

Cyberknife stereotactic reirradiation of recurrent head and neck squamous cell carcinoma



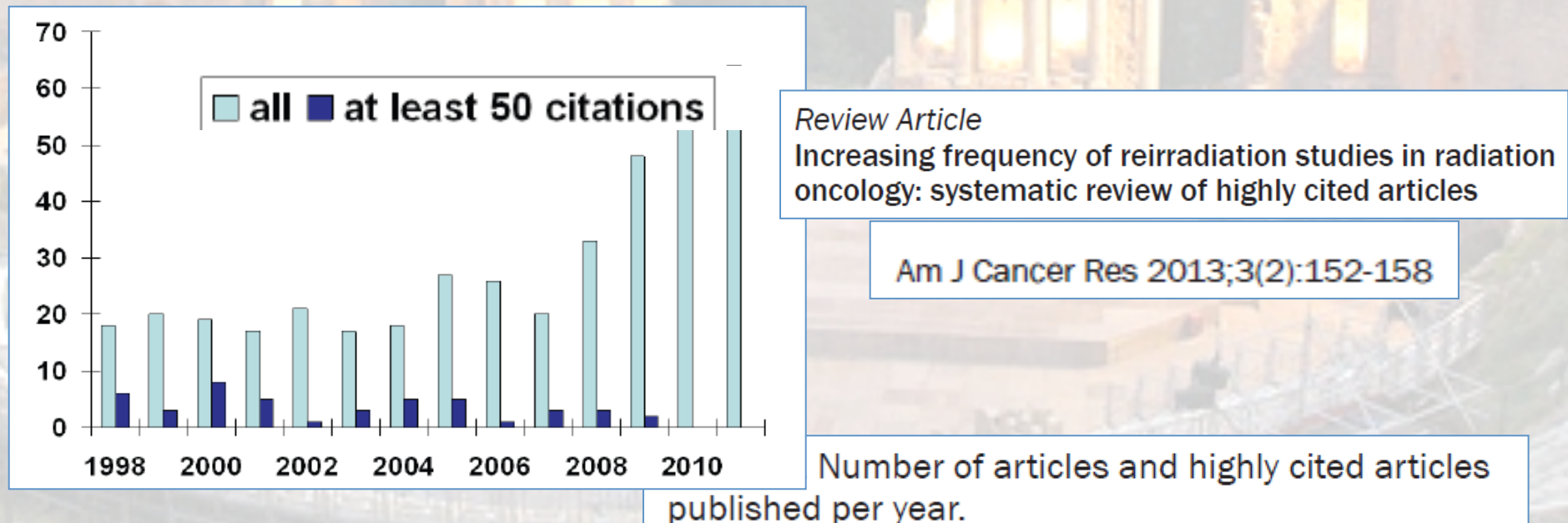
RITRATTAMENTO STEREOTASSICO CON CYBERKNIFE DELLA RECIDIVA LOCALE DI CARCINOMA SQUAMOCELLULARE DEL DISTRETTO TESTA COLLO: esperienza preliminare

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✓ *Despite aggressive treatment modalities, local recurrence or persistent disease is seen at rate as high as 3-50%. (Roh KW, IJROBP, 2009).*

✓ *In current practice, most patients are offered chemotherapy with palliative intent, with a median survival of 5 to 6 months (Vermorken JB, 2008-Kurzweg T, 2012)*

✓ *Surgery improves prognosis, although is not feasible in the majority of cases (Temam S, H&N, 2005)*



PATIENTS and METHODS

Characteristic		Value (%)
Age	Median	64
	Range	45-84
Sex	Male	16 (80%)
	Female	4 (20%)
Primary site	Paranasal sinus	7 (35%)
	Oropharynx	6 (30%)
	Salivary gland	2 (10%)
	Larynx	2 (10%)
	Other sites	3 (15%)
PS (ECOG)	0	7 (35%)
	1	10 (50%)
	2	3 (15%)

Characteristic**Value (%)****Prior surgery**

Yes

12 (60%)

No

8 (40%)

Prior chemotherapy

Yes

5 (25%)

No

15 (75%)

Prior radiotherapy

Dose (Gy)

