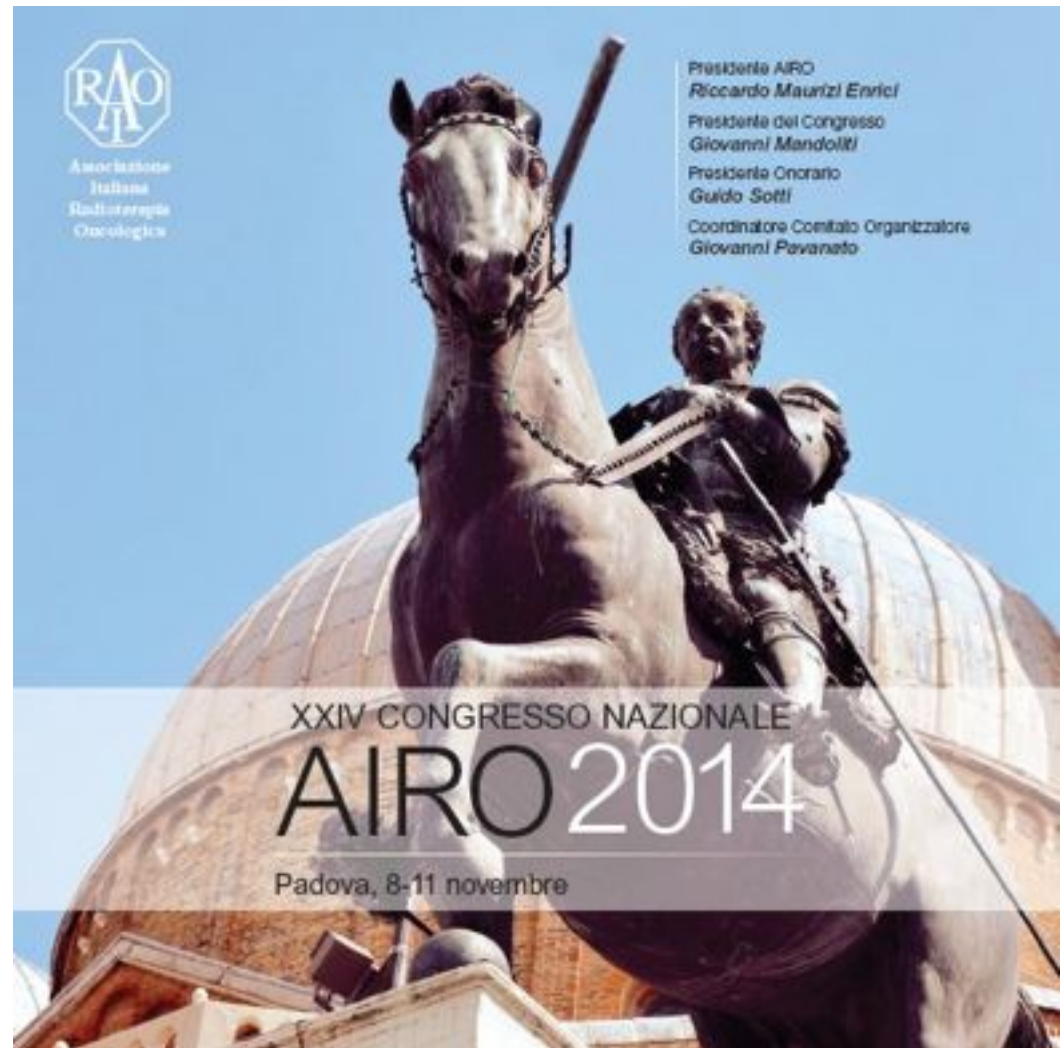


***Trattamento del carcinoma del rinofaringe in stadio avanzato con tecnica IGRT-IMRT (sia con sovradosaggio integrato che sequenziale): analisi sull'importanza della dose escalation, la sopravvivenza e la tossicità al trattamento.***

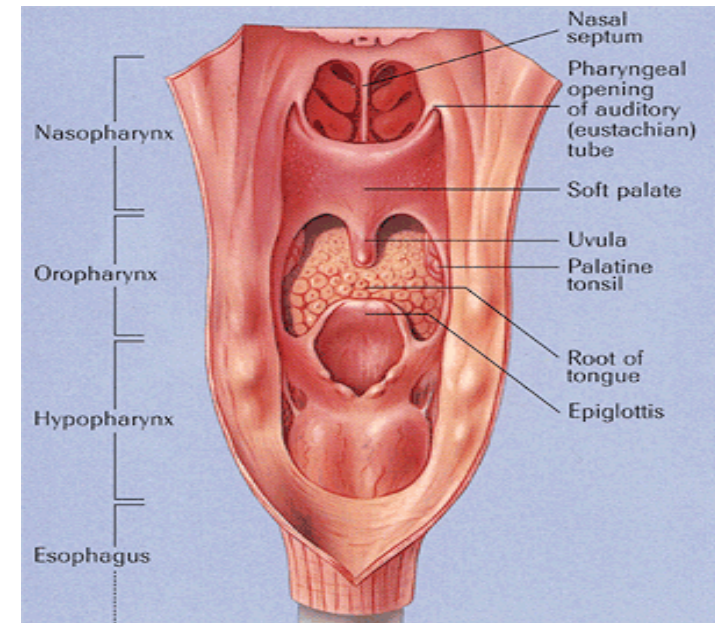
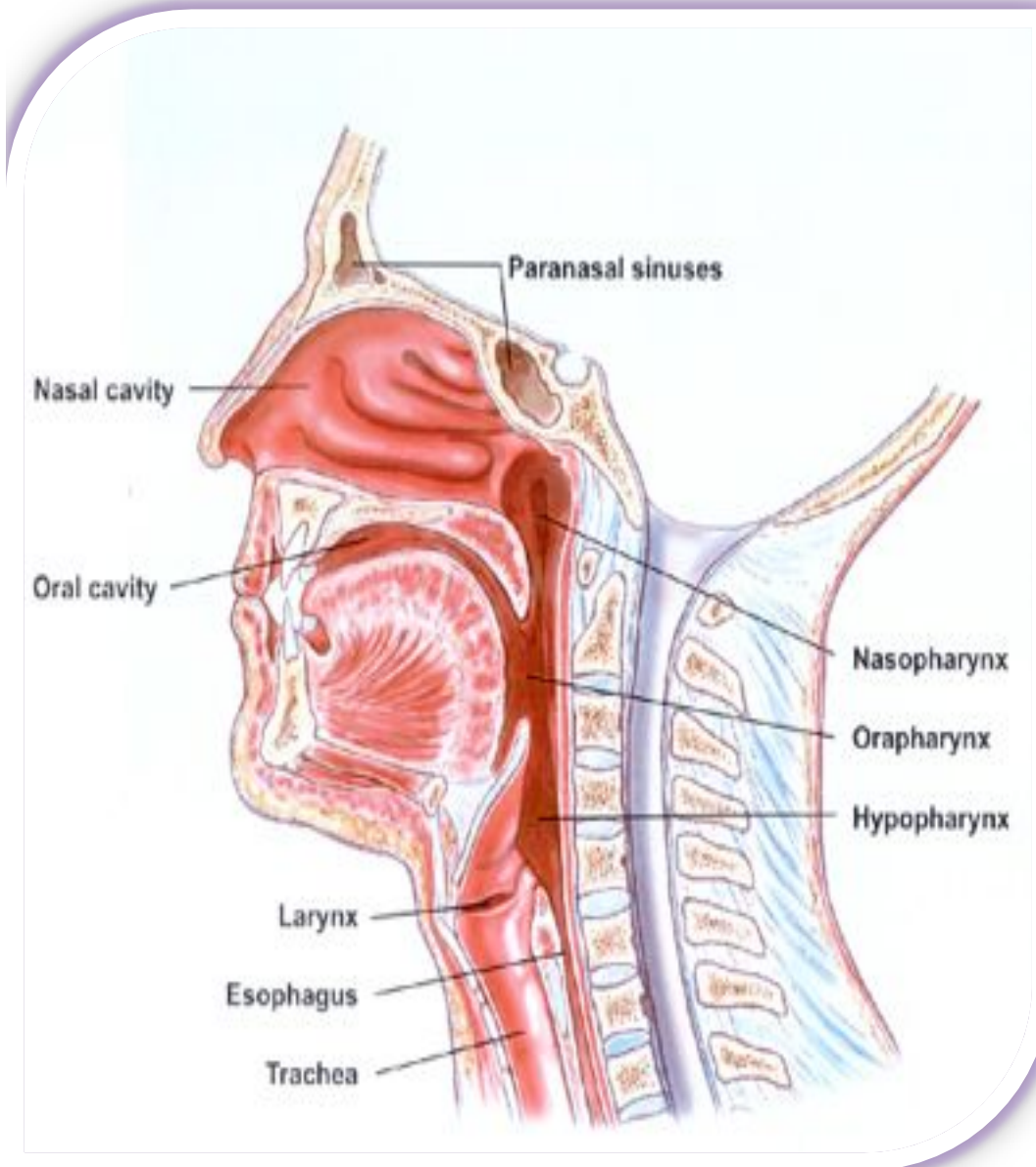
V.Armosini, A.Montalto, D.Caivano, I.Russo, R.Montagnoli, M.F.Osti, M.Valeriani, E.Clarke, V. De Sanctis, C.Bolzan, R. Maurizi Enrici

***Dr.ssa A. Montalto***



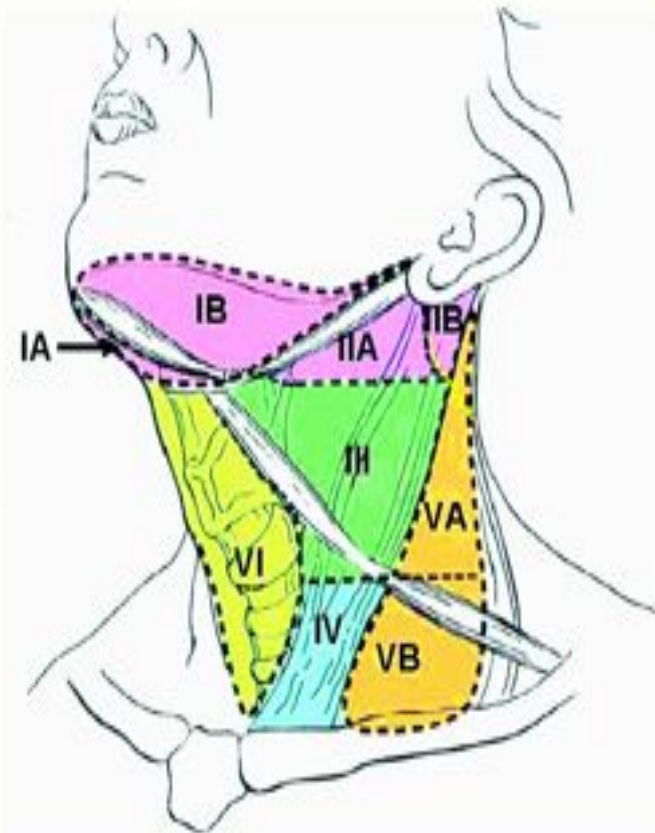
***Cattedra di Radioterapia  
Università "La Sapienza"  
Dir: Prof.R.Maurizi Enrici***





