Cancer Care Ontario
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Contouring Nomenclature

Recommendation Report

A project developed by the Head and Neck Community of Practice of the Radiation Treatment Program of Cancer Care Ontario
for circulation to Regional Cancer Programs.

Report Date: February 2014

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INTRODUCTION

The Contour Consensus Working Group was established to meet the following goals:

- To specify structures including organs at risk (OARs), gross target volumes (GTVs) and clinical target volumes (CTVs) for head and neck radiotherapy planning.
- To describe each structure and provide resources for further reference.
- To propose a standard nomenclature.

These initiatives were adopted for the following reasons:

- To establish a direct correspondence between clinical presentation and delineated targets and OARs that can be understood by a multi-disciplinary team.
- To facilitate province-wide collection of dose-volume data corresponding to clinical stage for the purpose of outcome analysis.
- To promote consistent contouring among radiation oncologists
- To standardize quality of care across the province.
- To provide a framework consistent with clinical trials to facilitate participation.
- To facilitate automation of contour processing and quality assurance.
- To facilitate sharing of software tools and best practices among centres with similar platforms.
- To facilitate peer review of contoured structures since clinical intent is explicitly conveyed in the naming of targets and OARs.

METHODS

It is important that any consensus reached by the group is consistent with and complimentary to existing practices. Contour nomenclature systems and target and OAR volume definitions currently in use by Ontario cancer centres and cooperative groups were reviewed. The detailed reviews and survey summaries are attached in Appendix A of this report. Any nomenclature system proposed must also be consistent with the principles of ICRU reports 50, 62, 71, 78 and 83. Various alternatives were considered. The nomenclature system described in this report is based on the system in place at the Princess Margaret Cancer Centre and recommended by the working group.

RESULTS

This report recommends the adoption of a standard nomenclature system as defined below. A concise summary of the nomenclature is tabulated in Appendix B.

Target Nomenclature

Three classes of targets are defined:

1. Primary targets and corresponding CTVs.
2. Gross nodes and corresponding CTVs.
3. Prophylactic CTVs.

Primary Targets

Within the first class, the primary target will be gross disease as identified by clinical assessment, biopsy, and/or diagnostic imaging. This target will be named 'GTV'. The corresponding CTV will adhere to the principles of ICRU report 83. The total prescribed dose in Gray will be appended to the CTV name. For example, a daily prescription dose of 212 cGy in 30 fractions would require the CTV to be named CTV63.6. Note that the decimal in the CTV name does not pose a problem for the treatment planning systems currently in use in Ontario.

This document addresses two situations in which there is no GTV. For the diagnosis of an unknown primary, unknown primary tumour volume (UTV) encompasses candidate mucosal primary sites. Typically UTV will equal CTV. In the post-operative setting, a region of high risk will be called HTV. HTV may represent the operative surgical bed or the pre-operative GTV as delineated with the aid of image fusion of the pre-operative diagnostic scan. When HTV delineates the operative surgical bed a further expansion for the corresponding CTV may not be required. When HTV delineates the pre-operative GTV an expansion may be required to generate the corresponding CTV. In all scenarios planning target volumes (PTVs) are generated from corresponding CTVs, not UTV or HTV, as UTV and HTV are not ICRU specified terminology.

Where more than one primary target exists, they must be enumerated using a prefix. For example, IGTV, IIGTV, IIIUTV, IVHTV would then give rise to ICTV70, IICTV70, IIICTV70, and IVCTV60.

Gross Nodes

Gross nodes are those that have radiological, clinical or pathological features of malignancy. Gross nodes are to be individually delineated and appropriately named to indicate their laterality and level. For example a level 2A pathological lymph node in the left neck would be labeled L2 or L2A. Node names are listed in Appendix B. If contiguous gross nodes are identified, then they can be included in the same structure, which is identified by the involved nodal levels. For example, L2A34 indicates that L2A, L3 and L4 are contiguous or conglomerate gross nodes. If multiple distinct gross nodes correspond to a single node level, they will be enumerated as in the case for gross disease (for example, IL3, IIL3). A gross nodal volume may be expanded by a margin respecting the same considerations accorded to primary targets to create a CTV. Contiguous CTVs may be grouped to form a single CTV. The CTV will be labeled as the gross node name followed by 'CTV' followed by the prescription in Gy (for example, L2A34CTV70 indicates the CTV corresponding to contiguous gross nodes at levels 2A, 3 and 4 in the left neck prescribed to 70 Gy).

