytherapy for recurrent prostate cancer after previous definitive radiation therapy: 5-year outcomes. Int J Radiat Oncol Biol Physics. 86(2):324-9.

11. Lee *et al.* Feasibility of high-dose-rate brachytherapy salvage for local prostate cancer recurrence after radiotherapy: the University of California – San Francisco experience. 67(4):1106-12.

11.0 Members of the protocol drafting committee

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12.0 Amendment History

A record of changes in this document

Date	Updated version number	Previous version number	Page Number/ Section (updated version)	Details
23.5.23	V1.0			New Document
18.10.23	V2.0	V1.0	All	Reformatted layout of document to be consistent with External Beam Network Protocols
14.3.25	V3.0	V2.0	All	Added in Salvage HDR
				Formatting updated in line with EofE RTN documentation
			Section 1.1	Inclusion criteria updated
			Section 5.1	Constraints updated