**Il rinofaringe rappresenta la porzione nasale del faringe. Il suo scheletro è costituito dalla fascia faringo-basilare, spessa struttura connettivale su cui si inserisce il muscolo costrittore del faringe. Il seno sfenoidale e la base dello sfenoide formano il tetto che si continua in dietro con il clivus e l'atlante a formare il muro posteriore. Anteriormente il rinofaringe è in continuità con le coane che ne costituiscono il limite anteriore. Il muro laterale del rinofaringe è formato, dall'avanti all'indietro, dal muscolo pterigoideo mediale, dai muscoli palatali, dal torus tubarius e dal recesso faringeo laterale (fossa di Rosenmüller). Inferiormente, infine, il palato molle separa il rinofaringe dall'orofaringe. Le adenoidi occupano il tetto del rinofaringe e tendono a ridursi dimensionalmente con l'età sebbene in molti adulti siano ancora presenti e ben visibili. Lo spazio parafaringeo è una struttura fibro-grassosa che separa il muro della mucosa rino-faringea dallo spazio masticatorio ed è spesso sede di invasione neoplastica da parte di tumori del rinofaringe con possibile infiltrazione dei muscoli masticatori.**

Comparison between the TNM atlas terminology and the Robbins' classification of the lymph nodes of the neck



TNM atlas for lymph nodes of the neck

Robbins' classification

Group number

Terminology

Level

Terminology

1	Submental nodes	Ia	Submental group
2	Submandibular nodes	Ib	Submandibular group
3	Cranial jugular nodes	II	Upper jugular group
4	Medial jugular nodes	III	Middle jugular group
5	Caudal jugular nodes	IV	Lower jugular group
6	Dorsal cervical nodes along the spinal accessory nerve	V	Posterior triangle group
7	Supraclavicular nodes	V	Posterior triangle group
8	Prelaryngeal and paratracheal nodes	VI	Anterior compartment group
9	Retropharyngeal nodes		
10	Parotid nodes Buccal nodes Retroauricular and occipital nodes		

## Selection and delineation of lymph node target volumes in head and neck conformal radiotherapy. Proposal for standardizing terminology and procedure based on the surgical experience

Vincent Grégoire<sup>a,\*</sup>, Emmanuel Coche<sup>b</sup>, Guy Cosnard<sup>b</sup>, Marc Hamoir<sup>c</sup>, Hervé Reyckler<sup>d</sup>

Recommendations for the radiological boundaries of the neck node levels

Level	Anatomical boundary					
	Cranial	Caudal	Anterior	Posterior	Lateral	Medial
Ia	Geniohyoid m.	Platysma m.	Symphysis menti; platysma m.	Body of hyoid bone	Medial edge of anterior belly of digastric m.	n.a. <sup>a</sup>
Ib	Mylohyoid m., cranial edge of submandibular gland or caudal edge of medial pterygoid m.	Platysma m.	Symphysis menti	Body of hyoid bone; posterior edge of submandibular gland	Basilar edge of mandible; platysma m.	Lateral edge of anterior belly of digastric m.
II	Bottom edge of the body of C1	Bottom edge of the body of hyoid bone	Posterior edge of submandibular gland; posterior edge of posterior belly of digastric m.	Posterior border of sternocleidomastoid m.	Medial edge of sternocleidomastoid m.	Internal edge of internal carotid artery, paraspinal (levator scapulae) m.
III	Bottom edge of the body of hyoid bone	Bottom edge of cricoid cartilage	Posterolateral edge of sternohyoid m.	Posterior edge of sternocleidomastoid m.	Medial edge of sternocleidomastoid m.	Internal edge of carotid artery, paraspinal (scalenus) m.
IV	Bottom edge of cricoid cartilage	Cranial border of clavicle	Posterolateral edge of sternohyoid m.	Posterior edge of sternocleidomastoid m.	Medial edge of sternocleidomastoid m.	Internal edge of internal carotid artery, paraspinal (scalenus) m.
V	Skull base	Cranial border of clavicle	Posterior edge of sternocleidomastoid m.	Anterior border of trapezius m.; scalenus m.	Platysma m.; skin	Paraspinal (levator scapulae, splenius capitis) m.
VI	Bottom edge of the body of hyoid bone	Sternal manubrium	Skin; platysma m.	Posterolateral edge of sternohyoid m.	Medial edge of common carotid artery, skin and anterior-medial edge of sternocleidomastoid m.	n.a.
Retro-pharyngeal	Base of skull	Cranial edge of the body of hyoid bone	Levator veli palatini m.	Prevertebral m. (longus colli, longus capitis)	Medial edge of internal carotid artery	Midline

<sup>a</sup> Midline structure lying between the medial borders of the anterior belly of the digastric muscle.

## ***VANTAGGI DELLA IMRT nei tumori del testa-collo***

- Maggior risparmio di vari OARs (parotidi, midollo spinale, bulbo, chiasma, nervi ottici)
- PTV Concavi
- Possibilità di dose escalation
- Possibilità di somministrazione contemporanea di livelli di dose differenziati per irradiare simultaneamente le sedi di malattia macroscopica e quelle con presunta malattia subclinica (SIB-IMRT)

**INDIAN J CANCER** Year : 2010 | Volume : 47 | Issue : 3 | Page : 267-273  
The role of intensity-modulated radiotherapy in head and neck cancer  
SA Bhide, R Kazi, K Newbold, KJ Harrington, CM Nutting. Head and Neck Unit,  
The Institute of Cancer Research and The Royal Marsden Hospital, London and Surrey,  
United Kingdom

*Considerazioni  
Radiobiologiche*



Int. J. Radiation Oncology Biol. Phys., Vol. 46, No. 3, pp. 619-630, 2000  
Copyright © 2000 Elsevier Science Inc.  
Printed in the USA. All rights reserved.  
0360-3016/00/\$-see front matter

PII S0360-3016(99)00435-1

**BIOLOGY CONTRIBUTION**

**RADIOBIOLOGICAL CONSIDERATIONS IN THE DESIGN OF  
FRACTIONATION STRATEGIES FOR INTENSITY-MODULATED RADIATION  
THERAPY OF HEAD AND NECK CANCERS**

**RADHE MOHAN, PH.D.,\* QIUWEN WU, PH.D.,\* MATTHEW MANNING, M.D.,\*  
AND RUPERT SCHMIDT-ÜLLRICH, M.D.\***

\*Department of Radiation Oncology, Medical College of Virginia, Virginia Commonwealth University and McGuire VA Hospital,  
Richmond, VA



Int. J. Radiation Oncology Biol. Phys., Vol. 49, No. 4, pp. 907-916, 2001  
Copyright © 2001 Elsevier Science Inc.  
Printed in the USA. All rights reserved.  
0360-3016/01/\$-see front matter

PII S0360-3016(00)01441-3

*Primi studi clinici*

**CLINICAL INVESTIGATION**

**Head and Neck**

**A PROSPECTIVE STUDY OF SALIVARY FUNCTION SPARING IN PATIENTS  
WITH HEAD-AND-NECK CANCERS RECEIVING INTENSITY-MODULATED  
OR THREE-DIMENSIONAL RADIATION THERAPY: INITIAL RESULTS**

**K. S. CLIFFORD CHAO, M.D., JOSEPH O. DEASY, PH.D., JERRY MARSHMAN, D.Sc., JOYCE HAYNIE, R.N.,  
CARLOS A. PEREZ, M.D., JAMES A. PURDY, PH.D., AND DANIEL A. LOW, PH.D.**



Int. J. Radiation Oncology Biol. Phys., Vol. 51, No. 4, pp. 880-914, 2001  
Copyright © 2001 Elsevier Science Inc.  
Printed in the USA. All rights reserved.  
0360-3016/01/\$-see front matter

PII S0360-3016(01)01749-7

*Linee guida*

**CRITICAL REVIEW**

**INTENSITY-MODULATED RADIOTHERAPY:  
CURRENT STATUS AND ISSUES OF INTEREST**

Intensity Modulated Radiation Therapy Collaborative Working Group

# RISULTATI CLINICI

Radiotherapy and Oncology 97 (2016) 249–257



Contents lists available at ScienceDirect

Radiotherapy and Oncology

journal homepage: [www.thegreenjournal.com](http://www.thegreenjournal.com)



Systematic review

Evidence-based review: Quality of life following head and neck intensity-modulated radiotherapy

Martin Scott-Brown<sup>a</sup>, Aisha Miah<sup>b</sup>, Kevin Harrington<sup>b,c</sup>, Chris Nutting<sup>b,\*</sup>

<sup>a</sup>Unit for Radiotherapy and Biology, University of Exeter, UK; <sup>b</sup>Head and Neck Unit, Royal Marsden Hospital, London, UK; <sup>c</sup>The Institute of Cancer Research, London, UK

Oral Oncology 48 (2016) 727–733



Contents lists available at ScienceDirect

Oral Oncology

journal homepage: [www.elsevier.com/locate/oraloncology](http://www.elsevier.com/locate/oraloncology)



Review

Swallowing outcomes following Intensity Modulated Radiation Therapy (IMRT) for head & neck cancer – A systematic review

Justin W.G. Roe<sup>a,b,\*</sup>, Paul N. Carding<sup>c,d</sup>, Raghav C. Dwivedi<sup>a,b,e</sup>, Rehan A. Kazi<sup>a,b,e</sup>, Peter H. Rhys-Evans<sup>a,b,e</sup>, Kevin J. Harrington<sup>a,b,e</sup>, Christopher M. Nutting<sup>a,b,e</sup>

<sup>a</sup>Head and Neck Unit, The Royal Marsden Hospital NHS Foundation Trust, Fulham Road, London SW3 6JJ, United Kingdom

<sup>b</sup>The Institute of Cancer Research, 127 Old Brompton Road, London SW7 3BP, United Kingdom