Prophylactic Nodes

Nodes at risk of subclinical disease are not individually contoured by level, but are contoured as a single region for each prophylactic dose level. The prophylactic nodal volume may be partitioned to correspond with each side of the patient's neck. For example, RCTV56 and LCTV56 correspond to right and left nodes prescribed to 56. A standard contouring atlas for the CTV of the neck is available on the RTOG website: http://www.rtog.org/CoreLab/ContouringAtlases/HNAtlases.aspx

Organ at Risk Nomenclature

A list of suggested OAR names and definitions is provided in Appendix C. Typically, only relevant organs will be contoured. Uppercase is used to denote organs to be reviewed and approved by the radiation oncologist. A named OAR must refer to the organ as defined according to accepted anatomical reference texts. The OAR contours may not be modified in the case of overlap with target structures as they delineate an anatomic structure. For example RPAROTID refers to the entire right parotid even when all or part of it is within a target volume. It is expected that additional regions will be constructed for planning purposes and named by prefixing or suffixing a lower case descriptor such as outRPAROTID or RPAROTIDin. In the case of serial organs, only the portion of the organ receiving significant dose needs to be contoured. For example, the spinal cord outside of the irradiated volume need not be contoured. Any tissues not included in the CTV or delineated as dose-limiting OARs should still be specified and named the remaining volume at risk (RVR) in accordance with ICRU 83.

Each OAR tabulated in Appendix C has been given a suggested name. It is not necessary for centres to adopt the suggested names as long as their OAR names correspond to organs as defined in the table.

OAR volumes may be combined into a single volume. In such a case, the component volumes must be delineated separately so that they correspond to those defined within the scope of this nomenclature. For example, LOPTIC, ROPTIC and CHIASM must each be delineated, but may be combined into a single structure, OPTIC.

All defined OAR structures are named in upper case.

DISCUSSION

The nomenclature presented here is based heavily on the system that has been in place at the Princess Margaret Cancer Centre for over seven years. This system has proven invaluable in facilitating contour review rounds and in-house collection of outcome data. This system has recently been implemented in several cancer centres. The adoption of the nomenclature system may require a change of contouring practices. Physicians and dosimetrists may require training and review sessions to become proficient with the new system. To ease the implementation, centres are encouraged to identify a local champion from each discipline of the radiotherapy team. For example, a senior therapist, dosimetrist, physicist and radiation oncologist specializing in the head and neck site will each be required to support this initiative within their respective disciplines. This group of champions is further encouraged to seek input and collaboration from their peers among the early adopters.

The nomenclature also permits reviewers to evaluate the treating physician's clinical intent relative to clinical presentation. Early adopters have observed that a consistent nomenclature eliminates ambiguity and speeds review of cases since reviewers are presented with a consistent table of structures for evaluation.

Other groups have suggested other nomenclature schemes for general use. Those approaches are contrasted with that of this work in Appendix D.

CONCLUSIONS

Adoption of a nomenclature system is necessary to facilitate the collection of dose-volume data from centres across the province. A consistent system further facilitates contour review and simplifies plan evaluation. Although this adoption may require some weeks of adjustment, the early adopters have reported a long term gain in efficiency.

It is CCO's intention to disseminate this report to the Regional Cancer Programs and advisory committees within the province and to make the document available to Ontario healthcare providers on the CCO website (www.cancercare.on.ca).This report will be reviewed on a regular basis to determine whether the information is still accurate and relevant to current practice and revised accordingly.

For general inquiries regarding this report, please contact: eric.gutierrez@cancercare.on.ca or RTP@cancercare.on.ca.

ACKNOWLEDGEMENTS

This recommendation report was developed by a special working group of the Radiation Treatment Program's Head and Neck Community of Practice. Members of the *Contouring Nomenclature Working Group* include: Lilian Doerwald-Munoz, BSc, MRT(T), CTIC, (lead), Adam Andronowski, MD, FRCPC, Lesley Buckley, PhD, MCCPM, Jackson Chan, BSc, MRT(T), CMD, D. Ian Hodson, MA, BM, BCh, FRCPC, Katie Lekx-Toniolo, PhD, MCCPM, April McAllister, MRT(T), Lynn Montgomery, BSc, MRT(T), Orest Ostapiak, PhD, FCCPM, Timothy Owen, MD, FRCPC, Nancy Read, MD, FRCPC, Dani Scott, MRT(T), BSc, Jennifer Stones, MRT(T), Khaled Zaza, MD, FRCPC.