Median

66

Range

50-70

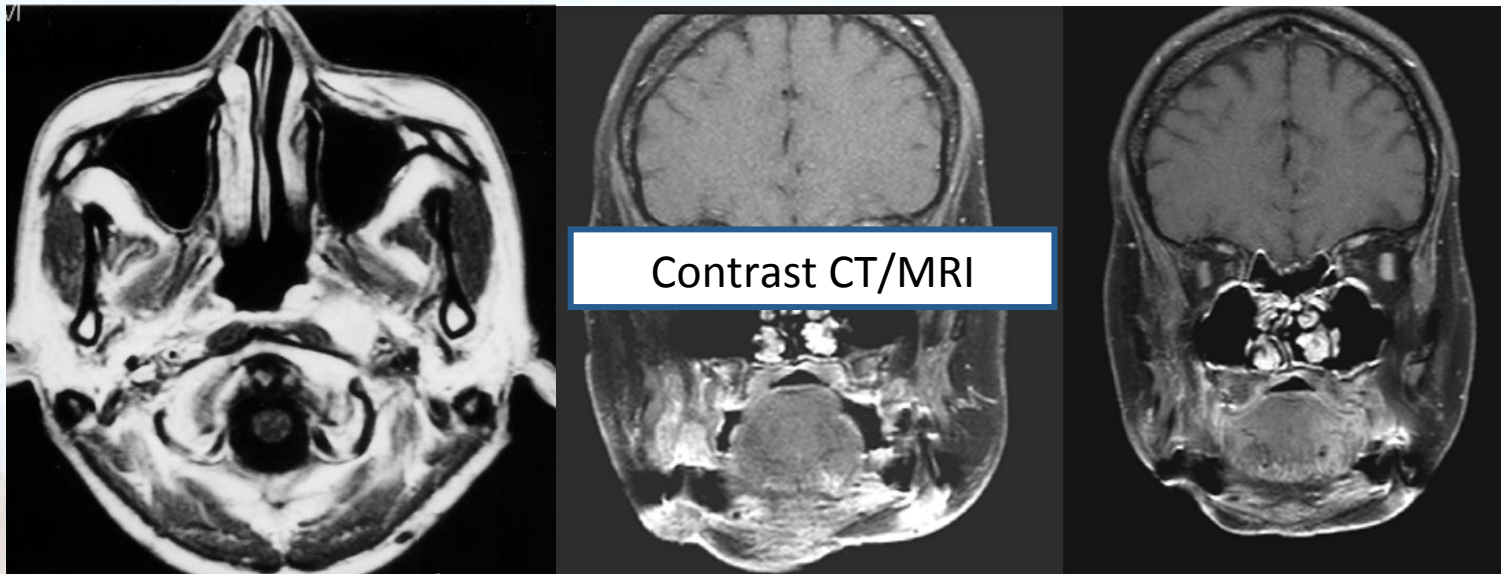
Interval (mo)