<sup>c</sup>Department of Speech, Voice and Swallowing, Freeman Hospital, Newcastle upon Tyne Hospitals NHS Foundation Trust, High Newton, Newcastle upon Tyne NE7 7DN, United Kingdom

<sup>d</sup>Faculty of Medical Sciences, University of Newcastle upon Tyne, NE1 7RU, United Kingdom

Articles

## 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, Mary Anne Tansy, Fawzi A Adab, Sarah J Jeffarick, Christopher Scrase, Bong K Yap, Roger P A'Hern, Mark A Sydesham, Merle Emson, Emma Hall, on behalf of the PARSPORT trial management group<sup>a</sup>

CLINICAL INVESTIGATION

Head and Neck

LONG-TERM SURVIVAL OF NASOPHARYNGEAL CARCINOMA FOLLOWING CONCOMITANT RADIOTHERAPY AND CHEMOTHERAPY

SIYUE HONGJUN CHENG, M.D.,<sup>1\*</sup> JAMES JER-MIN JIAN, M.D.,<sup>1\*</sup> STELLA Y. C. TSAI, M.D.,<sup>1\*</sup> K. LAWRENCE YEN, M.D.,<sup>2</sup> NEI-MIN CHU, M.D.,<sup>3</sup> KWAN-YEE CHAN, M.D.,<sup>3</sup> TRANS-DEE TAN, M.D.,<sup>3</sup> JASON C. CHENG, M.D.,<sup>4</sup> SZU-YUN LEE, M.S.,<sup>5</sup> CHENG-YEE HSIEH, M.D.,<sup>3</sup> AND ANDREW T. HUANG, M.D.<sup>1,6</sup>

Departments of <sup>1</sup>Radiation Oncology, <sup>2</sup>Research, <sup>3</sup>Head and Neck Surgery, <sup>4</sup>Medical Oncology, and <sup>5</sup>Radiology, Koo Foundation Sun Yat-Sen Cancer Center, Taipei, Taiwan; <sup>6</sup>Department of Medicine, Duke University Medical Center, Durham, NC

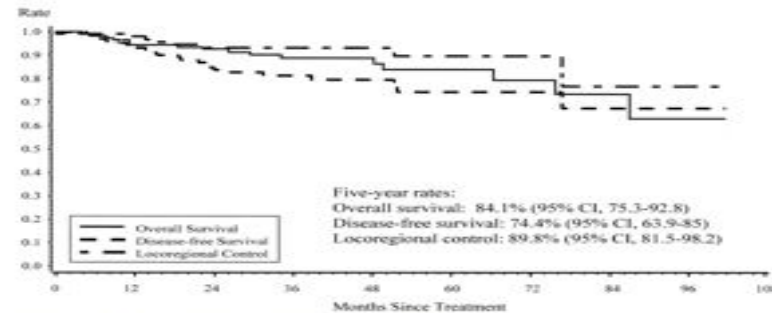


Fig. 1. Overall survival, disease-free survival, and locoregional control rates and confidence intervals (CI) in 107 patients with nasopharyngeal carcinoma.

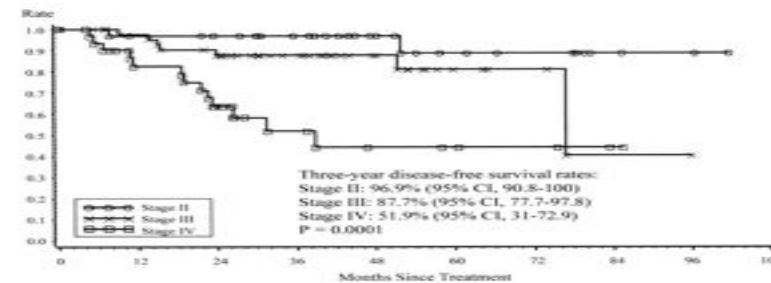


Fig. 3. Disease-free survival rates and confidence intervals (CI) by American Joint Committee on Cancer (AJCC) 1997 staging system.

Table 5. Comparative survival in literature: Review of Phase III studies

Series [Ref. no.]	Number of patients	AJCC 1988 stage	Treatment	Median FU (month)	*LRR	DFS	(Year)
Milan [8]	116	I-IV	RT 60-60 Gy	42	27%	56%	(4)
INSG [9,10]	113	IV	RT + VCA × 6	44	24%	58%	(3)
	168		RT 70 Gy	49	23%	31%	
Hong Kong [11]	171	†N size ≥ 4 cm or N3	BEP × 3 + RT 70 Gy	28.5	15%	47%	(2)
	40		RT (66 Gy + Boost)		15%	78%	
AOCOA [12]	37	†N size ≥ 3 cm N2-N3 or T3	PF × 2 + RT + PF × 3	41	16%	68%	(3)
	134		RT 66-74 Gy		31%	46%	
Intergroup Study [1]	152	III-IV	PE × 2-3 + RT	32	25%	58%	(3)
	69		RT 70 Gy		41%	24%	
Current series	78	III, IV	RT and P × 3 + PF × 3	44	14%	69%	(2)
	107		RT 70 Gy and Concurrent		7.5%	84%	
			PF × 2 + Adjuvant PF × 2			81%	
						74%	(5)

\*Crude rate.

†Ho's staging system.

Abbreviations: AJCC = American Joint Committee on Cancer; FU = follow-up; LRR = locoregional recurrence; DFS = disease-free survival; RT = radiotherapy; VCA = vincristine, cyclophosphamide, and doxorubicin; INSG: International Nasopharynx Study Group; BEP = bleomycin, epirubicin, and cisplatin; PF = cisplatin and 5-fluorouracil; AOCOA = Asian-Oceanian Clinical Oncology Association, PE = cisplatin and epirubicin.

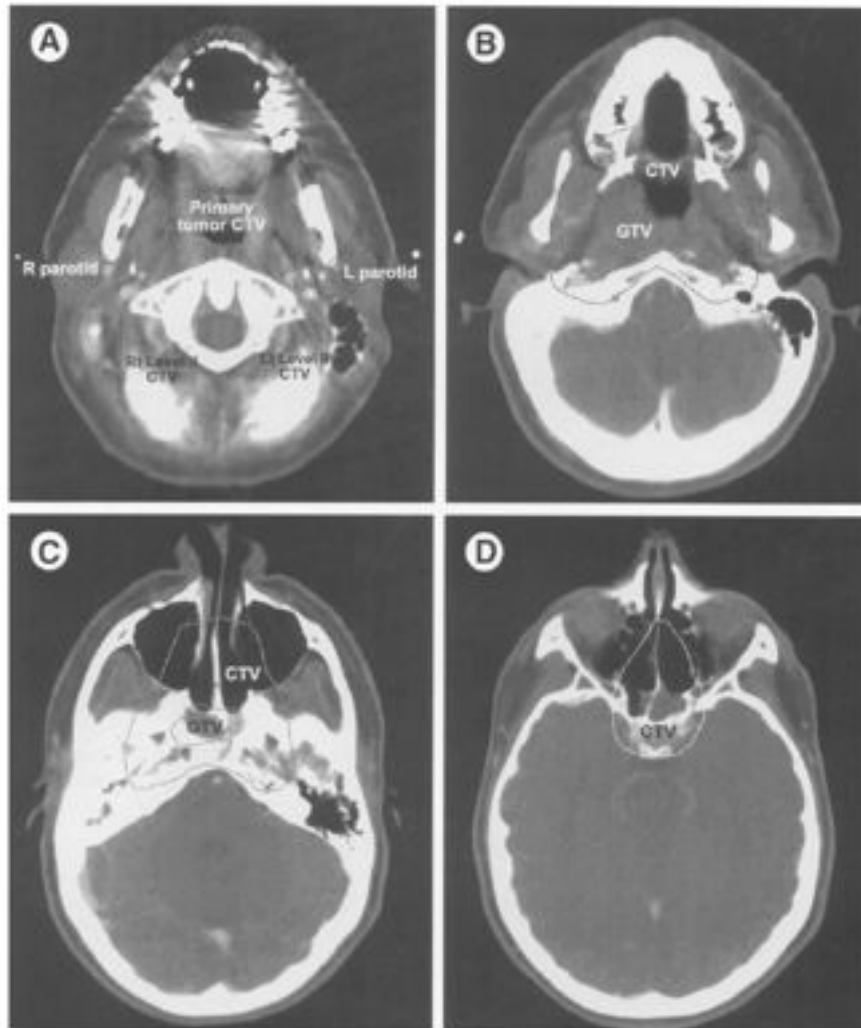
**Conclusion: CCRT and adjuvant chemotherapy is effective in Taiwanese patients with advanced NPC. The prognosis of AJCC 1997 Stage II and III disease is excellent, but, for Stage IV (M0), it is relatively poor.**



## Intensity-Modulated Radiation Therapy for Head and Neck Cancer: Emphasis on the Selection and Delineation of the Targets

Avraham Eisbruch, Robert L. Foote, Brian O'Sullivan, Jonathan J. Beitler, and Bhadrasain Vikram

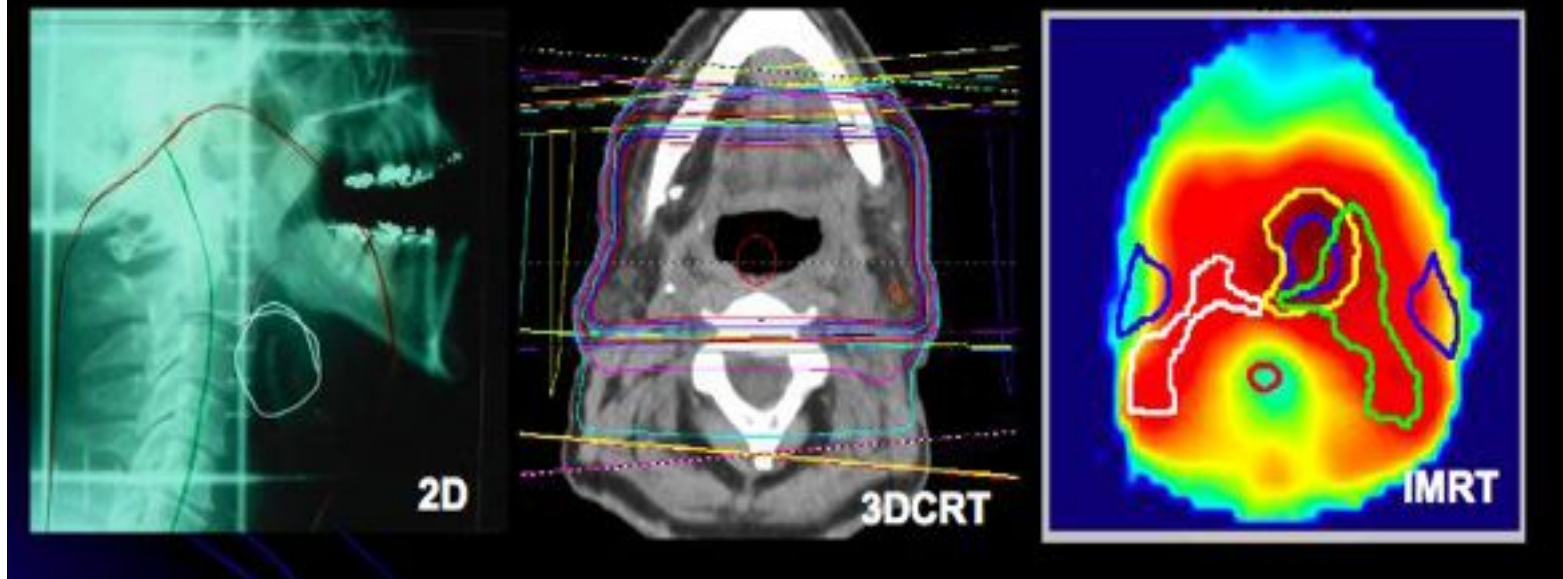
2002, Elsevier Science (USA).