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DISCLAIMER

- This recommendation report was developed by a working group of the Head and Neck Community of Practice of the Radiation Treatment Program of Cancer Care Ontario. The working group was comprised of head and neck radiation treatment professionals belonging to the disciplines of radiation oncology, medical physics, and radiation therapy. The material presented in this recommendation report illustrates the consensus reached among members of the Head and Neck Community of Practice and may not reflect current practice at all Ontario cancer centres. All approaches to treatment are subject to clinical judgment and actual practice patterns may not follow the material outlined in this report.
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APPENDIX A

Current State of Practice

Organ at Risk Nomenclature Across Ontario Cancer Centres

To save space, only one of a left and right pair of lateral organs is tabulated. An empty cell indicates that the structure is not routinely contoured.

Common	Variations				
BODY					
BRAIN (2/4)	Brain	Brain1			
BRSTEM (5/9)	Brstem	Brainstem	BRAINSTEM	brain stem	
Brain pituitary	pituitary				
CANAL					
CORD (5/9)	Cord (2/9)	SPINAL CORD	spinal cord		
LACOUSTIC (2/4)	Acoustic_LT	ACOUSTIC_L			
RCOCHLEA	Rt_cochlea				
LIEAR (4/5)	INNER EAR_LT				
EAR_RT					
EAR_BOTH					
RMEAR (4/4)					
RCHAMBER (2/2)					
LEYE (4/9)	Eye_LT	Lt_eye	EYE_LT	EYE_L	eye L
RLENS (4/9)	Lens_RT	Rt_lens	LENS_RT	LENS_R	lens R
LOPTIC (4/9)	Optic_LT	Lt_optic	OPTIC NERVE_LT	OPTIC_L	optic nerve L
OPTIC NERVES					
CHIASM (5/9)	Chiasm (2/9)	optic chiasm			
RETINA_RT					
LLACRIMAL (2/9)					
MANDIBLE (5/9)	Mandible (3/9)	mandible			
RMANDIBLE (2/3)	Mandible_1				
TM joint					
LSUB (3/6)	Subman_LT	SUBMANDIBULAR GLAND_LT	SUB_L		
RPAROTID (4/9)	Parotid_RT	Rt_parotid	PAROTID_RT	PAROTID_R	parotid R
PAROTID_BOTH	parotid total				
LPLEXUS (4/6)	Plexus_LT	PLEXUS_L			
LARYNX (5/8)	Larynx (2/8)				
Oral_cavity					
LIPS (4/5)	Lips				
ESOPHAGUS (5/6)	Esophagus				
POSTCRICOID (3/3)					
Thyroid					
RLUNG (4/4)					
VERTEBRAE					
PCMUSCLE					

Results of Contouring Consensus for Clinical Volume Delineation Survey Across Ontario Cancer Centres

