36th ICRO SUN PG TEACHING PROGRAM
WEBINAR ON PLAN EVALUATION

Plan Evaluation in Carcinoma Nasopharynx- Understanding the Targets

Dr Trinanjan Basu

Consultant Radiation Oncologist

HCG Cancer Centre

Mumbai

Disclaimer

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- This is an overview of the plan evaluation in carcinoma Nasopharynx.

- Details to be discussed on actual webinar day.

Points to be discussed

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- Essential background knowledge.
- Brief overview of Targets and OAR for carcinoma Nasopharynx-IMRT.
- Brief on plan evolution – 2D to 3D to IMRT.
- IMRT plan evaluation- Target volume, OAR.
- IMRT technical details.
- Future directions.

Essential background evidence

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ELSEVIER

Radiotherapy and Oncology 69 (2003) 227–236

RADIOTHERAPY & ONCOLOGY

www.elsevier.com/locate/radonline

CT-based delineation of lymph node levels and related CTVs in the node-negative neck: DAHANCA, EORTC, GORTEC, NCIC, RTOG consensus guidelines

Radiotherapy and Oncology 79 (2006) 15-20
www.thegreenjournal.com

Target volume delineation

Proposal for the delineation of the nodal CTV in the node-positive and the post-operative neck

Vincent Grégoire[a,*], Avraham Eisbruch[b], Marc Hamoir[c], Peter Levendag[d]

Radiotherapy and Oncology xxx (2013) xxx–xxx

Contents lists available at ScienceDirect

Radiotherapy and Oncology

journal homepage: www.thegreenjournal.com

ELSEVIER

Original article

Delineation of the neck node levels for head and neck tumors: A 2013 update. DAHANCA, EORTC, HKNPCSG, NCIC CTG, NCRI, RTOG, TROG consensus guidelines ☆

Vincent Grégoire [a,*], Kian Ang [b], Wilfried Budach [c], Cai Grau [d], Marc Hamoir [e], Johannes A. Langendijk [f], Anne Lee [g], Quynh-Thu Le [h,i], Philippe Maingon [j], Chris Nutting [k], Brian O'Sullivan [l], Sandro V. Porceddu [m], Benoit Lengele [n]

Radiotherapy and Oncology 134 (2019) 1–9

Contents lists available at ScienceDirect

Radiotherapy and Oncology

journal homepage: www.thegreenjournal.com

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Selection of lymph node target volumes for definitive head and neck radiation therapy: a 2019 Update

Julian Biau [a,b,*], Michel Lapeyre [b], Idriss Troussier [a], Wilfried Budach [c], Jordi Giralt [d], Cai Grau [e], Joanna Kazmierska [f], Johannes A. Langendijk [g], Mahmut Ozsahin [a], Brian O'Sullivan [h], Jean Bourhis [a,1], Vincent Grégoire [i,*,1]

Contents lists available at ScienceDirect

Radiotherapy and Oncology

journal homepage: www.thegreenjournal.com

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Original article

International guideline for the delineation of the clinical target volumes (CTV) for nasopharyngeal carcinoma

Radiotherapy and Oncology 115 (2015) 41–45

Contents lists available at ScienceDirect

Radiotherapy and Oncology

journal homepage: www.thegreenjournal.com

Nasopharyngeal carcinoma

Patterns of lymph node metastasis from nasopharyngeal carcinoma based on the 2013 updated consensus guidelines for neck node levels ☆

XiaoShen Wang [a,c], ChaoSu Hu [a,c,*], HongMei Ying [a,c], XiaYun He [a,c], GuoPei Zhu [a,c], Lin Kong [a,c], JianHui Ding [b,c]

Accepted Manuscript

International Journal of Radiation Oncology biology • physics

Delineation of neck clinical target volume specific to nasopharyngeal carcinoma based on lymph node distribution and the international consensus guidelines

Li Lin, M.D., Yao Lu, Ph.D., Xiao-Ju Wang, M.D., Hui Chen, B.S., Sha Yu, Ph.D., Jiao Tian, M.S., Guan-Qun Zhou, M.D., Lu-Lu Zhang, M.D., Zhen-Yu Qi, Ph.D., Jiang Hu, M.S., Jun Ma, M.D., Ying Sun, Ph.D.

PII: S0360-3016(17)34083-X

DOI: 10.1016/j.ijrobp.2017.11.004

Reference: ROB 24588

Radiotherapy and Oncology 134 (2019) 1–9

Contents lists available at ScienceDirect

Radiotherapy and Oncology

journal homepage: www.thegreenjournal.com

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Selection of lymph node target volumes for definitive head and neck radiation therapy: a 2019 Update

Julian Biau [a,b,*], Michel Lapeyre [b], Idriss Troussier [a], Wilfried Budach [c], Jordi Giralt [d], Cai Grau [e], Joanna Kazmierska [f], Johannes A. Langendijk [g], Mahmut Ozsahin [a], Brian O'Sullivan [h], Jean Bourhis [a,1], Vincent Grégoire [i,*,1]

Table 5

Selection of low risk nodal target volumes for nasopharyngeal cancers (according to recent international guidelines [68]).

Nodal Category (AJCC/UICC 8th ed.)	Levels to be included in the CTV-N-LR	
	Ipsilateral Neck	Contralateral Neck
N0	II-V, VIIa, VIIb[1]	II-V, VIIa, VIIb[1]
N1, N2	II-V, VIIa, VIIb[1,2,3,4]	II-V, VIIa, VIIb[1,2,3,4]
N3	Ib-IVb, Va,b,c, VIIa, VIIb	Ib-IVb, Va,b,c, VIIa, VIIb

OAR in Npx

- Spinal cord / BS/ optic apparatus.
- Mandible + TMJ.
- Parotids.
- DARS- pharyngeal constr, larynx. Oesophagus, oral cavity.
- Cochlea.
- Temporal lobes.
- Brachial plexus.
- Pituitary.

Important points

- Serial Vs parallel organs.
- Delineation guideline as per diff OAR.
- Consider adding PRV to serial structures.
- Delicate balance between PTV vs OAR.
- Additional help from secondary images like MRI – especially in optic chiasm, brainstem, brachial plexus.
- Keep in mind acute and late toxicity profile.
- QOL scales.

Radiotherapy and Oncology 110 (2014) 390–397

Contents lists available at ScienceDirect

Radiotherapy and Oncology

journal homepage: www.thegreenjournal.com

Radiotherapy of NPC

Recommendation for a contouring method and atlas of organs at risk in nasopharyngeal carcinoma patients receiving intensity-modulated radiotherapy

Ying Sun [a,1], Xiao-Li Yu [a,1], Wei Luo [a,1], Anne W.M. Lee [b,1], Joseph Tien Seng Wee [c,1], Nancy Lee [d,1], Guan-Qun Zhou [a], Ling-Long Tang [a], Chang-Juan Tao [a], Rui Guo [a], Yan-Ping Mao [a], Rong Zhang [e], Ying Guo [f], Jun Ma [a,*]

Radiotherapy and Oncology 117 (2015) 83–90

Contents lists available at ScienceDirect

Radiotherapy and Oncology

journal homepage: www.thegreenjournal.com

Head and neck guidelines

CT-based delineation of organs at risk in the head and neck region: DAHANCA, EORTC, GORTEC, HKNPCSG, NCIC CTG, NCRI, NRG Oncology and TROG consensus guidelines

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Chapter 1

Overview of Important "Organs at Risk" (OAR) in Modern Radiotherapy for Head and Neck Cancer (HNC)

Trinanjan Basu and Nithin Bhaskar

Additional information is available at the end of the chapter

http://dx.doi.org/10.5772/intechopen.80606

IntechOpen

Spinal cord & Brainstem

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SC:

2 ways to delineate: spinal cord itself Vs vertebral canal.

Recommend to add PRV 3-5 mm when drawing cord itself.

Cranial: Disappearance of cerebellum.

Caudal: 2 cm below the last PTV slice.

BS:

Brain stem comprises of midbrain, pons and medulla.

Cranial: level of inferior section of lateral ventricle. The organ is better visualized better in MRI.

Caudal: till the level of the tip of dense of C2 vertebra or foramen magnum.