**Figure 1.** Delineation of the primary tumor GTV and CTV, and upper Level II CTVs, in a case of nasopharyngeal cancer, tumor stage T3. The GTV was delineated on MRI and the contours were registered with the planning CT. For treatment planning, the GTV and CTV were each expanded uniformly by 5 mm to yield the corresponding PTVs. (A) Caudal to the nasopharynx: The pharyngeal walls and parapharyngeal spaces constitute the primary tumor CTV. Level II CTVs are delineated to the base of skull bilaterally. (B-C) The clivus, foramina at the base of skull, petrygoid plates, posterior maxillary sinuses, and nasal cavity are encompassed by the CTV. (D) Cranial to the MRI-defined GTV, the sphenoid and cavernous sinuses are encompassed by the CTV.

Planning comparisons have shown significant improvements in noninvolved organ sparing and in target irradiation of head and neck cancer by IMRT compared with conventional techniques.

# From 2D to 3D to IMRT



L'escalation della dose radioterapica è una delle strategie attualmente impiegate per migliorare il controllo locale e la sopravvivenza dei pazienti.

Elevare la dose alla neoplasia però, se da una parte aumenta la possibilità di controllo locale, dall'altra comporta il rischio di irradiazione con dosi decisamente eccessive agli organi ed ai tessuti sani limitrofi. L'impiego della tecnica IMRT, invece, consente di limitare la dose e quindi la tossicità agli organi a rischio con una caduta di dose immediatamente al di fuori del PTV.

Un altro dei vantaggi dell'IMRT è quello di poter somministrare dosì per frazione più elevate a porzioni delimitate della neoplasia con ulteriore risparmio degli organi a rischio. Questo tipo di boost concomitante viene chiamato SIB (Simultaneous Integrated Boost).

Il principio tecnico-fisico che distingue la IMRT dalla radioterapia convenzionale è quello di poter trattare il paziente con fasci con fluenze di intensità non uniforme

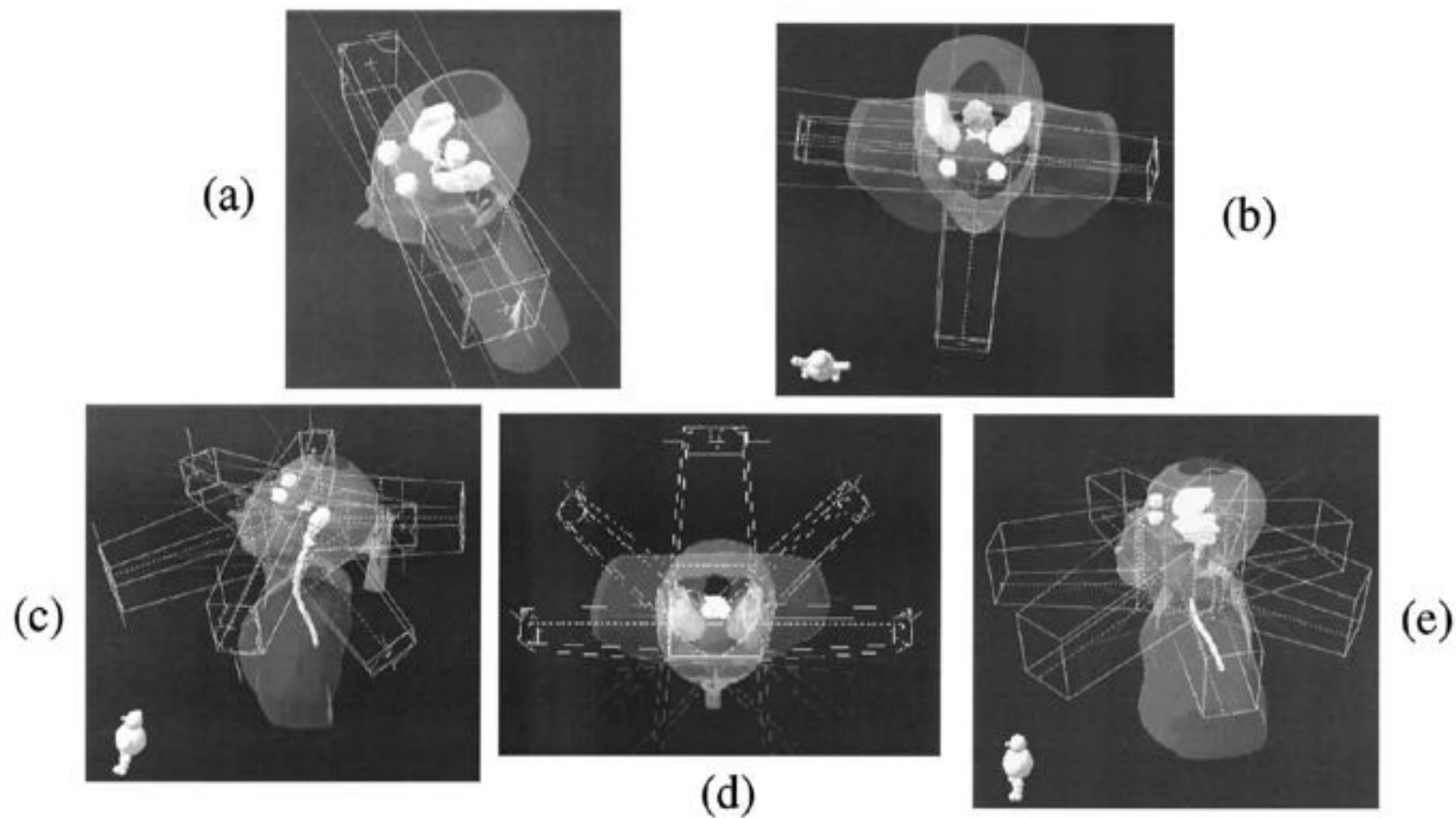


Fig. 1. (a, b) 2D-RT lateral opposing fields in Phase I and three fields in Phase II treatment. (c, d) 3D-CRT seven coplanar fields and six noncoplanar fields in Phase II treatment. (e) IMRT seven-field arrangement throughout treatment.

### THREE-DIMENSIONAL CONFORMAL VS. INTENSITY-MODULATED RADIOTHERAPY IN HEAD-AND-NECK CANCER PATIENTS: COMPARATIVE ANALYSIS OF DOSIMETRIC AND TECHNICAL PARAMETERS

LUCA COZZI, PH.D.,\* ANTONELLA FOGLIATA, DR.,\* ALESSANDRA BOLSI, DR.,\*<sup>†</sup>  
 GIORGIA NICOLINI, DR.,\* AND JACQUES BERNIER, PH.D., M.D.<sup>‡</sup>

\*Medical Physics Unit and <sup>†</sup>Department of Radiation Oncology, Oncology Institute of Southern Switzerland, Bellinzona, Switzerland; <sup>‡</sup>Medical Physics School, University of Milan, Milan, Italy

Conformal therapy vs. IMRT in head and neck • L. Cozzi et al

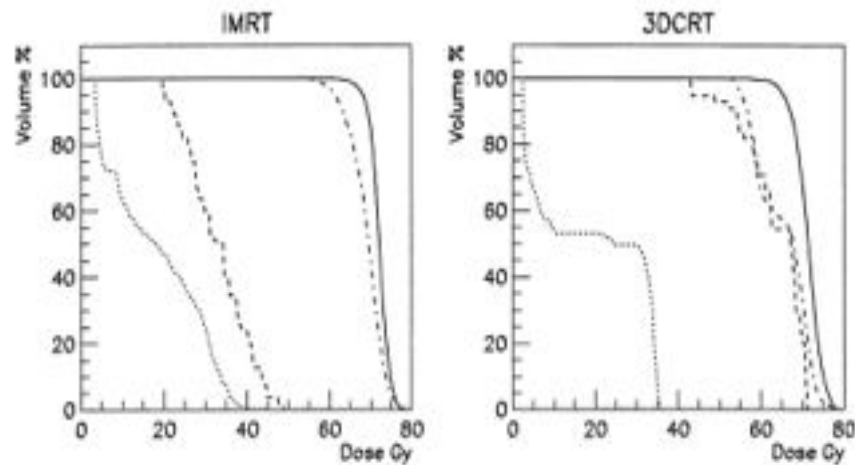


Fig. 2. Cumulative dose-volume histograms for target volumes and organs at risk for the same representative patient. Data are shown for the whole treatment with IMRT (70.2 Gy) or for the reference 3DCRT technique. The solid line represents PTVI, the dashed-dotted line represents PTVII-PTVI, the dashed line represents the parotid gland, and the dotted line represents the spinal cord.