Median

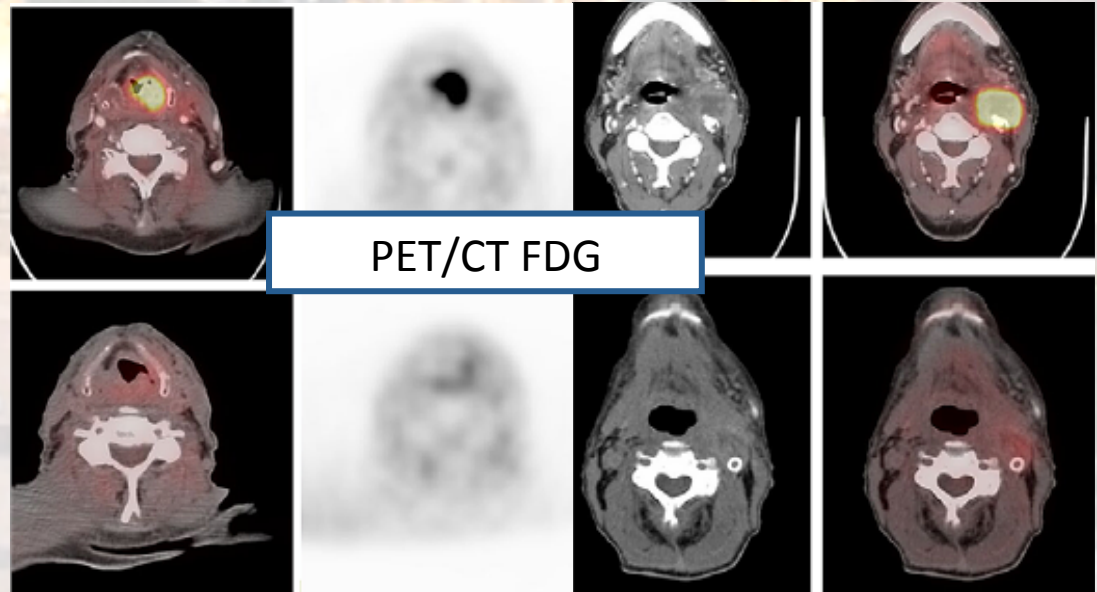
24

Range

12-168



Dgn of clinically
evidence
recurrence of
disease



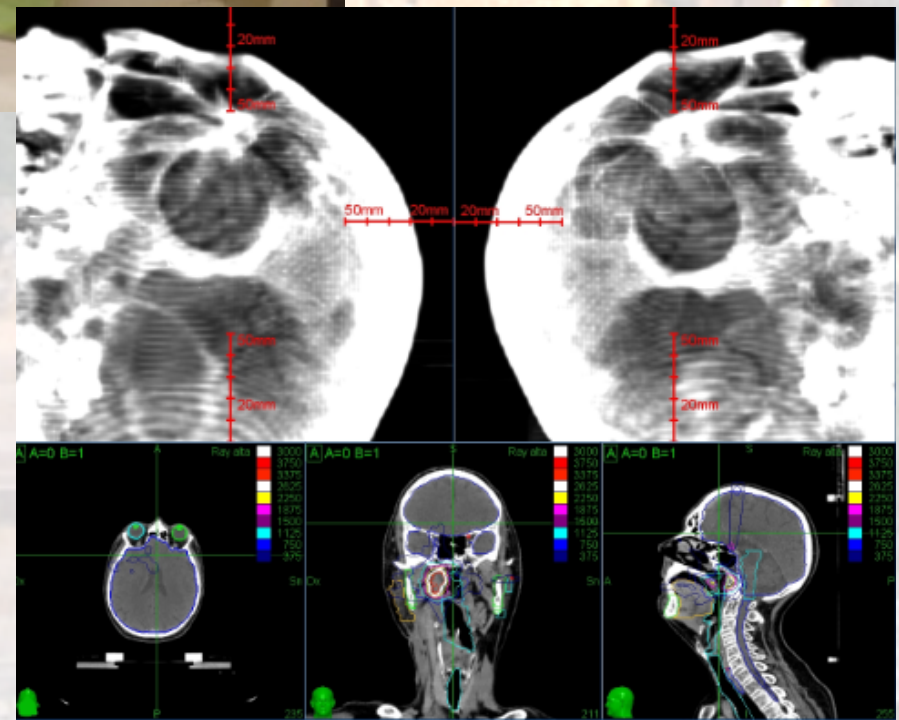
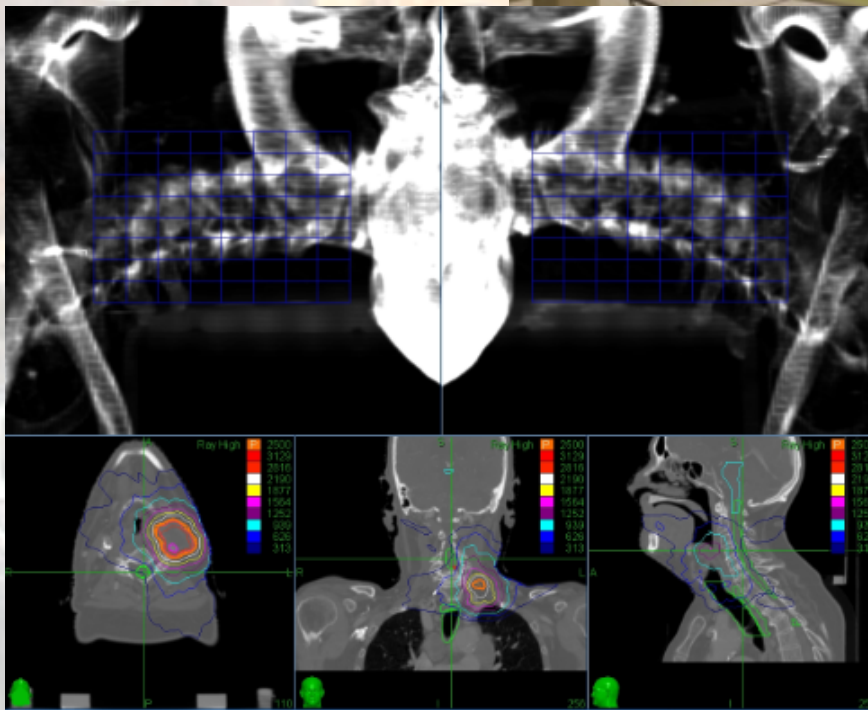
SBRT modality	n	%
Cyberknife	20	100%
Total dose (Gy)		
25	5	25%
30	11	55%
35	4	20%
N°of fractions		
5	20	100%
Isodose (%)		
80	20	100%