Add PRV 3-5 mm.

Optic apparatus

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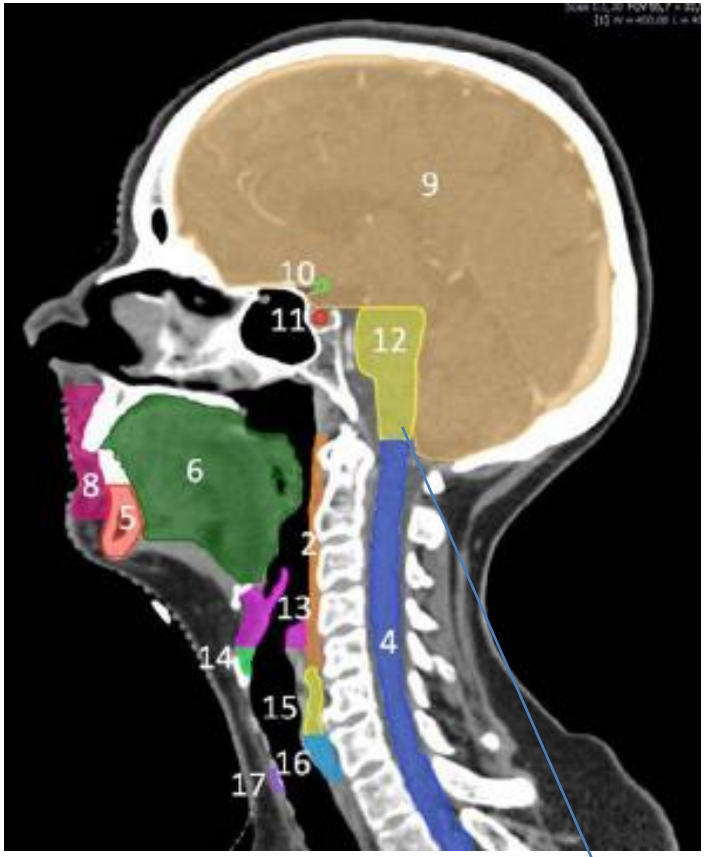
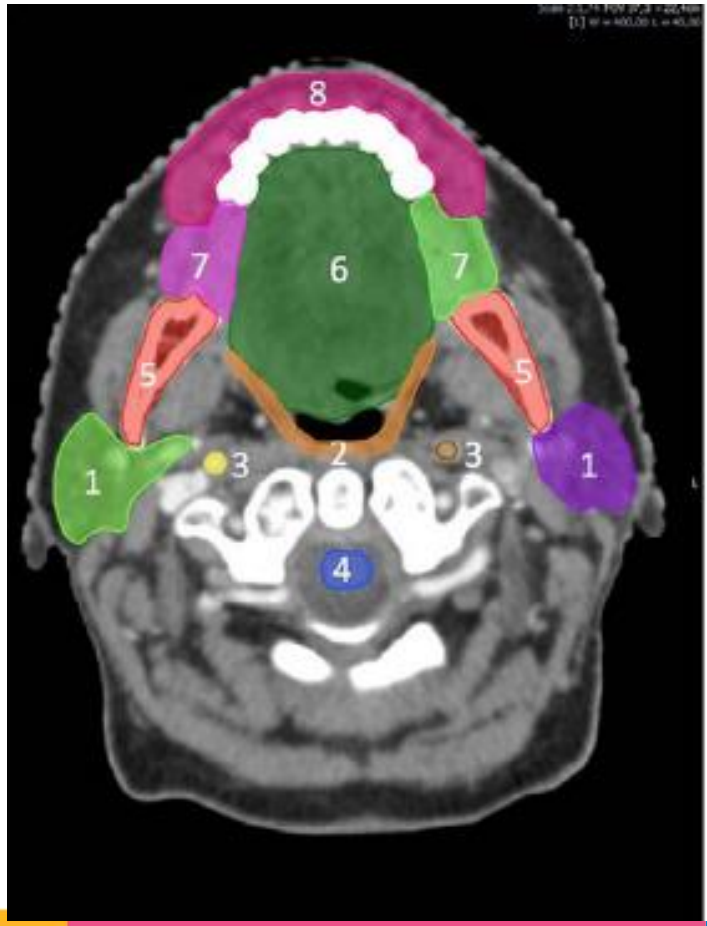
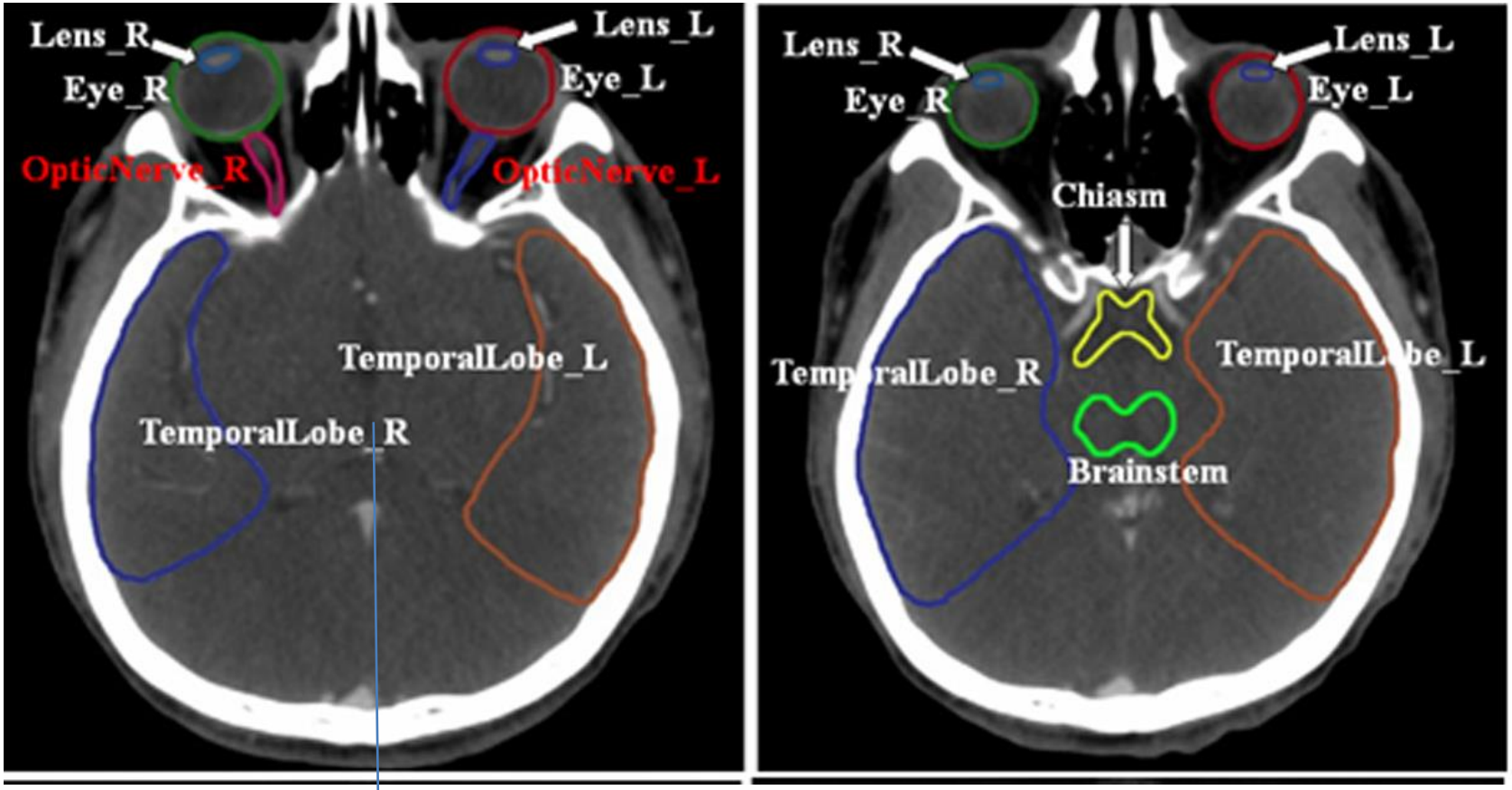
- Entire eyeball, optic nerves and optic chiasm.
- Craniocaudally: optic nerve is seen below the superior rectus.
- The nerve is 2-5 mm thick and is delineated from the posterior margin of retina and continued along its course posteriorly till it merges with the optic chiasm after passing through the superior orbital fissure.
- Optic chiasm: average it measures 8 x 14 mm (APxTrans) and is about 2–5 mm thickness in the super-inferior dimension.
- MRI helps in delineation: T1 bright signal.
- Combine all these and form PRV optics adding 2-3 mm.