### EVIDENTE SUPERIORITA' DELLE DISTRIBUZIONI DI DOSE AGLI OARs con IMRT vs 3DCRT

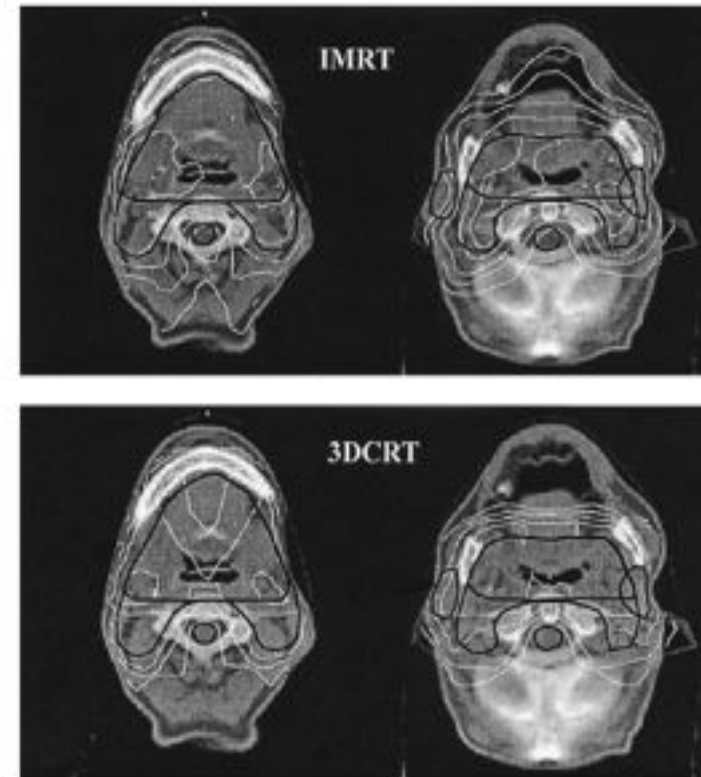


Fig. 1. Isodose distributions at (a) isocenter level and at (b) parotid level for 1 representative patient (Patient 7 in Table 1). Curves are shown for whole treatment (total dose: 70.2 Gy) with IMRT and for the reference 3DCRT technique. Isodose lines represent 36, 45, 54, 65, and 72 Gy, which correspond to, respectively, 50%, 62%, 75%, 90%, and 100%.

**3D-CRT**

**INTENSITY-MODULATED RADIOTHERAPY IN NASOPHARYNGEAL CARCINOMA: DOSIMETRIC ADVANTAGE OVER CONVENTIONAL PLANS AND FEASIBILITY OF DOSE ESCALATION**

MICHAEL K. M. KAM, F.R.C.R., RICKY M. C. CHAU, M.Sc., JOYCE SUEN, M.B.Ch.B.,  
 PETER H. K. CHOI, F.R.C.R., AND PETER M. L. TEO, M.D., F.R.C.R.

Department of Clinical Oncology, Chinese University of Hong Kong, Prince of Wales Hospital, Shatin, Hong Kong SAR, China

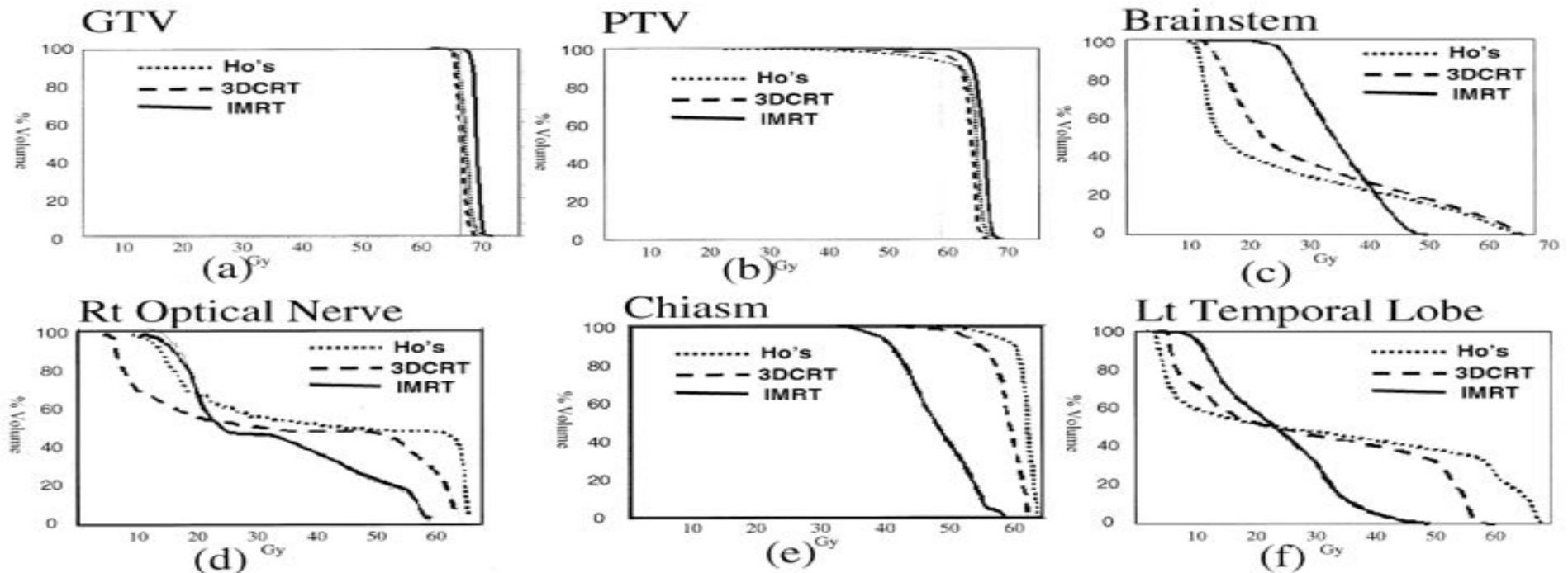


Fig. 7. DVH curves of (a) GTV, (b) PTV, (c) brainstem, (d) spinal cord, (e) right optic nerve, and (f) left temporal lobe with three different plans in T4N2M0 NPC.

**Conclusion:** IMRT is useful in treating all stages of nonmetastatic nasopharyngeal carcinoma because of its dosimetric advantages. In early-stage disease, it provides better parotid gland sparing. In locally advanced disease, IMRT offers better tumor coverage and normal organ sparing and allows room for dose escalation.

# TUMORI DEL RINOFARINGE

Radioterapia e chirurgia: gold standard terapeutico



Stage IVC

Local Recurrence

## Recommended treatment

- RT alone (2/70 Gy)
- Concurrent chemo-RT followed by adjuvant chemo
- 2/70 Gy + cisplatin 100 mg/m<sup>2</sup> on days 1, 21, 42 → cisplatin/5-FU × 3c
- Neck dissection for persistent/recurrent neck nodes
- IMRT may improve LRC and reduces severe xerostomia 80% → 35–40%
- Neoadjuvant chemo (e.g., using taxanes) is under investigation
- Platinum-based combination chemo; if CR, definitive RT, otherwise palliative RT dose to metastatic sites
- Reirradiation with IMRT, SRS, or brachytherapy. Cumulative dose is limited with respect to surrounding normal tissue tolerance. Alternative, surgery

A causa dell'alta percentuale di recidiva locoregionale (>50%) nuove strategie terapeutiche:

- *dose escalation*
- *CHT concomitante e/o neoadiuvante*
- *Nuovi frazionamenti*

## (AJCC 7TH ED., 2010)

### Primary tumor (T)

- TX: Primary tumor cannot be assessed  
T0: No evidence of primary tumor  
Tis: Carcinoma in situ  
T1: Tumor confined to the nasopharynx, or tumor extends to oropharynx and/or nasal cavity without parapharyngeal extension  
T2: Tumor with parapharyngeal extension\*  
T3: Tumor involves bony structures of skull base and/or paranasal sinuses  
T4: Tumor with intracranial extension and/or involvement of cranial nerves, hypopharynx, orbit, or with extension to the infratemporal fossa/masticator space

\*Note: Parapharyngeal extension denotes posterolateral infiltration of tumor.

### Regional lymph nodes (N)

- NX: No regional lymph node metastasis can be assessed  
N0: No regional lymph node metastasis  
N1: Unilateral metastasis in cervical lymph node(s), 6 cm or less in greatest dimension, above the supraclavicular fossa, and/or unilateral or bilateral, retropharyngeal lymph nodes, 6 cm or less, in greatest dimension\*  
N2: Bilateral metastasis in cervical lymph node(s), 6 cm or less in greatest dimension, above the supraclavicular fossa\*  
N3: Metastasis in a lymph node(s)\* >6 cm and/or to supraclavicular fossa\*  
N3a: Greater than 6 cm in dimension  
N3b: Extension to the supraclavicular fossa\*\*

\*Note: Midline nodes are considered ipsilateral nodes.

\*\*Note: Supraclavicular zone or fossa is relevant to the staging of nasopharyngeal carcinoma and is the triangular region originally described by Ho. It is defined by three points: (1) the superior margin of the sternal end of the clavicle, (2) the superior margin of the lateral end of the clavicle, (3) the point where the neck meets the shoulder (Fig. 4.2). Note that this would include caudal portions of levels IV and VB. All cases with lymph nodes (whole or part) in the fossa are considered N3b.

### Distant metastasis (M)

- MX: Distant metastasis cannot be assessed  
M0: No distant metastasis

### Stage grouping

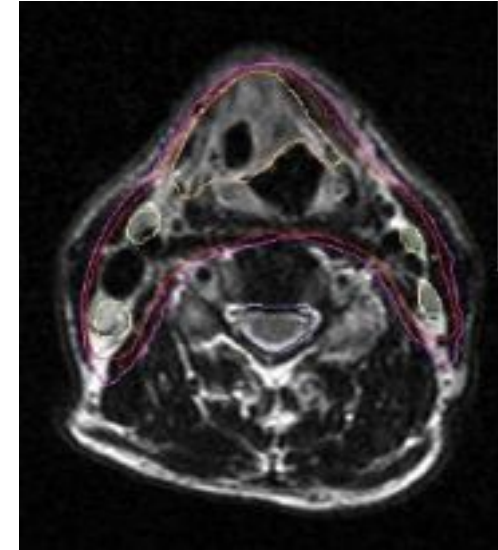
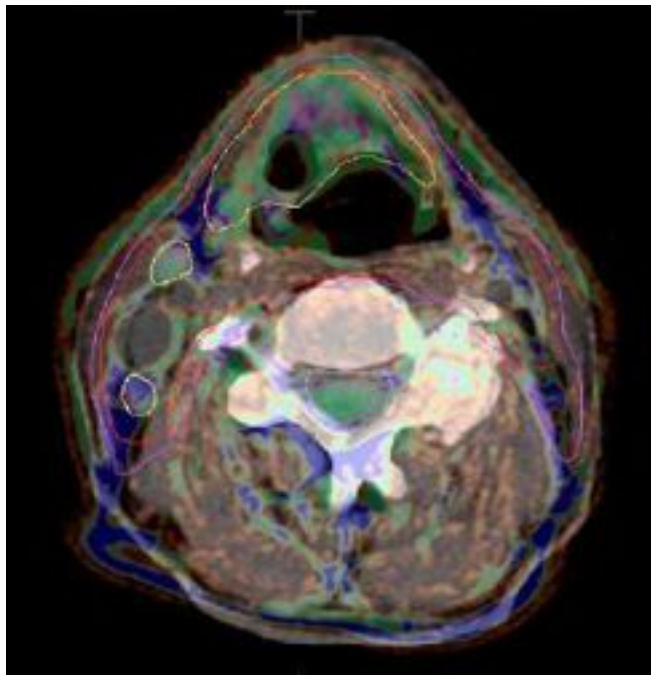
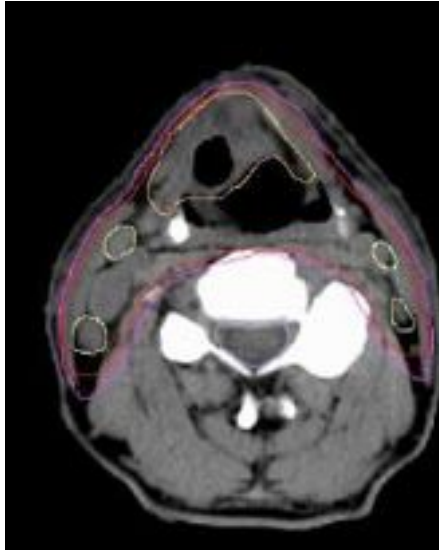
- 0: TisN0M0  
I: T1N0M0  
II: T1N0M0, T2N0-1M0  
III: T1-2N2M0, T3N0-2M0  
IVA: T4N0-2M0  
IVB: Any T, N3, M0  
IVC: Any T, any N, M1