**GTV 39.3 cc
(5-211cc)**

PTV GTV+1mm

Median time to retreatment 24 months (range 12-168 months)

Planning CT 1.25 mm



VOI Skin Spine Tracking Volume Ball-cube

Properties

VOI Opacity

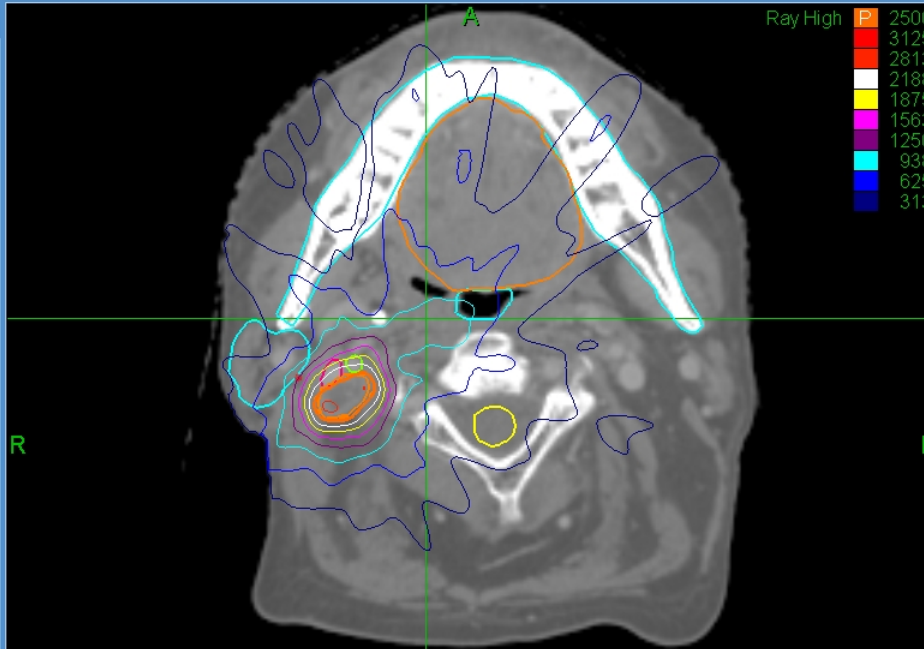
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Display VOI as overlay