Overlap 1 slice between SC and BS:
Monroe et.al. – to avoid dose dumping.



Inferior most section of lateral ventricle

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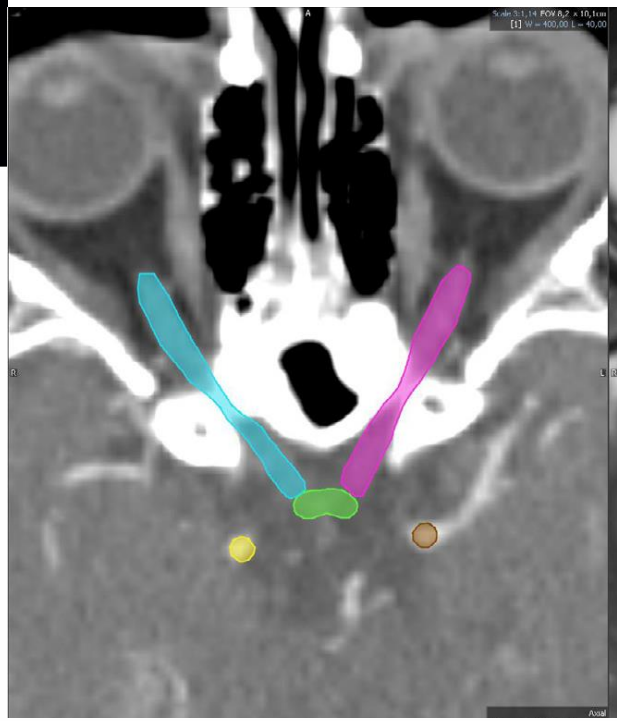
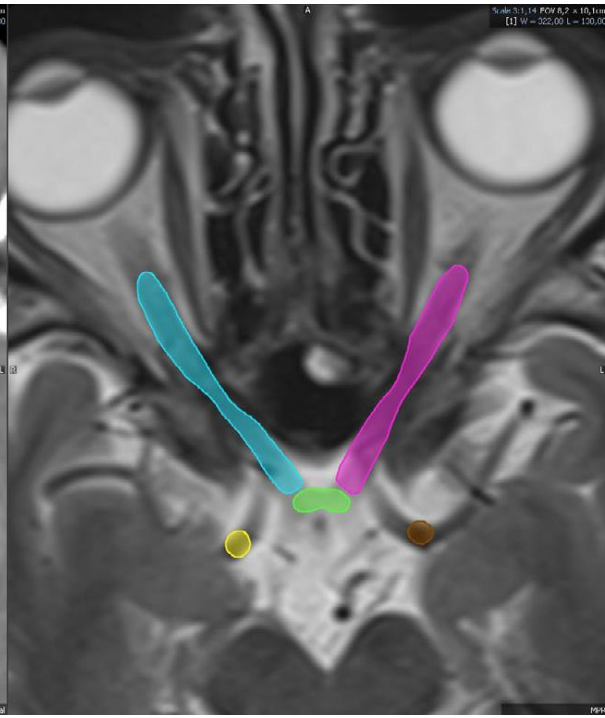




Parotid glands

Practical Radiation Oncology (2016) 6, e315-e317

practical radiation oncology
pro
www.practicalradonc.org

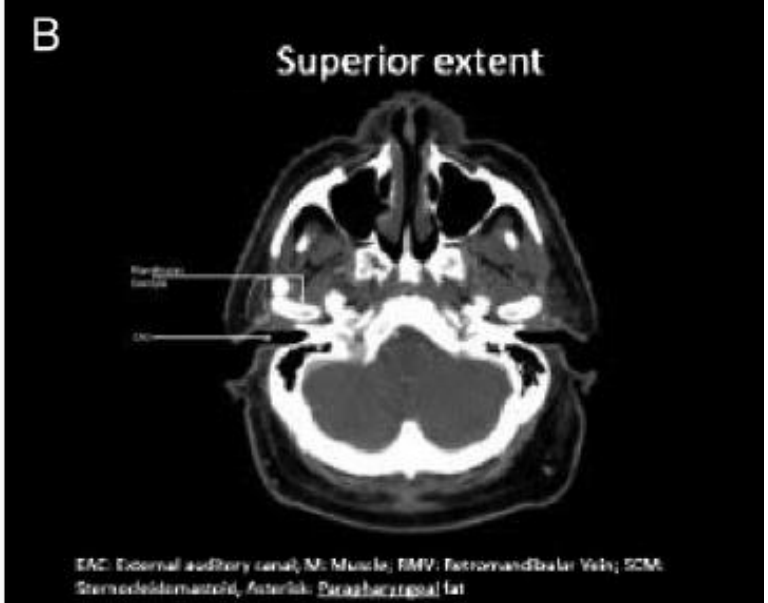
Teaching Case

A radiation oncologist's guide to contour the parotid gland

Laura Freedman MD [a,*], Charif Sidani MD [b]

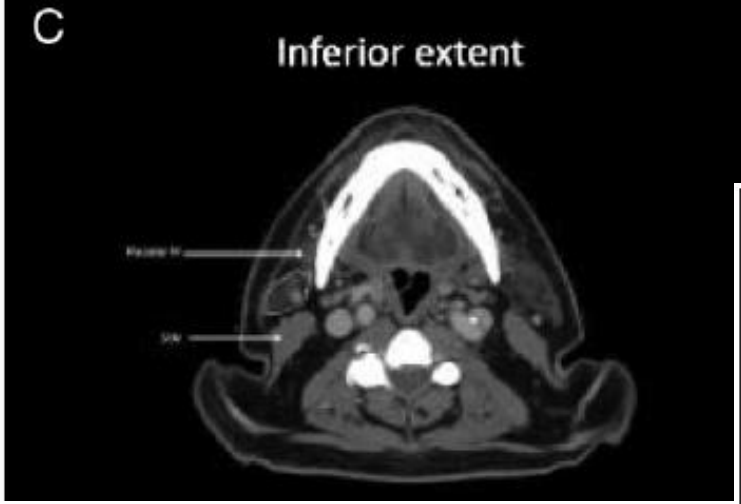
Organ at risk	Remarks	Anatomic boundaries					
		Cranial	Caudal	Anterior	Posterior	Lateral	Medial
Parotid gland	Include carotid artery, retromandibular vein and extracranial facial nerve.	External auditory canal, mastoid process	Post. part submandibular space	Masseter m., post. border mandibular bone, med. and lat. pterygoid m.	Ant. belly sternocleidomastoid m., lat. side post. belly of the digastric m. (posterior-medial)	Subcutaneous fat, platysma	Post. belly of the digastric m., styloid process, parapharyngeal space