## ***ESAMI DIAGNOSTICI DI RIFERIMENTO***

- ***TC.*** Particolarmente utile per documentare l'interessamento osseo della neoplasia, per lo studio della laringe (brevi tempi di acquisizione) e per lo studio delle stazioni linfonodali. Inoltre è indicata in caso di controindicazione alla RM o in pazienti poco collaboranti nei quali un esame di RM sarebbe difficilmente effettuabile o poco attendibile per artefatti da movimento.
- ***RM.*** Oggi da ritenersi l'esame di prima scelta nella maggior parte dei tumori della testa e del collo, perché in genere fornisce maggiori informazioni sulla reale estensione della malattia, sull'eventuale interessamento della base del cranio, sull'interessamento perineurale e sulla estensione endocranica.
- ***PET.*** Prendendo in esame solo la PET-FDG (fluorodesossiglucosio), senza cioè considerare i promettenti risultati dei nuovi marcatori, si può identificare il ruolo della PET principalmente nella ricerca di un tumore primitivo ignoto in paziente che si presenta con metastasi linfonodali del collo; oppure nell'identificazione di malattia residua o recidiva dopo trattamento primario; oppure nell'individuazione di lesioni primitive sincrone o metacrone, ovvero di metastasi a distanza, e, infine, per la stadiazione del collo (particolarmente utile, nei casi dubbi, nella discriminazione tra linfonodi interessati omolateralmente o anche controlateralmente)

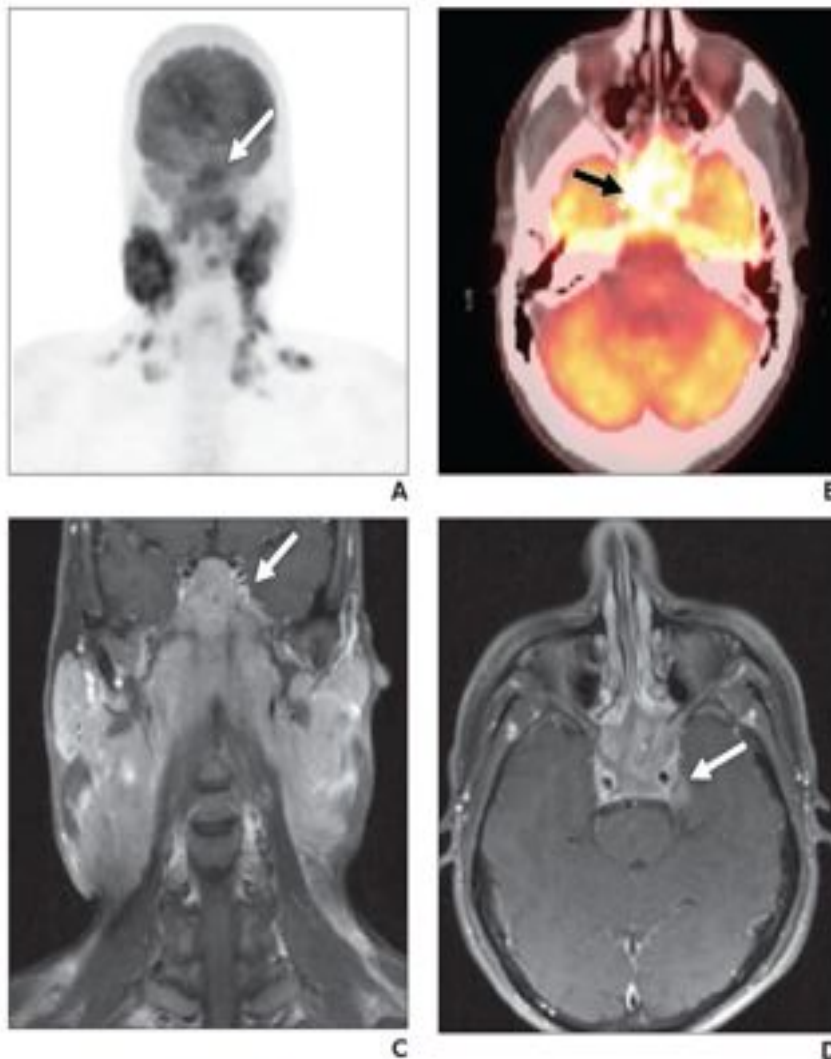


## CURRENT ROLE OF IMAGING (CT, MR, CT/PET)



Fusione TC-RM: ai fini della delineazione del target e linfadenopatie presenti

### FDG PET/CT of Nasopharyngeal Carcinoma

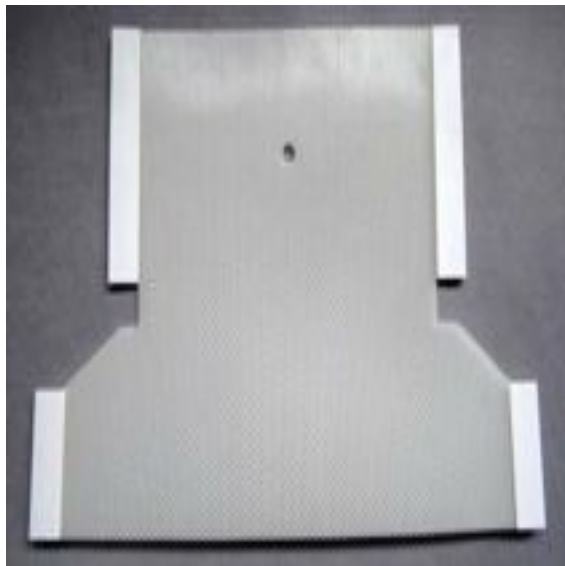


**PET** : Individuazione tumore primitivo,  
malattia recidiva/residua

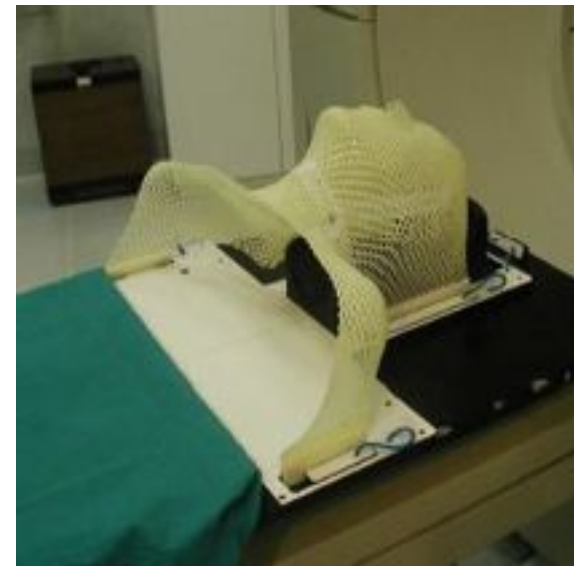
**Fig. 1**—25-year-old man who underwent staging MRI and FDG PET/CT for evaluation of recently diagnosed nasopharyngeal carcinoma (arrows). **A–D**, Anterior maximum-intensity-projection PET image (**A**), axial fused PET/CT image (**B**), and coronal (**C**) and axial (**D**) T1-weighted contrast-enhanced MR images. MR images reveal large nasopharyngeal mass with involvement of skull base and prevertebral space. Mass extends into intracranial compartment in sella turcica and cavernous sinuses. Multiple, bilateral, enlarged cervical lymph nodes are noted. FDG PET/CT image reveals large hypermetabolic nasopharyngeal mass extending into skull base and bilateral enlarged FDG-avid supraclavicular and cervical lymphadenopathy; these findings are consistent with metastatic disease.

## *SISTEMA DI IMMOBILIZZAZIONE E RIPOSIZIONAMENTO*

Per il distretto testa-collo vengono usate **maschere termoplastiche**, dotate di sistema di ancoraggio per dispositivi solidali al lettino dell'acceleratore. Tali dispositivi sono costituiti da una base rigida, di solito in plexiglass o carbonio, sui quali è presente un supporto per la testa intercambiabile, di diversa forma, adattabile alle caratteristiche anatomiche del paziente e alle esigenze del trattamento. La maschera viene scaldata in acqua ad una temperatura di circa 60-65 gradi, diventando malleabile. Successivamente viene posta su testa-collo e spalle del paziente, prendendone la forma. Freddandosi ridiventa rigida ed essendo stata ancorata alla base, garantisce la perfetta immobilità. Sulla maschera è possibile segnare direttamente sia i punti di repere dell' iso-TC che, successivamente, dell'isocentro definitivo.