CONTOURING CONVENTIONS FOR ONTARIO CANCER CENTRES										
Practice	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**
Primary contoured separately from gross nodes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes
Gross nodes individually named	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes
Personnel involved with contouring Targets	RO, Resident, CSRT	RO, Resident, Fellow, CSRT	RO	RO, Resident, Fellow	RO, Resident, Fellow	RO, Fellow	RO	RO, Resident, Fellow	RO	RO
Anatomical boundaries of CTV	Air Cavity, Bone, Skin, Fascia, Brain Stem, Spinal Canal	Unknown	Air Cavity, Bone, Skin, Fascia,	Air Cavity, Bone, Skin, Fascia, Brain Stem, Cord, Esophagus, Parotids	Air Cavity, Bone, Skin, Fascia, Brain Stem, Cord,	Bone, Skin	Air Cavity, Bone, Skin, Fascia, Parotids	Air Cavity, Bone, Fascial and anatomic planes	Air Cavity, Bone, Fascia (Variable)	Bone, Skin
Primary GTV to high dose CTV margin	5 mm	5 mm	5 mm	5 mm	10 mm	5 mm	5 mm	5 mm	5 mm	10 mm
Nodal GTV to Microscopic (low dose) CTV margin	low dose CTV drawn independently	1-5 mm	5 mm	unknown, inconsistent	1-5 mm	5 mm	5 mm	5 mm	5 mm	10 mm
Distinct CTV for each GTV and gross node	Yes	Yes	Yes	No	No	No	Yes	Yes	No	Yes
Gross nodes contoured & labeled by level	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes
Naming convention primary GTV	GTV	GTV	GTV*	GTV primary	GTV*	GTV primary	GTV primary	GTV primary	GTV primary	GTV primary
Naming Convention gross nodes	Level and laterality	Level and laterality	Level and laterality	GTV node	GTV*	GTV*	GTV node	Level and laterality	GTV node	GTV node
Personnel involved in contouring gross disease	RO Residents Clinical Specialist	RO Fellow Residents Clinical Specialist	RO	RO Fellow Residents	RO Fellow Residents	RO Fellow	RO	RO Fellow Residents	RO	RO
CTVs are volume expansion of 1ary & gross node contours	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	No
CTV expansions are edited back	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Anatomical boundaries	Healthy bone Skin Fascial planes Some OARs Air cavities	Healthy bone* Skin* Fascial planes* Some OARs* Air cavities*	Healthy bone Skin Fascial planes Some OARs Air cavities	Healthy bone Skin Fascial planes Some OARs Air cavities	Healthy bone Skin Fascial planes Some OARs Air cavities	Healthy bone Skin	Healthy bone Skin Fascial planes Some OARs Air cavities	Healthy bone Air cavities, Fascial and anatomic planes and OARs	Healthy bone Fascial planes Air cavities	Healthy bone Skin
Commonly GTV (primary) to microscopic CTV margin?	5mm	10mm	5mm	5mm variable	10mm	5mm	5mm	5mm	5-10mm	5mm
Commonly GTV (node) to microscopic CTV margin?	5mm	1-5mm	5mm	5mm variable	1-5mm	5mm	5mm	5mm	5mm	10mm

CONTOURING CONVENTIONS FOR ONTARIO CANCER CENTRES										
Practice	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**
Commonly GTV (primary) to high dose CTV margin?	5mm	5mm	5mm	5mm	10mm	-	5mm	5mm	5mm	10mm
Commonly GTV (node) to high dose CTV margin?	5mm	5mm	5mm	1-5mm	0mm	5mm	5mm	5mm	5mm	10mm
Who contours the CTV for each gross disease?	Automated process then manually edited	RO Fellows Residents	RO	RO Fellows Residents	RO Fellows Residents	RO Fellows	RO	RO Fellows Residents	RO	RO Dosimetrists
Do you contour separate CTVs for each, the primary and gross nodes?	Yes	Yes	Yes	No	No	No	Yes	Yes	No	Yes
Are the CTV regions named according to a convention?	-	-	CTV primary	-	-	-	CTV primary	-	-	CTV primary
	CTV nodes (e.g.R2 CTV 63, etc.)	-	CTV nodes (e.g.R2 CTV 63, etc.)	-	-	-	-	CTV nodes (e.g.R2 CTV 63, etc.)	-	CTV nodes (e.g.R2 CTV 63, etc.)
	CTV (dose) (e.g. CTV 70, CTV 63, etc.)	CTV (dose) (e.g. CTV 70, CTV 63, etc.)	CTV (dose) (e.g. CTV 70, CTV 63, etc.)	CTV (dose) (e.g. CTV 70, CTV 63, etc.)	CTV (dose) (e.g. CTV 70, CTV 63, etc.)	CTV (dose) (e.g. CTV 70, CTV 63, etc.)	CTV (dose) (e.g. CTV 70, CTV 63, etc.)	CTV (dose) (e.g. CTV 70, CTV 63, etc.)	CTV (dose) (e.g. CTV 70, CTV 63, etc.) No fixed convention	CTV (dose) (e.g. CTV 70, CTV 63, etc.)
Does the low dose CTV encompass the CTV for higher doses?	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No
Who contours the nodal regions at risk for microscopic disease?	RO Residents Clinical specialist	RO Fellows Residents	RO	RO Fellows Residents	RO Fellows Residents	RO Fellows	RO	RO	RO	RO
Do all practitioners use a consistent naming convention for the nodal low dose CTV?	Yes	-	Yes	Yes	Yes	No	Yes	Yes	No	Yes
Please give an example of low dose CTV encompassing elective nodal regions.	CTV56 CTV63	CTV56 RCTV56 LCTV56	LCTV56 RCTV56	CTV56	CTV56	-	CTVn5600	RCTV56	-	CTVn56
Is laterality of nodal vol. indicated in the nomenclature	Yes	Yes	Yes	No	No	Yes	No	Yes	No	Yes
Does your centre use the N0 neck consensus guidelines?	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes
*DATA WITH AN ASTERIX HAS BEEN DERIVED BASED ON ADDITIONAL INFORMATION PROVIDED										