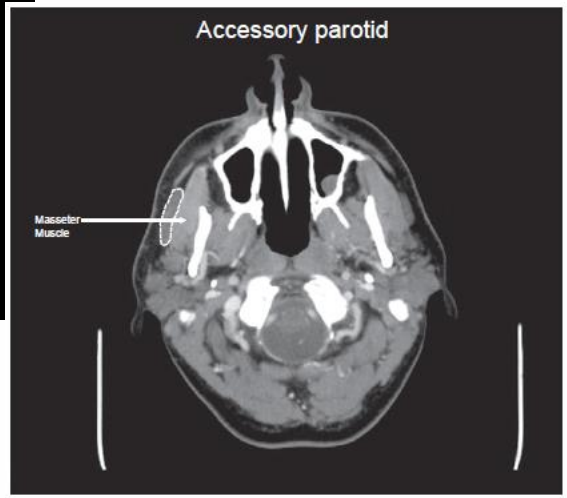
B

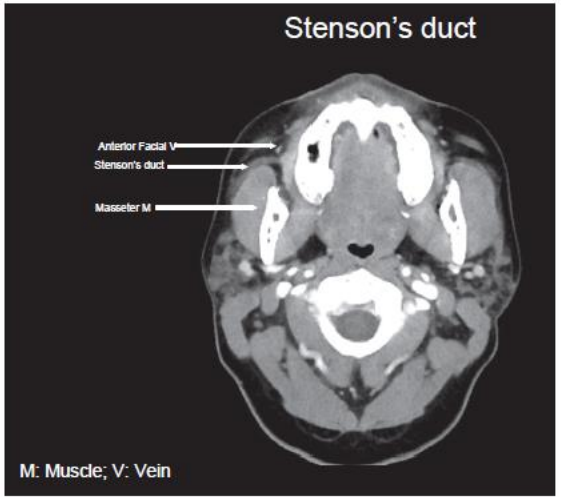


EAC: External auditory canal; M: Muscle; RMV: Retromandibular Vein; SCM: Sternocleidomastoid, Asterisk: Parapharyngeal fat

C







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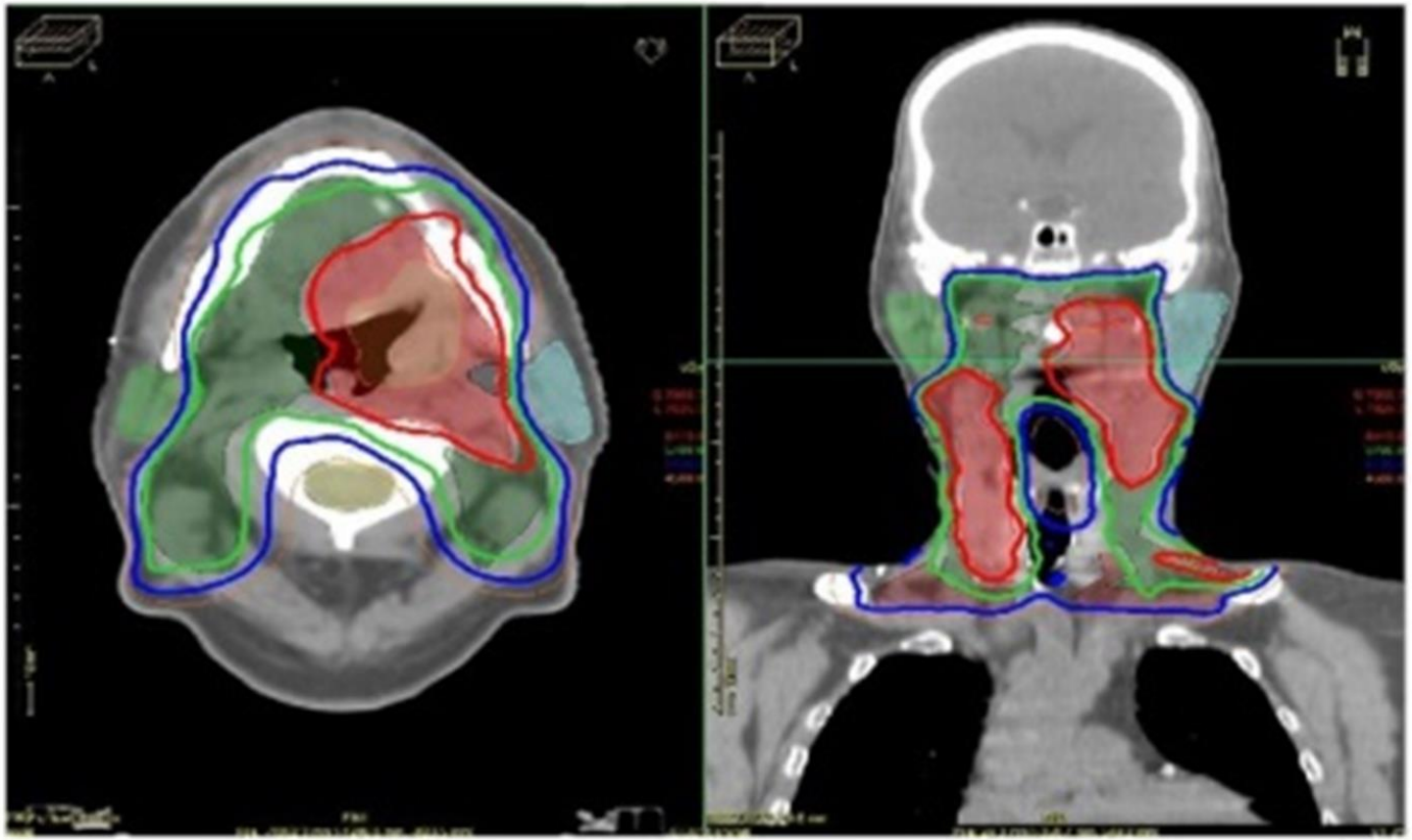
Parotid-sparing intensity modulated versus conventional radiotherapy in head and neck cancer (PARSPORT): a phase 3 multicentre randomised controlled trial

*Christopher M Nutting, James P Morden, Kevin J Harrington, Teresa Guerrero Urbano, Shreerang A Bhide, Catharine Clark, Elizabeth A Miles, Aisha B Miah, Kate Newbold, MaryAnne Tanay, Fawzi Adab, Sarah J Jefferies, Christopher Scrase, Beng K Yap, Roger P A'Hern, Mark A Sydenham, Marie Emson, Emma Hall, on behalf of the PARSPORT trial management group**



DARS – Swallowing structures

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Organ at risk	Anatomic boundaries					
	Cranial	Caudal	Anterior	Posterior	Lateral	Medial
Superior PCM	Inferior tip of pterygoid hamulus	Inferior edge of C2	Pterygoid hamulus, BOT, pharyngeal lumen	Prevertebral muscles	Medial pterygoid muscles	Pharyngeal lumen
Middle PCM	Superior edge of C3	Inferior edge of hyoid	BOT, hyoid	Prevertebral muscles	Hyoid—greater horn. Thyroid cartilage—superior horn	Pharyngeal lumen
Inferior PCM	First slice inferior to inferior edge of hyoid	Inferior edge of arytenoid cartilage	Soft tissue of supraglottis/ glottis	Prevertebral muscles	Superior horn of thyroid cartilage	
Cricopharyngeal muscle	First slice inferior to arytenoid cartilage	Inferior edge of cricoid	Posterior edge of cricoid	Prevertebral muscles	Thyroid gland/ cartilage, fatty tissue	
EIM	First slice inferior to cricoid	1 cm inferior to the upper extend	Tracheal lumen	Prevertebral muscles	Thyroid gland, fatty tissue	
Cervical esophagus	1 cm inferior to the cricoid	Sternal notch				
BOT	Inferior edge of C1	Superior edge of hyoid	Posterior 1/3 from mandibular bone to pharyngeal lumen	Pharyngeal lumen	Width of the lumen of pharynx	
Supraglottic larynx	Tip of epiglottis	First slice superior to the arytenoid cartilage	Hyoid, thyroid cartilage, preepiglottic space	Pharyngeal lumen, inferior PCM	Thyroid cartilage	Pharyngeal lumen (lumen to be excluded)
Glottic larynx	Superior edge of arytenoid cartilage	Inferior edge of cricoid cartilage (only the soft tissue element)	Thyroid cartilage	Inferior PCM, pharangeal lumen/ cricoid	Thyroid cartilage	Pharyngeal lumen (lumen to be excluded)

