

Appendix 8: Details of Radiotherapy Planning

Radiation Treatment Planning

Patients will be instructed on bowel and bladder filling protocol prior to first planning appointment, and will follow the bowel and bladder protocol for the planning CT scan and during treatment.

All patients will undergo planning CT scan of the pelvis, supine, with the pelvis immobilized (recommended) and with an empty rectum and comfortably full bladder.

Patients with a maximum post-prostate rectal internal diameter of > 2 cm will be rescanned after evacuating their bowels.

The dome of bladder should extend to at least the superior aspect of the femoral heads.

Slice thickness should be 3 mm or less through the prostate. Total scanned volume should be at least 2 cm superior to the dome of bladder superiorly and at least 2 cm inferior to the inferior aspect of the ischial tuberosities.

Target and Organ at Risk Contouring

The CTV is the prostate gland, and will be contoured on each CT image.

Seminal Vesicles (SV): Patients with an estimated risk of seminal vesicle involvement of $> 15\%$ based on Partin's nomogram (Appendix 4) will have the proximal seminal vesicles included in the CTV. For patients with more than 15% risk of SV involvement, the proximal seminal vesicles will be defined as the portion from its origin with the prostate and extending 1 cm superiorly.

Bladder and Rectal Wall: The inner and outer bladder wall and inner and outer rectal wall will be contoured for a distance of 18 mm beyond the most inferior and superior contoured prostate slices or seminal vesicles when it is included in the CTV.

Femoral heads: Both femoral head and necks will be contoured.

The Planning Target Volume (PTV) will be expanded beyond the prostate and if applicable the contoured portion of the seminal vesicles. This will be 7 mm posteriorly (toward the rectum) and 10 mm in all other planes.

Planning Dose constraints and prescribed dose

A RT quality assurance committee will be established consisting of a Radiation Oncologist, Radiation Physicist and a Radiation Therapy planner. This committee will be available for consultation should questions arise concerning the treatment protocol. All centres will be accredited for activation by the committee after providing paper or electronic copy of plans for 5 recent cases demonstrating:

- CTV and PTV contoured according to protocol.
- Organs at risk (bladder and rectal walls and femoral heads) contoured according to protocol
- DVH for bladder and rectal wall, PTV and CTV that meet dose constraints for the hypofractionated treatment arm.

- A statement that patients will be treated with an approved daily image guidance technique

Treatment Technique:

IMRT will be the technique used for patients accrued from centres where all study patients can be treated with IMRT. In those centres where IMRT is not routinely available, then IMRT may be used when required to meet dose constraints. In these situations care must be taken to ensure that the CTV and PTV coverage are not compromised to meet dose constraint guidelines. If IMRT is not available then dynamic conformal arc therapy, or 6 or 7-field conformal therapy is acceptable, provided that the dose-constraints outlined below can be met. It is not anticipated that a 4-field conformal technique will be adequate to meet the required normal-tissue dose constraints.

Hypofractionated Treatment arm:

CTV	D99 \geq 60Gy
PTV	D99 \geq 57Gy (-5%) The volume of PTV exceeding 63Gy should not exceed 1 cubic centimetre (+5%)
Contoured rectal wall:	50% to receive less than 37Gy 70% to receive less than 46Gy
Contoured bladder wall:	50% to receive less than 37Gy 70% to receive less than 46Gy
Femoral head and neck:	5% to receive less than 43Gy
Dose prescription:	60Gy in 20 (3Gy) fractions over 4 weeks prescribed to CTV minimum

Conventional Treatment arm:

CTV	D99 \geq 78Gy
PTV	D99 \geq 74.1Gy (-5%), The volume of PTV exceeding 81.9 Gy should not exceed 1 cubic centimetre (+5%)
Contoured rectal wall:	50% to receive less than 53Gy 70% to receive less than 71Gy
Contoured bladder wall:	50% to receive less than 53Gy 70% to receive less than 71Gy
Femoral head and neck:	5% to receive less than 53Gy

Dose prescription: 78Gy in 39 (2Gy) fractions over 7.8 weeks prescribed to CTV minimum

Treatment Delivery:
Daily image-guidance will be used.

Allowable Techniques:
Implanted fiducial markers
Ultrasound
Cone-beam CT
Tomo-CT

IMRT Quality Assurance

All IMRT plans will undergo quality assurance evaluation with ion chamber measurements or an equivalent method of dose verification to verify the absolute dose for each IMRT field and film dosimetry to measure the relative dose for each IMRT field, as would be required for standard clinical practice. Independent MU calculation may be substituted for ion chamber dosimetry when available.