Literature Review

Naming Standards Previously Proposed

A naming convention has recently been proposed[2] and is currently being tested in certain centres in the Netherlands and in some recent RTOG trials. This system differs from the one proposed here in several key features:

- Names are partitioned to facilitate data mining.
- Names contain a label such as PTV, CTV, GTV, a margin specified in mm (or PRV if the margin is non-uniform and the region is an organ at risk) and a dose level specified in cGy.
- Node targets are distinguished from primary targets but are not named.

ICRU report 83 also makes suggestions regarding target nomenclature. While the alternative nomenclature systems may be applied quite generally, they do not address the specific needs arising from head and neck radiotherapy planning. In particular, there is no allowance for naming individual gross nodes. Finally, there is not a one-to-one correspondence between the alternative systems and the one proposed here. These differences are highlighted in the table of Appendix D.

Target Volume Expansion Margins

There is a wide variation in the expansion of a GTV volume. The approaches may include a volumetric expansion or an anatomic expansion. Most co-operative groups favour the volumetric approach- likely based on the subjective nature of an anatomic expansion. The following are the suggestions of the major co-operative groups:

- RTOG 0-20 mm, but the most current studies suggest 5-10mm
- ECOG 10-20 mm
- NCIC 5-10 mm

One recent study (Caudell et al.), retrospectively analyzed this issue. Their results based on 220 patients suggested no increase in local failure with smaller margins or with a volumetric expansion. Their final conclusion suggests 10mm as a reasonable GTV to CTV expansion.
The option of including an intermediate dose volume around the CTV and using even smaller GTV to CTV expansion has also been suggested in this study and is an option in the NCIC HN6 study.

Pirus et al. performed histopathologic analysis to assess the extent of extra capsular extension of metastatic lymph nodes in head and neck cancers to determine appropriate target volumes expansions. They found that the incidence of extra capsular extension was associated with larger nodes but still present in nodes less the 1cm and ranged between 1-10 mm. This paper recommends the use of 10 mm CTV margins around gross disease to account for extra capsular extension.

<u>Literature Review on Margins Conclusion</u>:
A range of 5-10mm for a GTV to CTV expansion is reasonable. Including the option of an intermediate dose (63Gy) also seems reasonable. CTV to PTV expansion needs to be institution specific.

APPENDIX B

Concise Summary of Nomenclature

This nomenclature is based on the H&N Structure Nomenclature Contouring / Planning Guidelines and Terminology v.3.1 of the RMP Head and Neck site Group, Princess Margaret Hospital/UHN developed by Stephen Breen and John Kim.

Summary representation of target nomenclature syntax

Clinical Region	Tumour Nomenclature	Target Nomenclature
Primary:	[I|II|III|IV|…](G|H|YG|U)TV	[I|II|III|IV|…]CTV(dose)
Gross Neck Nodes:	[I|II|III|IV|…](L|R) [H|Y](node level)	[I|II|III|IV|…](L|R)(node level)CTV(dose)
Prophylactic Neck:	none	[R|L]CTV(dose)

Guide to notation

() label within round brackets is required

[] label within square brackets is used as needed

Item#1|Item#2|Item#3|… choose only one item from the list items separated by pipes.