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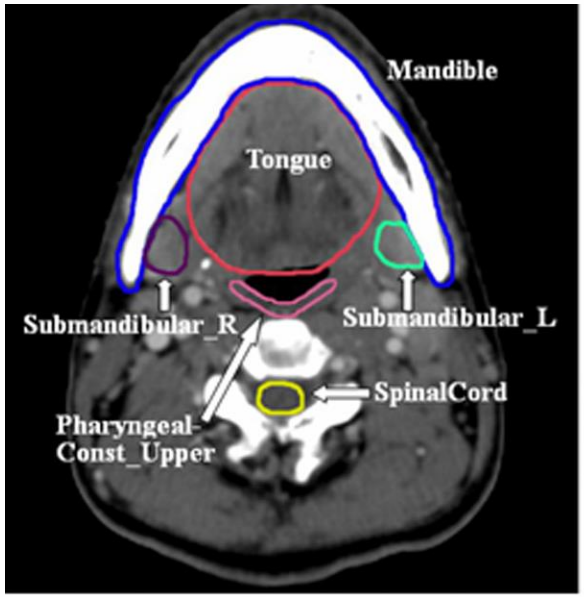
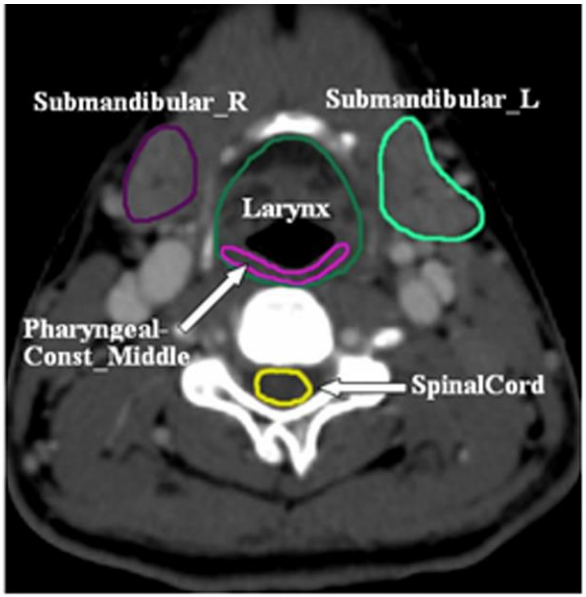
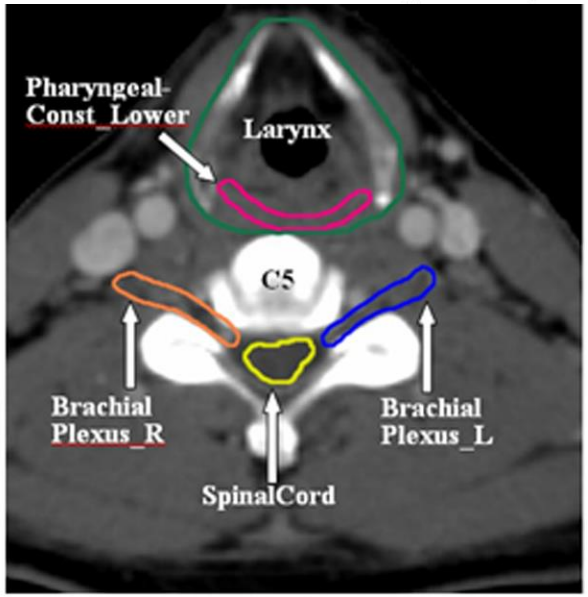




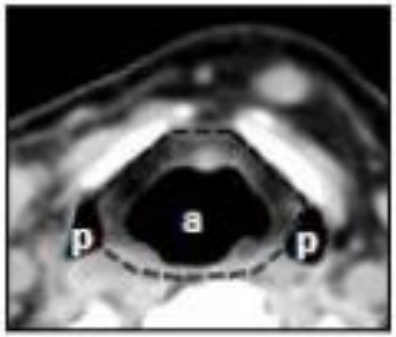


Accepted Manuscript

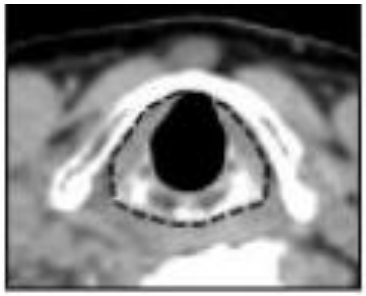
A Radiation Oncologist's Guide to Contouring the Larynx

Laura Freedman MD

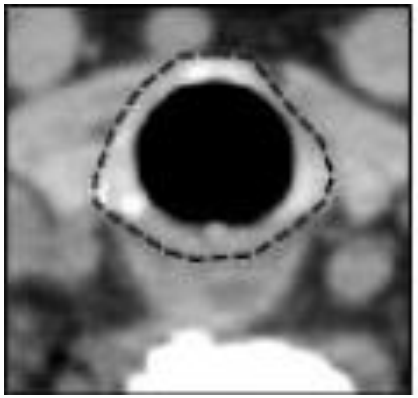
PII: S1879-8500(15)00375-6
DOI: doi: 10.1016/j.prro.2015.10.007
Reference: PRRO 546



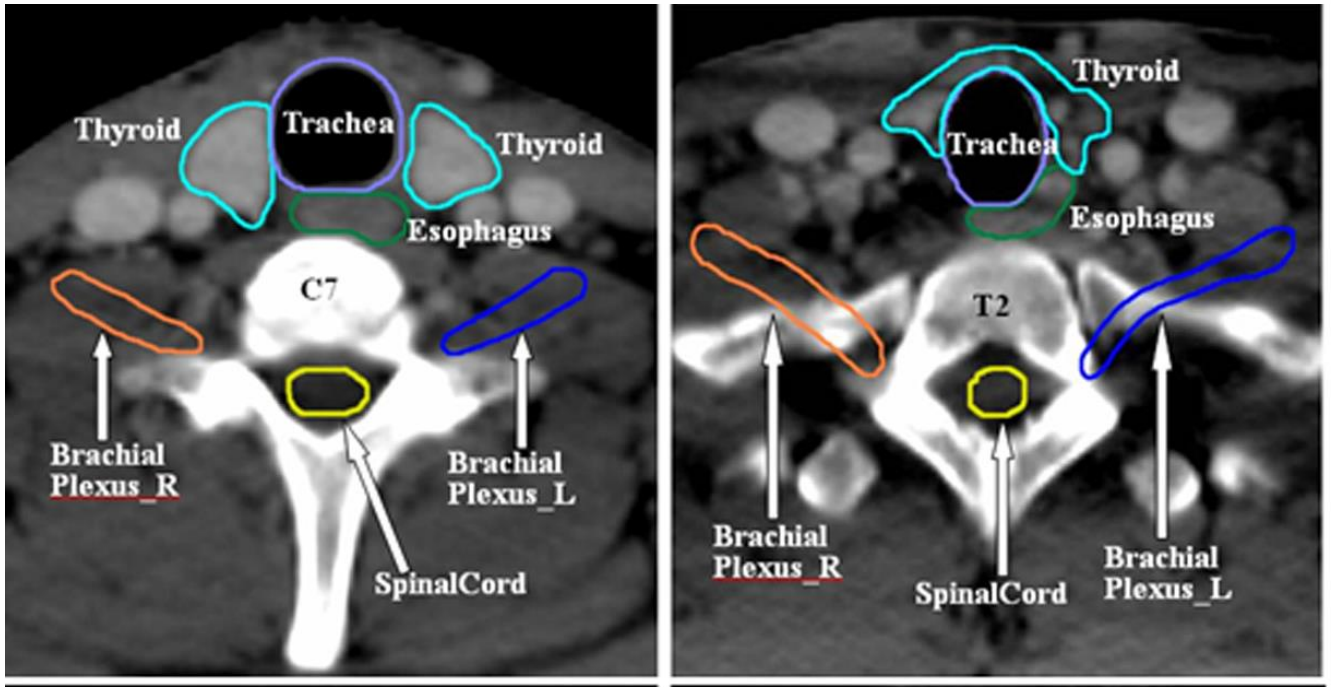
Most Superior Larynx Contour:
On the first image where you do not see the hyoid bone as you go inferiorly.



The boundary of the larynx contour is the inner edge of the thyroid cartilage anteriorly and the posterior edge of the cricoid cartilage posteriorly.



