Clinical Datasheet: UKRC cervix model

DVHE version: 13.5.15

Source institution: UK RapidPlan Consortium

NB: This model is not intended to replace clinical decisions, provide medical advice or endorse any particular radiation plan or treatment procedure. The patient's medical professionals are solely responsible for and must rely on their professional clinical judgement when deciding how to plan and provide radiotherapy. The local institution should validate this model before using clinically.

Anatomical region: Female pelvis, cervical cancer

Clinical criteria

Trial protocol/(inter)national guidelines (if applicable):	Plans in the model were generated according to the INTERTECC protocol. Some centres who validated final model were working to INTERLACE protocol.
Imaging	CT; full/empty bladder scans
Patient selection criteria: Invasive carcinoma of the cervix FIGO clinical stage IB2 or above: treated in non-operative setting (intact uterus) FIGO clinical stage IB1 or below: treated post-operatively (hysterectomy/lymphadenectomy)	

Training plans

Number of plans	37
Beam geometry, energy	2 x 360^{o} arcs, 6MV
Machine, MLC	Varian Clinac/Truebeam, Millenium MLC
Modality (IMRT/VMAT)	VMAT
Calculation algorithm(s)	AAA
Optimisation algorithm(s)	PRO
Prescribed dose and fractionation	50.4Gy/28# (intact uterus) 45Gy/25# (post-operative)
Plan normalisation	Median PTV dose
Immobilisation	Knee rest

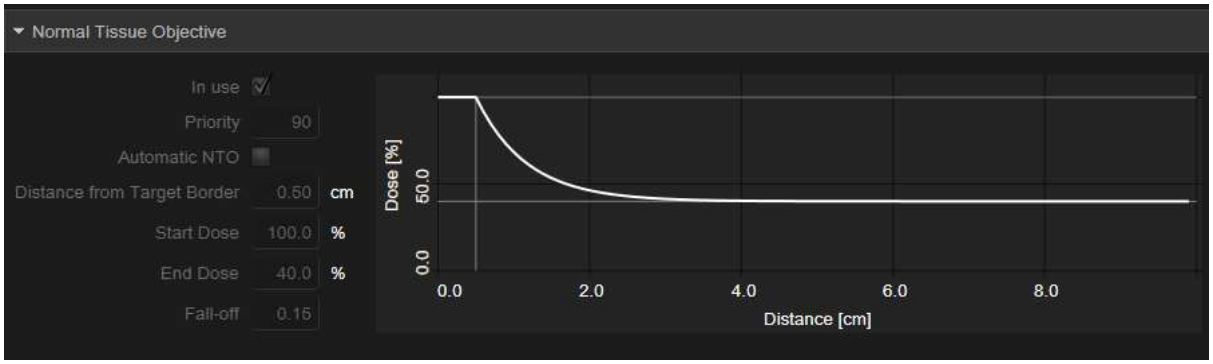
Structures included in model

Structure	Definition	No. cases in model	Comment
PTV_final	PTV_final=PTV1+PTV2+PTV3+PTV4 (following INTERTECC protocol)	37	
Bladder	Defined on full bladder scan	37	
Bowel	Bowel loops, contoured to 2cm superior to PTV	37	Training log suggests 54 should be used. Model also validated in centres who contour bowel sac
Rectum	From sigmoid flexure to anus. Treated as solid structure	37	
Bone_Marrow	All pelvic bones, contoured from level of ischial tuberosities to L5 or iliac crest (whichever is most superior)	38	
Femoral Heads	Exclude femoral neck	72	Model also validated in centres who include femoral neck

Model parameters

Structure	**Code**	**Objective**	**Volume (%)**	**Dose (% or Gy)**	**Priority**
PTV_final	PTV_High	Upper	0	101%	90
		Lower	100	100%	120
Bladder	15900	Upper	0	48.5Gy	90
		Upper (fixed vol, gen dose)	0	generated	90
		Line	generated	generated	generated
Bowel	7199	Upper	0	48.5Gy	90
		Upper (fixed vol, gen dose)	0	generated	90
		Line	generated	generated	generated
Rectum	14544	Upper	0	48.5Gy	90
		Upper (fixed vol, gen dose)	0	generated	90
		Line	generated	generated	generated
Bone_Marrow	9608	Line	generated	generated	generated
Femoral Heads	FemoralHeads	Line	generated	generated	generated

NTO



Plan acceptance criteria

The following plan acceptance criteria were used to assess the plans put into the model:

Structure	**Dose-volume metric**	**Objective (type)**
PTV	D99%	≥ 90%
	D95%	≥ 95%
	D5%	< 105%
	D2%	< 107%
Rectum	V30Gy	≤ 60% (soft)
	V45Gy	≤ 50% (soft)
	D1cc	< 100% (hard)
Bowel	V45Gy	< 78cc (soft)/158cc (hard)
	D1cc	< 100% (hard)
Bladder	V45Gy	≤ 50% (soft)
	D1cc	< 100% (hard)
Femoral heads	V30Gy	≤ 15% (soft)
	Max	< 50Gy (hard)
Bone marrow	V10Gy	< 90% (soft)
	V20Gy	< 75% (soft)

Model validation

The model was validated as follows:

A clinical model from one of the consortium centres was tested by two other centres (for details of initial model, see Hussein M et al, Radiother Oncol 2016; 120: 473-9). Based on feedback from these centres, refinements were made. The final model was tested by five of the consortium centres (initial three centres plus two others who had not participated in model development), each of whom used it to generate plans for ten patients who had previously been planned locally.

Suggested workflow

It is recommended that the model be used as follows for optimum results:

1. Run a single optimisation with no interaction.
2. Review the results. To improve target coverage or homogeneity, consider the following:
    a. For target coverage, generate a structure from the 95% isodose line. Create a pseudo PTV = (((PTV_final-Dose[95%]) + 2mm margin) – OARs) | PTV_final. Apply the same lower objective as PTV_final to this new structure.
    b. For hotspots, generate a structure from the 103% isodose. Apply the same upper objective as PTV_final to this new structure.

    If required, additional dose-volume points can also be added for OARs if particular dose-volume objectives are not met. It is recommended that these initially be given a priority of 70, but that this is adjusted interactively as required (see step 3).
3. Continue the previous optimisation, using the current plan for intermediate dose. Step back to level 1, adjust priorities interactively if required, and then allow to continue the optimisation automatically.