Notes

- [I|II|III|…] enumerates separate distinct regions ordered according to size from largest to smallest. These may be grouped into one region if regions are contiguous and the Roman numeral label is omitted.
- Node levels are named as follows: 1A, 1B, 2A, 2B, 3, 4, 5, 6, 7 and are contoured according to the RTOG contouring atlas: http://www.rtog.org/CoreLab/ContouringAtlases/HN.aspx
- Node levels that are contiguous may be grouped into a single region labeled with the levels of nodes encompassed. For example, if L2A, L2B, and L3 are contiguous, then the volume may be named L2A2B3.
- An excised or chemo-reduced node may be considered as high risk. The region will be named according to the node level prefixed with H or Y respectively. For example, LH2A, LY2B, LH3.
- Explanation of Primary target types
    - GTV – gross tumour volume
    - HTV – high risk target volume encompassing area of resection
    - YGTV – chemo reduced tumour volume
    - UTV – unknown primary tumour volume
- Upper case is used exclusively for regions named in compliance to this nomenclature. Additional regions may be named providing lower case is used or a lower case prefix or suffix is added to the name. For example, refGTV, CTV70pet, and preopR2A.
- CTV must always suffixed by the prescribed dose. For example, CTV70, R2BCTV63.

Summary of target definitions

Primary Target and corresponding CTVs:

[I|II|III|…](G|H|YG|U)TV	→ [I|II|III|…]CTV(dose)
GTV – Gross Tumour Volume Represents grossly involved regions of primary tumour, but excludes gross nodes (see below).	GTV plus a margin† but limited to within bounding tissue planes*
HTV – High risk Tumour Volume Region encompassing or adjacent to tumour bed post resection via biopsy, local resection or primary surgery	HTV with no margin and limited to within bounding tissue planes*
YGTV – Chemo reduced Gross Tumour Volume Determined by clinician based on disease response to chemotherapy	YGTV plus a margin† but limited to within bounding tissue planes*
UTV – Unknown Tumour Volume Candidate mucosal primary sites with unknown primary diagnosis	UTV with no margin and limited to within bounding tissue planes*

Gross Neck Nodes and corresponding CTVs:

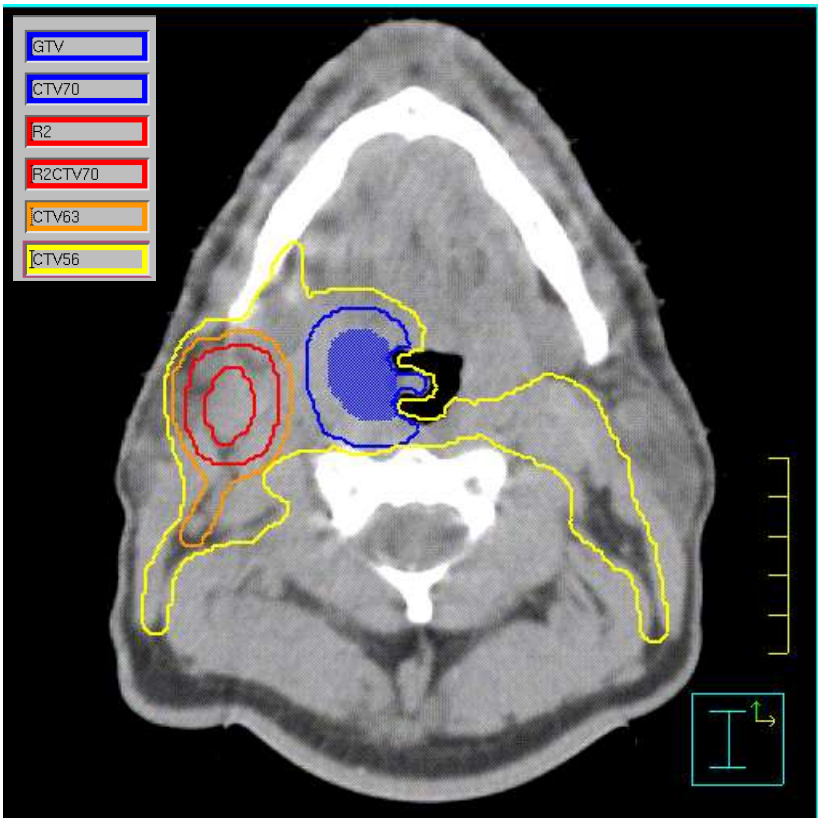
[I|II|III|…](L|R) [H|Y](node level)	→ [I|II|III|…](L|R)(node level)CTV(dose)
Grossly positive lymph nodes are defined as any lymph nodes with focal nodal necrosis; or heterogeneity; or > 1 cm in axial dimension; or smaller nodes clinically suspected to be gross.	Gross node plus a margin† but limited to within bounding tissue planes*
Region corresponding to a node resection considered to be at high risk	Region is contoured with no margin but limited to within bounding tissue planes*
A grossly positive lymph nodes that have been reduced by response to chemotherapy	Chemotherapy responsive gross node plus a margin† but limited to within bounding tissue planes*

Prophylactic Neck CTVs:

	→ [R|L]CTV(dose)
Nodal regions to receive elective irradiation according to presence of risk factors for relevant tumour site and burden of LNs involvement.	Drawn by Radiation Oncologist or other head and neck expert based on DAHANCA, EORTC, GORTEC, NCIC, RTOG consensus guidelines.