Most Inferior Larynx Contour:
The last image where you see the cricoid cartilage as a complete ring. The larynx contour is the outer surface of the cricoid cartilage



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Sparing and larynx and oesophageal inlet: relation to late dysphagia and tube dependency

Radiotherapy and Oncology 93 (2009) 539–544

Contents lists available at ScienceDirect

Radiotherapy and Oncology

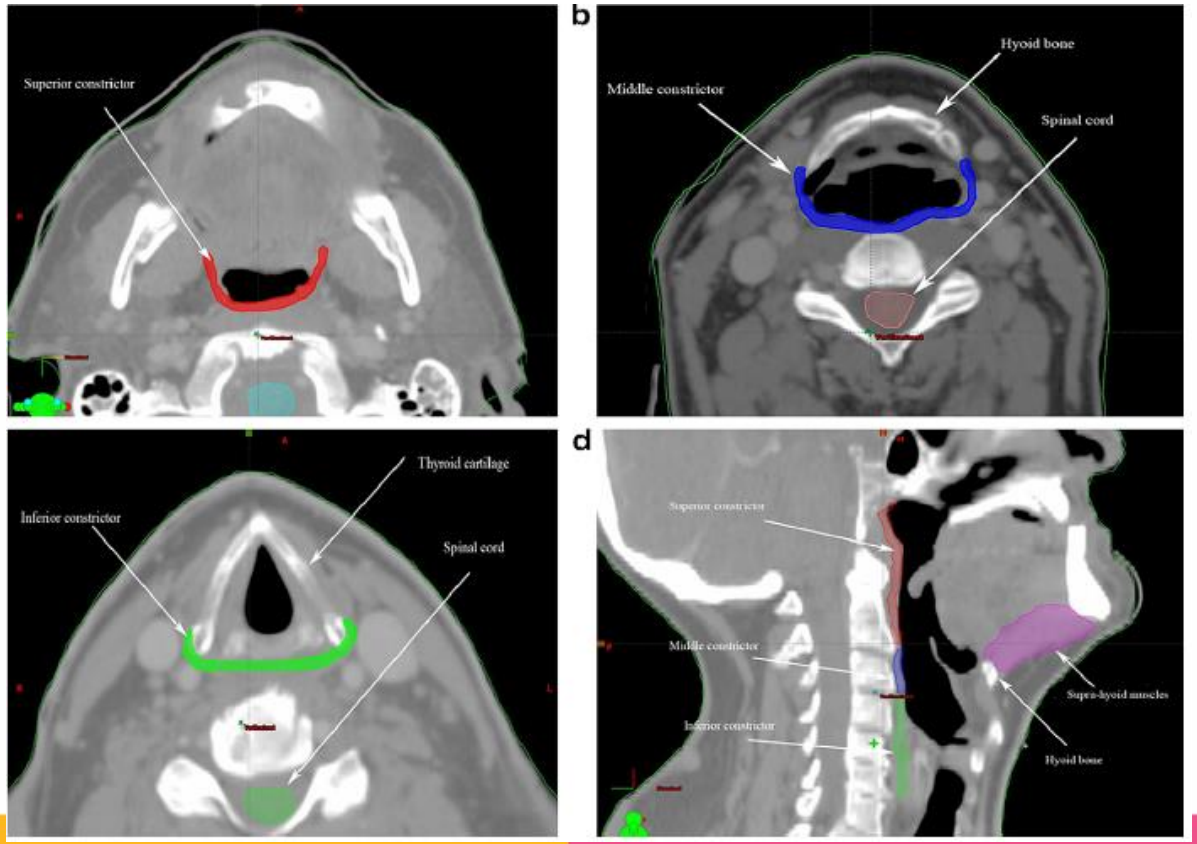
journal homepage: www.thegreenjournal.com

Head and neck chemoradiotherapy

Correlation between dose to the pharyngeal constrictors and patient quality of life and late dysphagia following chemo-IMRT for head and neck cancer ☆

Shreerang A. Bhide [a,b,*], Sarah Gulliford [a], Rehan Kazi [b], Iman El-Hariry [b], Kate Newbold [b], Kevin J. Harrington [a,b], Christopher M. Nutting [b]

[a] The Institute of Cancer Research, London, UK; [b] The Royal Marsden NHS Foundation Trust Hospital, London, UK