**Maschera termoplastica**



**Maschera termoplastica conformata**

## *ESECUZIONE TRATTAMENTO*



Acceleratore OBI



## ...DISTRIBUZIONE DELLA DOSE



Int. J. Radiation Oncology Biol. Phys., Vol. 48, No. 2, pp. 329-337, 2000  
Copyright © 2000 Elsevier Science Inc.  
Printed in the USA. All rights reserved.  
0360-3016/00/000000-08

PII S0360-3016(00)00885-X

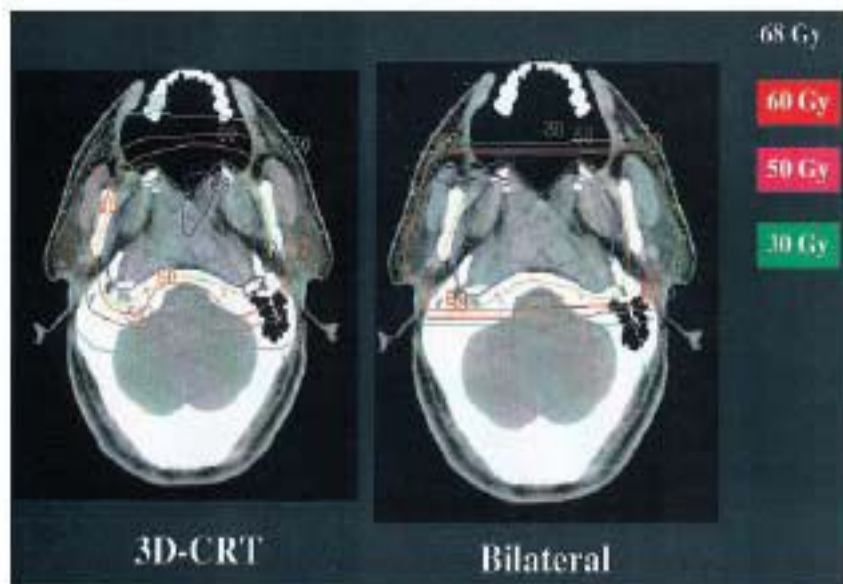
CLINICAL INVESTIGATION

Head and Neck

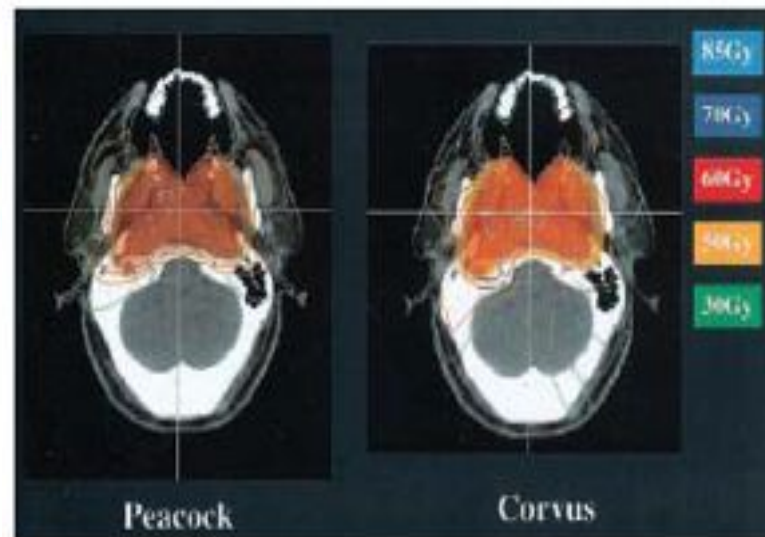
### COMPARISON OF TREATMENT PLANS INVOLVING INTENSITY-MODULATED RADIOTHERAPY FOR NASOPHARYNGEAL CARCINOMA

PING XIA, PH.D., KAREN K. FU, M.D., GORDON W. WONG, B.S., CLAYTON AKAZAWA, C.M.D., AND LYNN J. VERHEY, PH.D.

Department of Radiation Oncology, University of California at San Francisco, San Francisco, CA



(a)



(a)

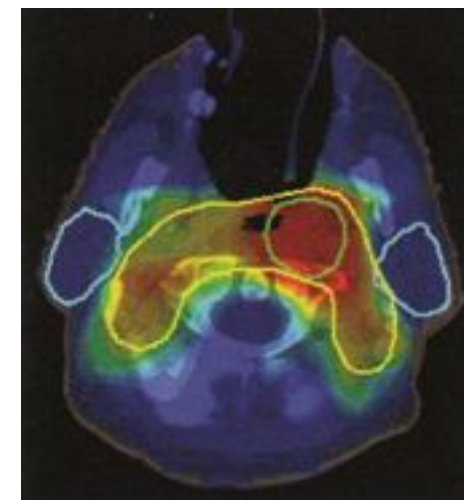
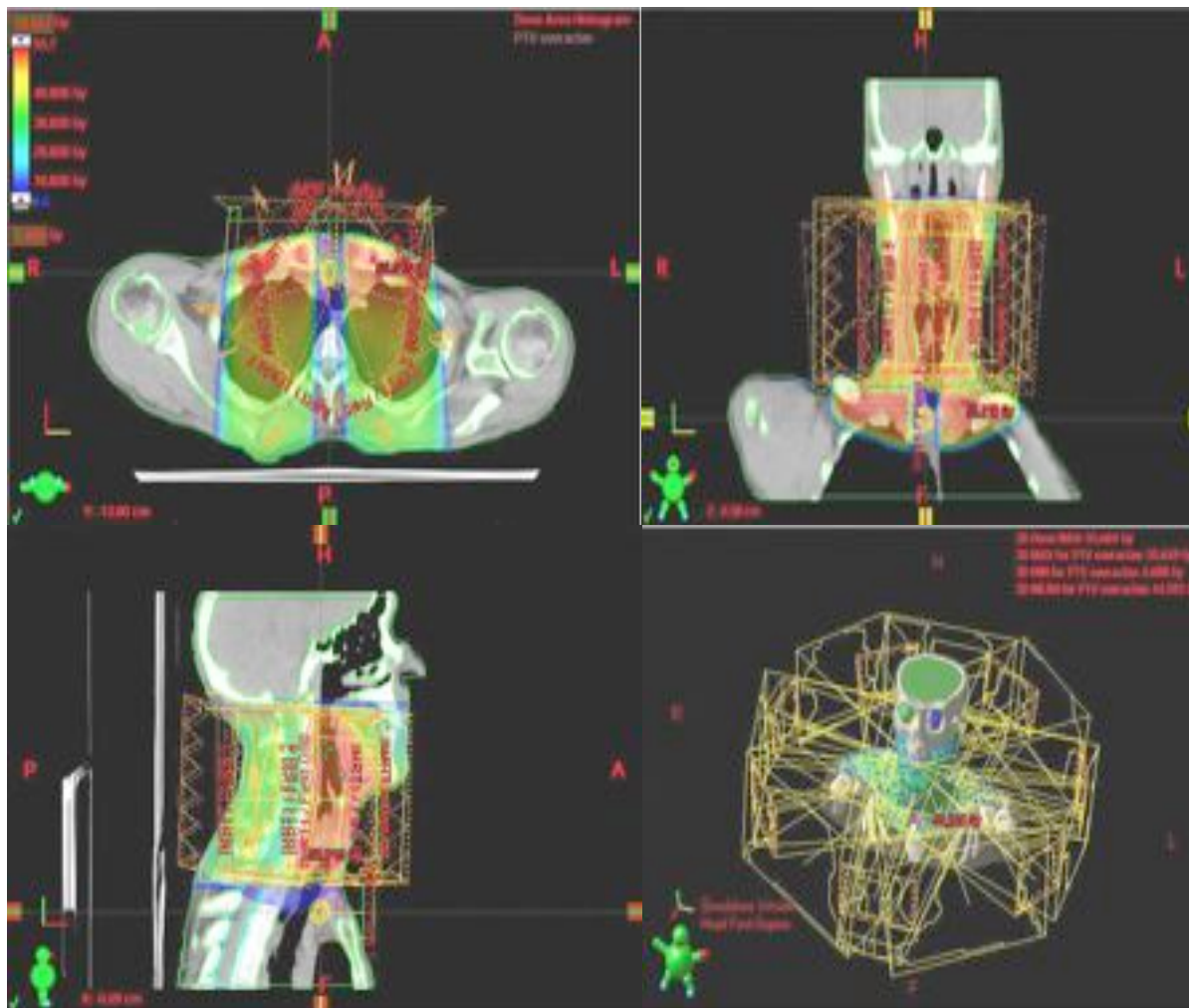
“IMRT techniques provide improved tumor target coverage with significantly better sparing of sensitive normal tissue structures in the treatment of locally advanced nasopharyngeal carcinoma”.

La tecnica ad Intensità Modulata viene eseguita con fasci multipli coplanari (generalmente 5-7 fasci) in modo da ottimizzare la distribuzione della dose al target, mantenendo entro i limiti di tolleranza la dose agli organi critici (midollo < 40Gy; 50% delle parotidi < 26Gy; cavo orale < 65Gy; mandibola < 70Gy)

Volumi irradiati 2 nei trattamenti con boost sequenziale: 50 Gy in 25 fr da 2 Gy/die + boost di 20 Gy in 10fr da 2 Gy/die.

Volumi irradiati 3 nei trattamenti con boost integrato: a partire da 72 Gy in 30 fr da 2.4 Gy/die + 60 Gy in 30 fr + 54 Gy in 30 fr, fino a 64.4 Gy in 28 fr da 2.3 Gy + 56 Gy in 28 fr + 50.4 Gy in 28 fr da 1.8 Gy.