* Bounding tissue planes may include uninvolved bone, muscle, skin, and air cavity.
† Margin used must be in accordance with documented protocol.

Example: A CT slice showing targets and clinical volumes.



APPENDIX C

Organ at Risk (OAR) nomenclature

Organ Name	Suggested Name	Description
Body	BODY	The patient's external contour. All tissues within and including the skin.
Brachial plexus	RPLEXUS LPLEXUS	Nerve arising from ventral rami C5-T1 spinal cord exit through neural foramina of cervical vertebrae posterior to vertebral artery: interspaces C4-5 to T1-2 form trunks. Trunks travel between anterior and middle scalene muscles, cross over 1st rib to enter axilla going parallel and posterior to subclavian artery and then along auxiliary vein (best seen on T1- weighted MRI). It comprises of non-enhancing linear structures of 5mm thickness.
Carotid artery	RCAROTID LCAROTID	The common carotid arteries differ in length and in their mode of origin. The right begins at the bifurcation of the innominate artery behind the sternoclavicular joint and is confined to the neck. The left springs from the highest part of the arch of the aorta to the left of, and on a plane posterior to the innominate artery, and therefore consists of a thoracic and a cervical portion.
Cochlea	RCOCHLEA LCOCHLEA	Part of the inner ear, size 10X10X10 mm, lies in pyramid petrous bone, part of the temporal bone, contour on bone windows.
Inner ear	RIEAR LIEAR	The portion of the ear located within the temporal bone that is involved in both hearing and balance and includes the semicircular canals, vestibule, and cochlea. Also called internal ear, labyrinth.
Lacrimal gland	RLACRIMAL LLACRIMAL	Two lobes located in the lateral upper portion of the bony orbit.
Lung	RLUNG LLUNG	The two lungs are conical in shape and situated in thoracic cavity bounded by the thoracic inlet in neck, and below by diaphragm. In the center is the mediastinum which contains the great vessels and the heart. The right lung is larger than left.
Middle ear	RMEAR LMEAR	A part of the ear that consists of the eardrum (tympanic membrane) and, beyond it, a cavity (tympanum). This cavity is connected to the pharynx (nasopharynx) via a canal known as the Eustachian tube. The middle ear cavity also contains a chain of three small bones, the ossicles (the malleus, incus, and stapes), which connect the eardrum to the internal ear.
Optic nerve	ROPTIC LOPTIC	Exits from the retina (back of the eyeball) and enters into the optic chiasm through the optic canal.
Brain	BRAIN	As seen within in the skull bones, down to superior aspect of C1 vertebral body.
Brainstem	BRSTEM	Superior extent: top of the posterior clinoid. Inferior extent: superior aspect of C1 vertebral body.
Esophagus	ESOPHAGUS	Upper border: crico-pharyngeal inlet at inferior border of posterior cricoid cartilage at C5-C6 vertebral space; lower border: thoracic inlet.
Eye	REYE LEYE	The eyeball as seen on an axial CT scan
Larynx	LARYNX	"triangular prism shaped" structure at C4-C6 vertebral bodies levels including (epiglottis only below the hyoid) extending from the hyoid bone to inferior border of cricoid cartilage covering anterior commissure and arytenoids.
Lens	RLENS LLENS	The lens is part of the posterior segment of the eye. The lens has an ellipsoid, biconvex shape. The anterior surface is less curved than the posterior. In the adult, the lens is typically circa 10 mm in diameter and has an axial length of about 4 mm.
Lips	LIPS	Two fleshy folds that surround the opening of the mouth. The upper lip is separated from the nose by the philtrum, the area that lies between the base of the nose and the pigmented edge (called the vermillion border or the carmine margin) of the upper lip. The upper and lower lips meet at the corners (angles) of the mouth, which are called the oral commissures.
Mandible	MANDIBLE	Whole bone as seen on CT from TMJ to symphysis menti, bilaterally.
Optic chiasm	CHIASM	Below brain base , between hypothalamus and pituitary glands, junction of optic nerves and optic tracts, mean size: height 3.5 mm x width15 mm.
Parotid gland	LPAROTID RPAROTID	Lies in parotid compartment with boundaries: superior-zygoma, inferior-styloid process, is musculature, internal carotid artery, jugular vein, anterior-line from zygomatic arch to EAC , posterior- EAC, deep lobe into stylomandibular tunnel (posterior edge of mandible ramus, SCM, posterior belly of digastrics muscle and stylomandibular ligament), medial- internal carotid artery, styloid process.
Pharyngeal constrictor muscle	PCMUSCLE	The superior constrictor muscle of the pharynx is one of the paired external muscles of the pharynx. It arises from several sites: the inferior two-thirds of medial pterygoid