Radiotherapy and Oncology 115 (2015) 63–66

Contents lists available at ScienceDirect

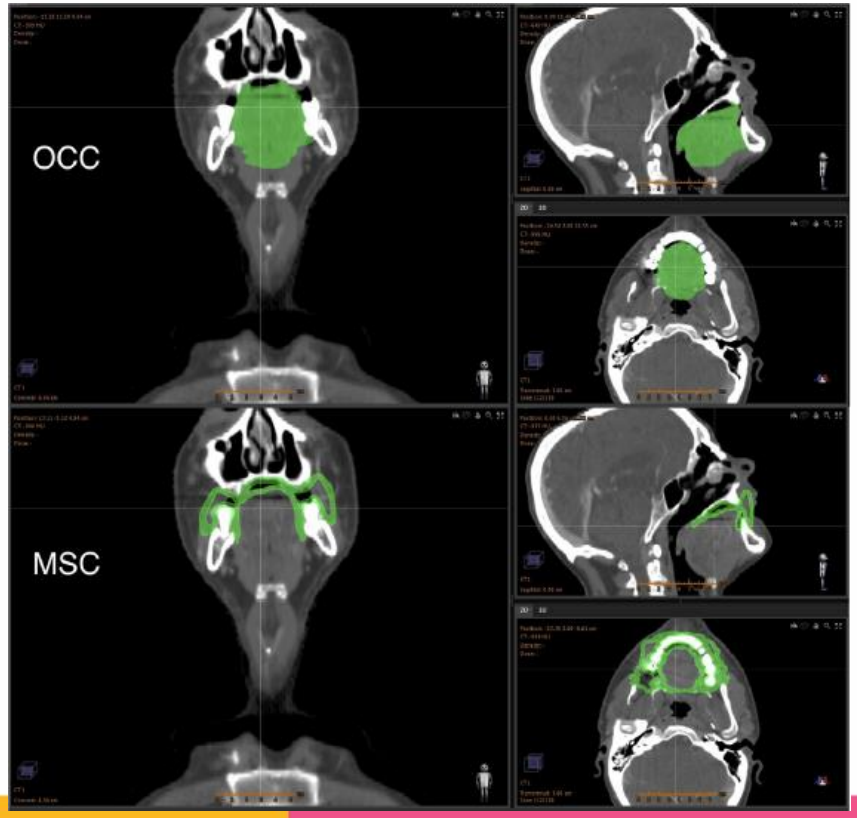
Radiotherapy and Oncology

journal homepage: www.thegreenjournal.com

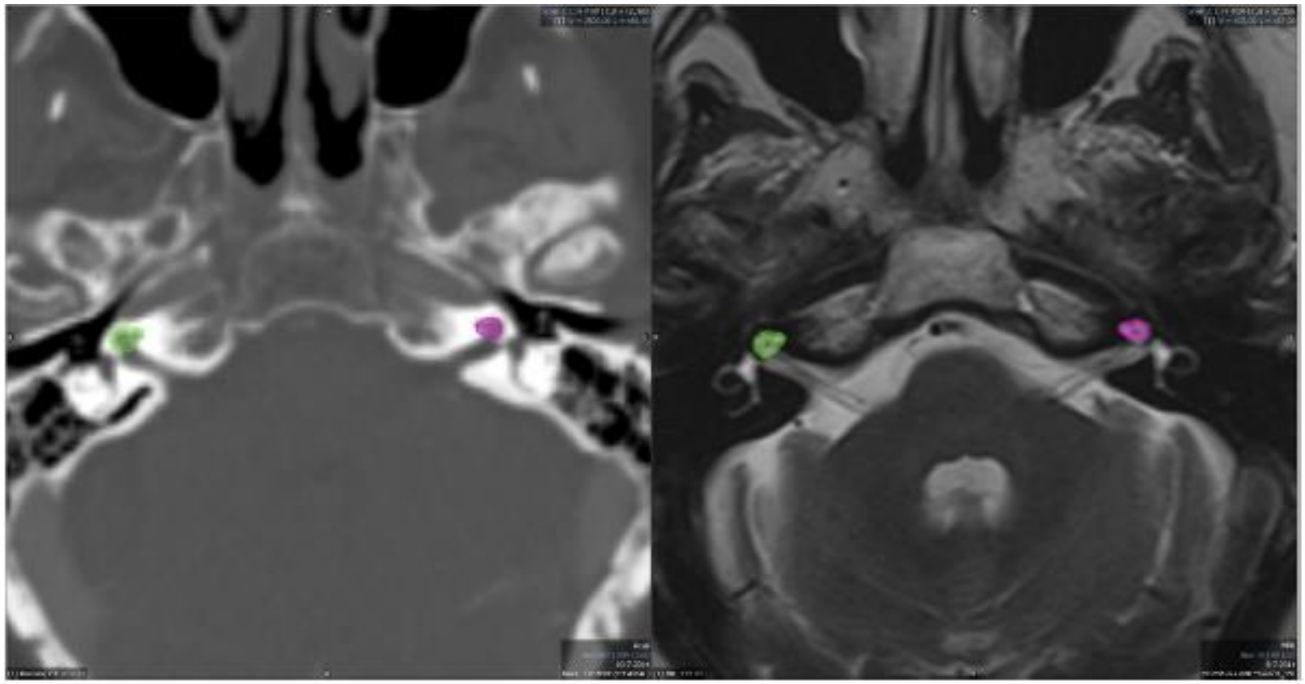
Deliniation of oral mucosa

A novel method for delineation of oral mucosa for radiotherapy dose–response studies

Jamie A. Dean [a,*], Liam C. Welsh [b], Sarah L. Gulliford [a], Kevin J. Harrington [b], Christopher M. Nutting [b]



Cochlea



Small spiral structure of about 0.6cm3 volume located in the petrous part of temporal bone.
The small bony cavity can be visualized better with a setting of 120/1500 on CT.
The structures of inner ear are visualized more in T2 weighted MRI images.
The semicircular canals should not be contoured.

Petsuksiri *et al. Radiation Oncology* 2011, **6**:19
http://www.ro-journal.com/content/6/1/19

RADIATION ONCOLOGY

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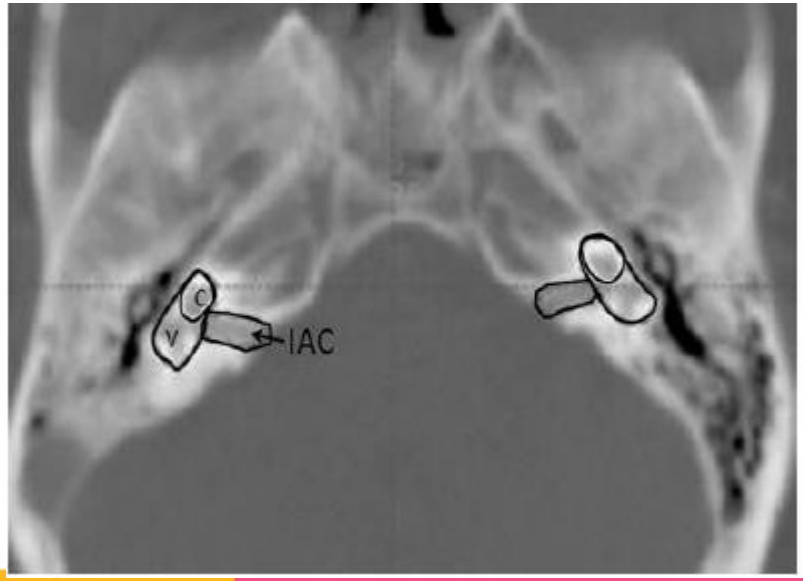
RESEARCH **Open Access**

Sensorineural hearing loss after concurrent chemoradiotherapy in nasopharyngeal cancer patients

Limiting dose to cochlea reduces SNHL.



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Review Article

Toxicity with radiotherapy for oral cancers and its management: A practical approach

ABSTRACT

Radiotherapy-induced damage in the oral mucosa is the result of the deleterious effects of radiation, not only on the oral mucosa itself but also on the skin, adjacent salivary glands, bone, dentition, and masticatory apparatus. From basic skin care to dental and oral health maintenance, several ointments and lotions, oral and parenteral medications, biological response modifiers, cytoprotective drugs, newer radiation techniques and surgery have been introduced to combat and more importantly to prevent the development of these complications. Radiotherapy-induced oral complications involve complex and dynamic pathobiological processes. This in the immediate- and long-term course lowers the quality of life and predisposes patients to serious clinical disorders. Here, we focus on these oral complications of radiotherapy, highlight preventive and therapeutic developments, and review the current treatment options available for these disorders.

KEY WORDS: Future directions, management, pathobiology, QOL, radiation toxicity

Trinanjan Basu, Sarbani G. Laskar, Tejpal Gupta, Ashwini Budrukkar, Vedang Murthy, Jai P. Agarwal

Department of Radiation Oncology, Tata Memorial Hospital, Parel, Mumbai - 400012 India

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European School of Oncology
Learning to care

The European School of Oncology

certifies that

Trinanjan Basu

has attended the

3rd ESO-ESTRO Masterclass in Radiation Oncology

Cascais, Portugal – 8/12 November 2014

and is pleased to recognize her/his active and diligent participation

Topic in the questionnaire	Most troublesome response
Skin over the irradiated region (face and neck).	Sub cutaneous edema.
Oral cavity.	Dryness of mouth and sticky saliva.
Dental status including jaws.	Dental sensitivity.
Swallowing capability.	Increased time to swallow.
Speech.	Change in voice quality.
Nutrition.	Dietary modifications.
General physical status.	Generalised fatigue.
Personal life.	Fear of disease recurrence.
Professional life.	Regular working.
Any specific concerns not addressed in the above.	None.

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Brief Communication

Head-and-neck cancer patients beyond 2 years of disease control: Preliminary analysis of intensity-modulated radiotherapy late-effect assessment scale

ABSTRACT

Over a decade of intensity-modulated radiotherapy (IMRT) improved the toxicity profile among head-and-neck cancer patients and also improved the quality of life (QOL). Several parameters' few subjective and few objectives have documented various aspects related to QOL. Patients surviving beyond a certain period will have few unattended concern. A single questionnaire-based evaluation might answer few untouched issues. This brief communication formulated such an indigenous single-institution scale named IMRT late-effect assessment scale (ILEA). The preliminary analysis identified concerns related to dryness of mouth, swallowing habit change, and fear of disease recurrence. Future large-scale prospective evaluation is needed.

KEY WORDS: Head-and-neck cancer, intensity-modulated radiotherapy, quality of life, survival

Trinanjan Basu, Shikha Goyal, Tejinder Kataria, Deepak Gupta

Division of Radiation Oncology, Medanta – The Medicity, Gurgaon, Haryana, India

J Can Res Ther 2019;15:696-9.

2D to 3D to IMRT

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- The background.
- Drawbacks of 2D/3D.
- Why the need of IMRT in Npx plan?
- Plan evaluation?
- Acceptance criterion.
- ICRU 83 parameters.

ELSEVIER

Radiotherapy and Oncology 68 (2003) 153–161

RADIOTHERAPY & ONCOLOGY
JOURNAL OF THE EUROPEAN SOCIETY FOR THERAPEUTIC RADIOLOGY AND ONCOLOGY

www.elsevier.com/locate/radonline

Limitation of conventional two dimensional radiation therapy planning in nasopharyngeal carcinoma

Radiotherapy and Oncology 104 (2012) 286–293

ELSEVIER

Contents lists available at SciVerse ScienceDirect

Radiotherapy and Oncology

journal homepage: www.thegreenjournal.com

Phase III randomised trial

A prospective, randomized study comparing outcomes and toxicities of intensity-modulated radiotherapy vs. conventional two-dimensional radiotherapy for the treatment of nasopharyngeal carcinoma

Oral Oncology 50 (2014) 506–512

Contents lists available at ScienceDirect

Oral Oncology

journal homepage: www.elsevier.com/locate/oraloncology

adding life to years

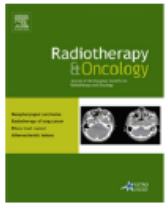
The impact of dosimetric inadequacy on treatment outcome of nasopharyngeal carcinoma with IMRT