**DOSE INDICATIVA: 64.4-72Gy a 2.3-2.4 Gy per frazione.**



*Distribuzione dose IMRT-SIB*

## ***REQUISITI PER IL PIANO DI TRATTAMENTO***

- *Sistemi di immobilizzazione: maschera a 5 punti*
- *TC-PET: dai seni frontali fino alla biforcazione tracheale*

### *DEFINIZIONI VOLUMI RINOFARINGE*

*GTV: aree macroscopiche di malattia (T ed N)*

*CTV70: GTV+5mm*

*CTV59.4*

*Rinofaringe  
Clivo, base cranica  
Fossa pterigoidea  
Spazio parafaringeo, parte inf. Seno sfenoidale  
terzo post. Cavità nasale+Seni mascellari  
LN retrofar, II, III, V alto, IB se N+  
Retrofaringei*

*CTV50.4: LN a basso rischio (IV e V basso)*

## ***DOSE MASSIMA AGLI ORGANI A RISCHIO***

### *CRITICI*

- *Tronco Encefalico, n. ottici, chiasma* 54Gy
- *Midollo spinale* 45Gy
- *Mandibola, art temp-mand* 70Gy
- *Lobi temporali* 60Gy
- *Tess. Non spec*  $\leq 110\%$  dose prescritta PTV70

### *Organi a rischio*

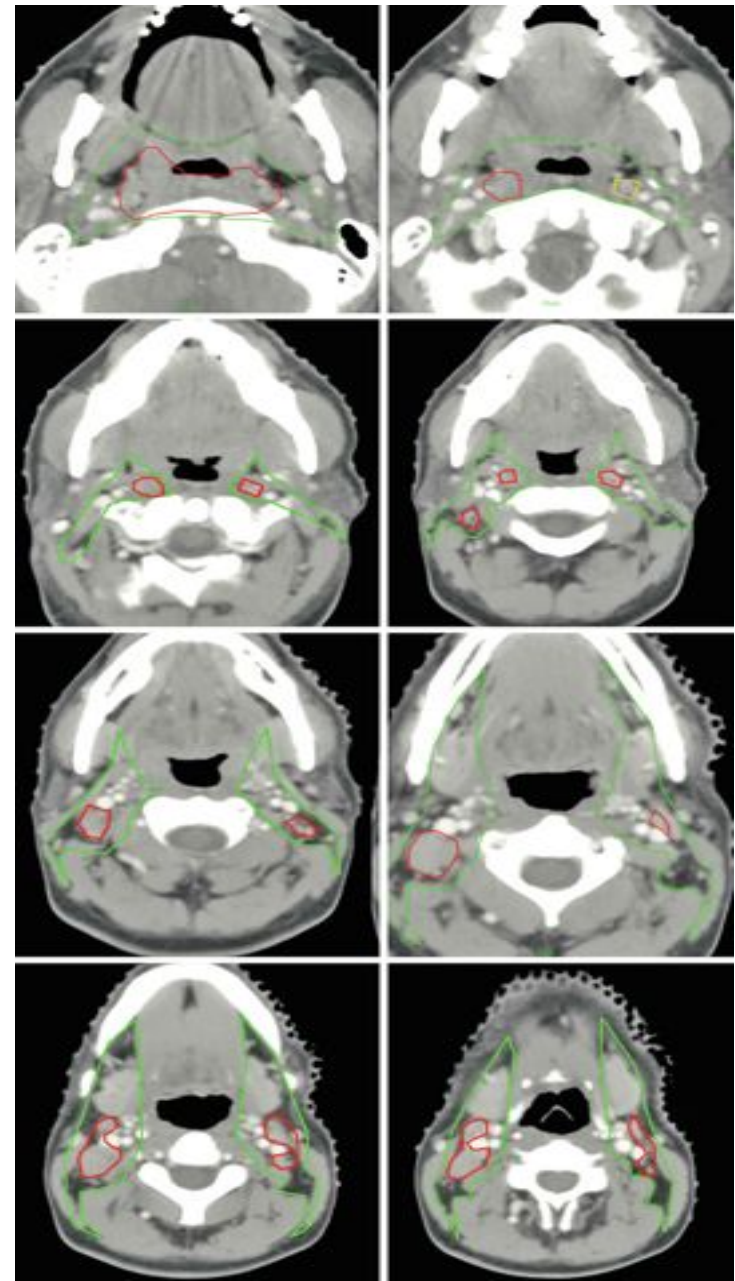
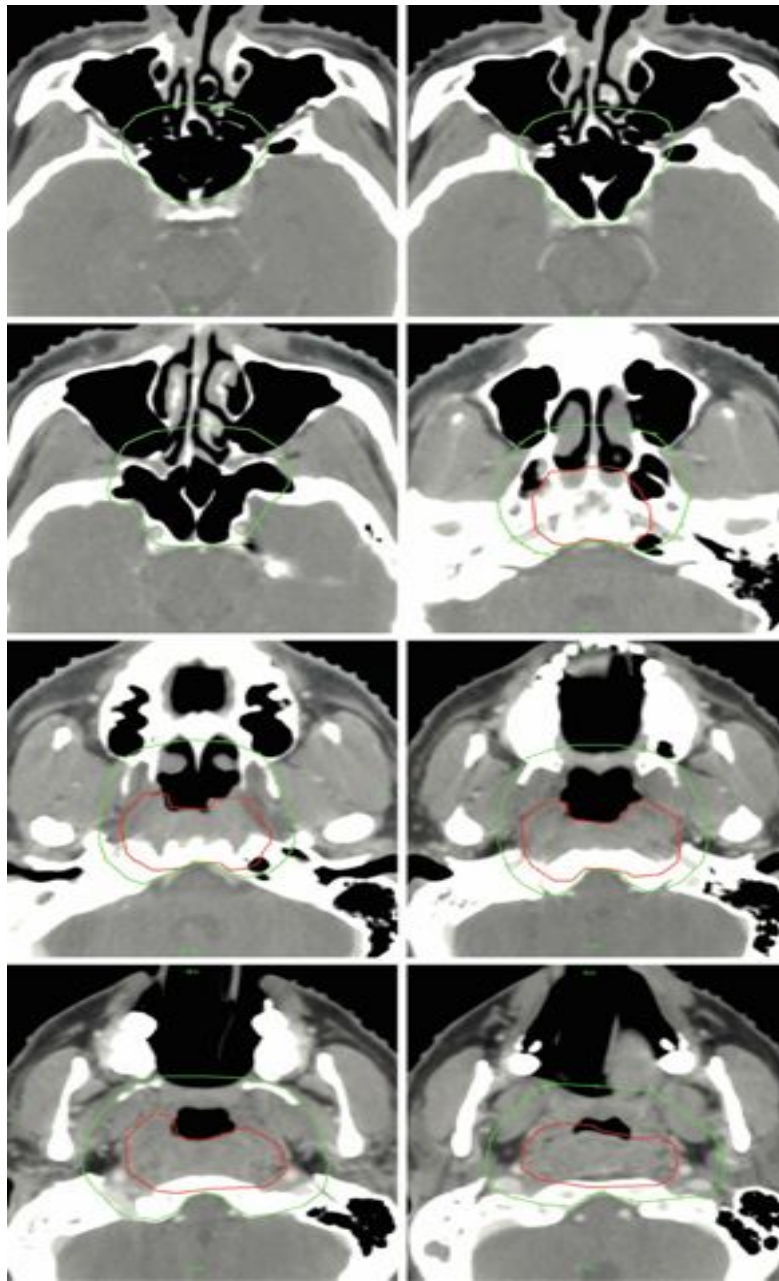
- *Orecchio int/medio* 50Gy
- *Lingua* 55Gy
- *Laringe glottico* 45Gy
- *Occhi* 35Gy

- *Gh. Parotidi*

{ *Dose Media  $\leq 26$ Gy (Vol 1 ghian) o*  
*20cc Vol tot  $< 20$ Gy o*  
*50% Vol 1 gh  $< 30$ Gy*



*T3 N2*  
*GTV*  
*PTV*



*...La nostra esperienza*

## ***OBIETTIVO***

Valutare l'efficacia del trattamento esclusivo IMRT-IGRT con intento curativo in pazienti con carcinoma del rinofaringe in stadio avanzato.

Considerazioni sull'importanza:

➤ *Dose escalation*

➤ *Sopravvivenza a lungo termine*

➤ *Tossicità*

## *MATERIALI E METODI*

- Tra Gennaio 2009 e Gennaio 2014
- 13 pz con carcinoma del rinofaringe localmente avanzato, sottoposti a radioterapia ad intensità modulata (IMRT) e guidata da immagini (IGRT)

Stadio II	3pz (23%)
Stadio III	3pz (23%)
Stadio IVA	3pz (23%)
Stadio IVB	4pz (31%)

-9 pz (69%) chemioterapia neoadiuvante e/o concomitante al trattamento radioterapico.

- 11 pz (84.6%) IMRT-SIB con 3 livelli di dose:

fra 72 Gy in 30 frazioni e 64.4 Gy in 28 sul PTV1

fra 60 Gy in 30 frazioni e 56 Gy in 28 sul PTV2

fra 54 Gy in 30 frazioni e 50.4Gy in 28 sul PTV3

-2 pz boost sequenziale con: 50Gy in 25 frazioni al PTV1 +  
sovradosaggio di 20Gy in 10 frazioni sul PTV2

Stadio clinico	Numero pz	Trattamento radioterapico	Boost	Cht
II	3	Imrt-sib	concomitante	2 pz concom. 1 pz no
III	3	1 pz imrt 2 pz imrt-sib	1 sequenziale 2 concomitante	1 cht concom. 1 pz conc. 1 pz no
IVA	3	1 pz imrt 2 pz imrt-sib	1 sequenziale 2 concomitante	1 cht conc. 2 cht conc.
IVB	4	Imrt-sib	concomitante	1 no cht conc. 3cht conc.

## ***RISULTATI***

### **Mediana di follow-up 30 mesi (range 5-65 mesi)**

- Recidiva locale 2 pz (15.4%)
- Metastasi a distanza 2 pz (15.4%) .
- Dose escalation al di sopra dei 64.4 Gy miglior controllo locale di malattia.
- Tossicità acuta:
  - mucosite di grado 1 o 2 in 5 pz (38.5%) e di grado 3 in 1 pz (8%)
  - disfagia di grado 1 o 2 in 8 pz (62.5%).
  - xerostomia di grado 1 o 2 in 10 pz (77%)
  - perdita di peso >10% in 3 pz (23%) (SNG)
  - tossicità ematologica di grado 2-3 in 2 pz (15.4%) (cht concomitante)
- Tossicità tardiva: xerostomia in 5 pz (38.5%) (persistente a 12 mesi dalla fine della RT).

Stadio clinico	Numero pz	Recidiva locoregionale	Mts a distanza	Insuccesso trattamento
II	3	1	0	1
III	3	0	1	1
IVA	3	0	1	1
IVB	4	1	0	1

Tossicità	G1	G2	G3	G4
Cutanea	2	8	3	0
Xerostomia	2	6	2	0
Disfagia	4	4	0	0
Mucosite	3	2	1	0
G.I. (Perdita di peso)	0	1	2	0
Ematologica	0	1	2	0

## *CONCLUSIONI*

- Alto tasso di controllo locale
- Tecnica IMRT-IGRT con dose escalation permette:
  1. migliore copertura del target
  2. notevole riduzione della tossicità sia acuta che tardiva
- Limiti:
  1. comparsa di metastasi a distanza
  2. ridotto campione di pazienti



Associazione  
Italiana  
Radioterapia  
Oncologica

*...Grazie*

*...Grazie*

Presidente AIRO  
*Riccardo Maurizi Enrici*  
Presidente del Congresso  
*Giovanni Mandoliti*  
Presidente Onorario  
*Guido Sotti*  
Coordinatore Comitato Organizzatore  
*Giovanni Pavanato*

XXIV CONGRESSO NAZIONALE  
**AIRO 2014**

Padova, 8-11 novembre