		plate in continuity with the pterygoid hamulus, the pterygomandibular raphe, and the posterior end of the mylohyoid line on the mandible. The middle pharyngeal constrictor is a fanshaped muscle, smaller than the inferior pharyngeal constrictor muscle. It arises from the whole length of the upper border of the greater cornu of the hyoid bone, from the lesser cornu, and from the stylohyoid ligament. The Inferior pharyngeal constrictor, the thickest of the three constrictors, arises from the sides of the cricoid and thyroid cartilage
Pituitary gland	PITUITARY	The pituitary gland is located in the middle of the base of the brain, inferior to the hypothalamus. The pituitary fossa, in which the pituitary gland sits, is situated in the sphenoid bone in the middle cranial fossa at the base of the brain
Postcricoid pharynx	POSTCRICOID	The lower portion of the pharynx that is found between the hyoid bone on the front of the neck and the lower border of the cricoid cartilage where the larynx begins.
Skin	SKIN	A rind structure that encompasses dermal layers. Typically 5 mm thick.
Spinal canal	CANAL	The spinal canal (or vertebral canal or spinal cavity) is the space in vertebrae through which the spinal cord passes
Spinal cord	CORD	The true cord as seen on CT scan (neuro or CNSA window) or MRI. Begins at the superior aspect of C1 vertebral body. The lower extent should be below the lowest extent of the PTV, usually vertebral body of T3/4
Submandibular gland	LSUB RSUB	Lies in submandibular triangle with boundaries: anterior and posterior bellies of digastrics muscle and inferior margin of mandible. It forms a “C” around the anterior margin of the mylohyoid muscle which divides the gland into deep and superficial lobes.
Thyroid cartilage	THYCART	The thyroid cartilage is the largest of the nine cartilages that make up the laryngeal skeleton, the cartilage structure in and around the trachea that contains the larynx.

APPENDIX D

Comparison of Nomenclature Schemes

Target Type	Scheme	This work	ICRU Report 83[6]	ATC[2]
GTV	Gross Disease	[#]GTV	GTV-T (Modality, Cumulative dose) Examples: GTV-T (clin, 10 Gy) GTV-T (MRI T2, fat sat, 0 Gy)	GTV – not specific
	Gross Nodal Disease	(R|L)<node level>	GTV-N	GTV – not specific
	Distant Metastasis	N/A	GTV-M	GTV – not specific
	Resection Bed	[#]HTV	N/A	GTV – not specific
	Unknown Primary	[#]UTV	N/A	GTV—not specific
CTV	Primary CTV	[#]CTV<Gy>	CTV-T (Modality, Cumulative Dose)	CTVp[#]_[mm]_<cGy>
	Nodal CTV	(R|L)<node level>CTV<Gy>	CTV-N (Modality, Cumulative Dose)	CTVn[#]_[mm]_<cGy>
	Primary + Nodal CTV	N/A	CTV-T+N (Modality, Cumulative Dose)	N/A
	Resection Bed	[#]CTV<Gy>	CTV	N/A
PTV	Gross Disease	[#]PTV<Gy>	PTV – not specific	PTVp[#]_[mm]_< cGy>
	Nodal Disease	(R|L)<node level>PTV<Gy>	PTV – not specific	PTVn[#]_[mm]_<cGy>