Radiotherapy and Oncology 110 (2014) 377–384

Contents lists available at ScienceDirect

Radiotherapy and Oncology

journal homepage: www.thegreenjournal.com



Review

Evolution of treatment for nasopharyngeal cancer – Success and setback in the intensity-modulated radiotherapy era

International Journal of Radiation Oncology biology • physics

www.redjournal.org

adding life to years

Clinical Investigation

International Guideline on Dose Prioritization and Acceptance Criteria in Radiation Therapy Planning for Nasopharyngeal Carcinoma

ELSEVIER

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INTRODUCTORY PAPER

QUANTITATIVE ANALYSES OF NORMAL TISSUE EFFECTS IN THE CLINIC (QUANTEC): AN INTRODUCTION TO THE SCIENTIFIC ISSUES

SØREN M. BENTZEN, PH.D., D.SC.,* LOUIS S. CONSTINE, M.D.,† JOSEPH O. DEASY, PH.D.,‡ AVI EISBRUCH, M.D.,§ ANDREW JACKSON, PH.D.,‖ LAWRENCE B. MARKS, M.D.,¶ RANDALL K. TEN HAKEN, PH.D.,§ AND ELLEN D. YORKE, PH.D.‖

Basic points in IMRT

- Immobilisation.
- Reproducible and accurate set up.
- Image verification.
- Serial Online image matching.
- Check for need of adaptive RT (ART).
- Re-planning.
- ***MR guided RT (MgRT).***

Merlotti et al. Radiation Oncology (2014) 9:264
DOI 10.1186/s13014-014-0264-9

RADIATION ONCOLOGY

HOG
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REVIEW Open Access

Technical guidelines for head and neck cancer IMRT on behalf of the Italian association of radiation oncology - head and neck working group

Technical Innovations & Patient Support in Radiation Oncology 14 (2020) 43–50

Contents lists available at ScienceDirect

Technical Innovations & Patient Support in Radiation Oncology

journal homepage: www.elsevier.com/locate/tipsro

Research article

A review of Image Guided Radiation Therapy in head and neck cancer from 2009–2019 – Best Practice Recommendations for RTTs in the Clinic

Planning concepts from ICRU 83

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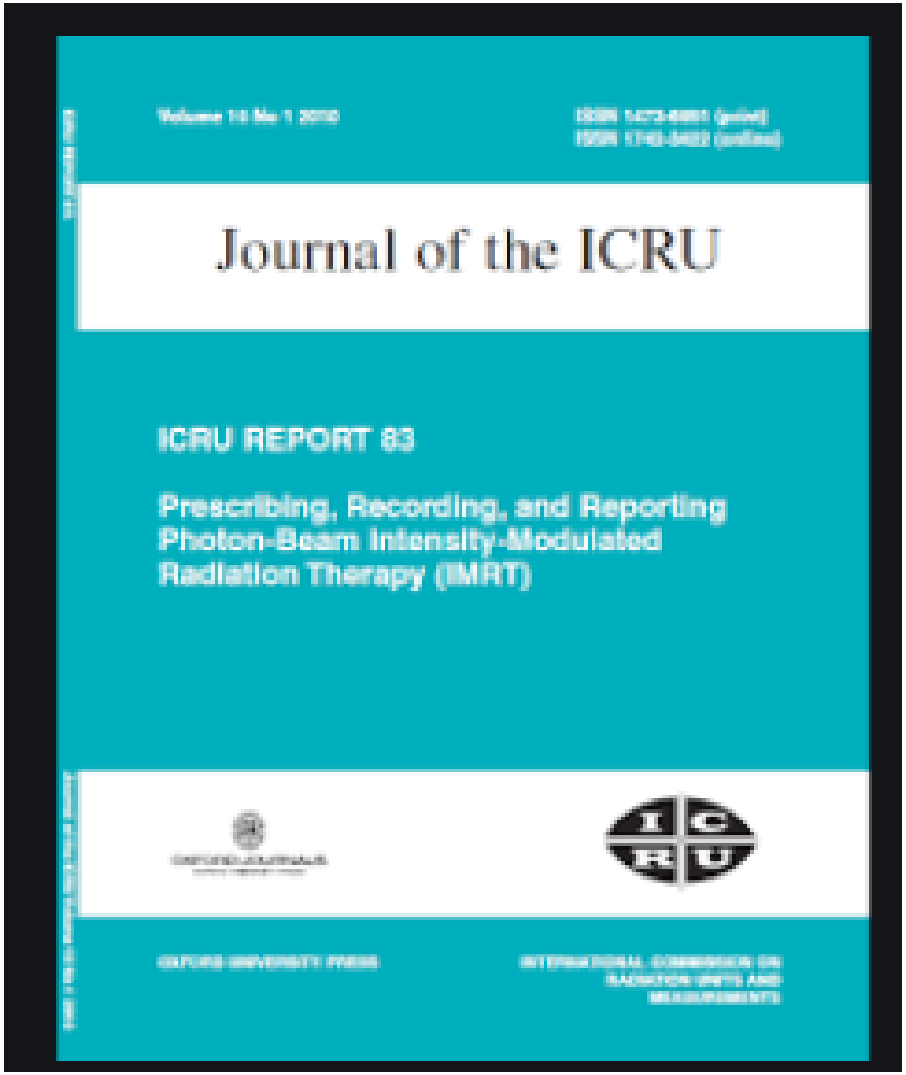

Important points

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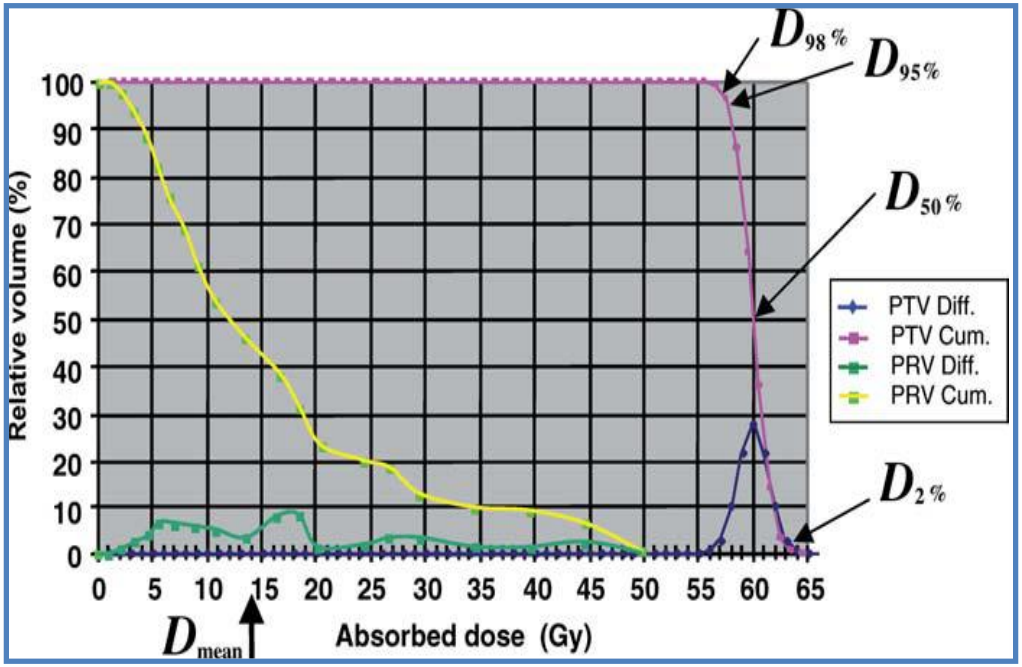
- **Beam related issues**
- **DVH analysis issues**
- **Overlapping volumes**
- **RVR**
- **Differential PTV in head neck**
- **Developing a systematic approach**

- Dmax and Dmin…..Change to D98 and D2, D50.
- DVH.
- OAR.
- Homogeneity index, CI, Heterogenity- hot/cold spot.



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APPLIED RADIATION ONCOLOGY

CB-CHOP: A simple acronym for evaluating a radiation treatment plan

Mary Dean, MD; Rachel Jimenez, MD; Eric Mellon, MD, PhD; Emma Fields, MD; Raphael Yechieli, MD; Raymond Mak, MD

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