Layouts

Layout selection buttons: A, C, S, 3D, C, A, C, S

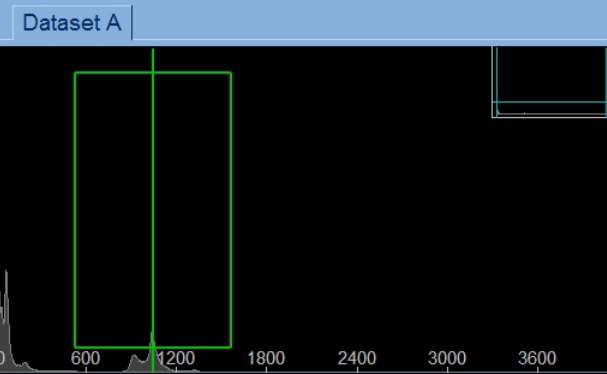
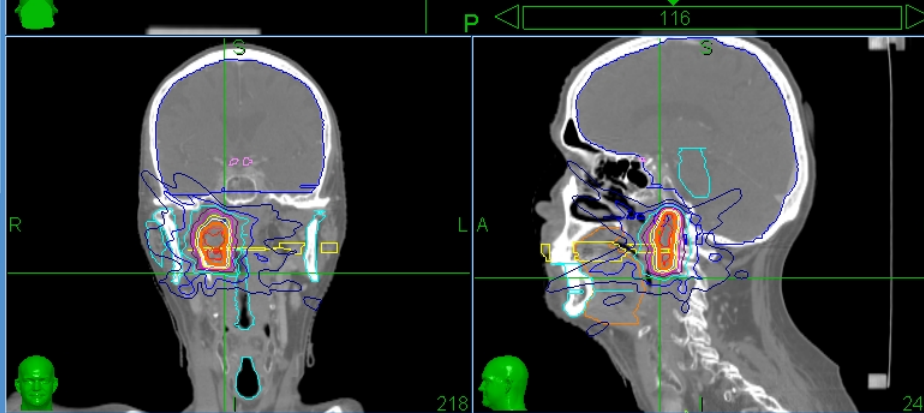
Plan
 25Gyal80_Def
 2012-12-27 14:20:15
 Rx
 80%, 2500.00 cGy



VOI Summary						
#	Pri...	S...	Name	Type	Color	Volume (m...
1	<input checked="" type="checkbox"/>		PTV	Target	Orange	11341.29
2	<input checked="" type="checkbox"/>		GTV retrofaringe	Target	Red	6592.12
3	<input checked="" type="checkbox"/>		R cochlea	Critical	Green	143.22
4	<input checked="" type="checkbox"/>		Eyes	Critical	Cyan	17838.55
5	<input checked="" type="checkbox"/>		Brain	Critical	Blue	1575952.11
6	<input checked="" type="checkbox"/>		Optic Chiasm	Critical	Pink	1462.60
7	<input checked="" type="checkbox"/>		Brain Stem	Critical	Cyan	31424.00
8	<input checked="" type="checkbox"/>		spinal cord	Critical	Yellow	22942.46
9	<input checked="" type="checkbox"/>		R giugular vein	Critical	Magenta	16953.60
10	<input checked="" type="checkbox"/>		oral cavity	Critical	Orange	110150.94
11	<input checked="" type="checkbox"/>		TM J	Critical	Cyan	93636.51
12	<input checked="" type="checkbox"/>		artefatti	Critical	Yellow	80285.34
13	<input checked="" type="checkbox"/>		GTV LC dx	Target	Orange	1330.75
14	<input checked="" type="checkbox"/>		R carotid a	Critical	Light Green	5161.77
15	<input checked="" type="checkbox"/>		R parotid gland	Critical	Cyan	20642.33
16	<input checked="" type="checkbox"/>		airway	Critical	Cyan	27578.76
17	<input type="checkbox"/>		Skin	Critical	Dark Green	9004056.92
18	<input checked="" type="checkbox"/>		optic nerves	Critical	Light Blue	1721.54
19	<input type="checkbox"/>		VolRilColonna	Critical	Magenta	1345745.93
20	<input checked="" type="checkbox"/>		lens	Critical	Light Green	500.81
21	<input type="checkbox"/>		blocchi	Critical	Magenta	1097649.97

Conformity Index
 Range: 1.02-1.16

Move Up Move Down Move to Top Move to Bottom



Vertical toolbar with navigation and tool icons: Home, Hand, Rotate, Zoom, etc.

- Show Isocenters
- Show Beam on 3D

Show 3D VOIs

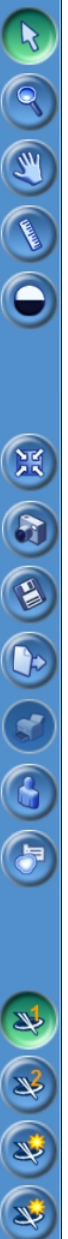
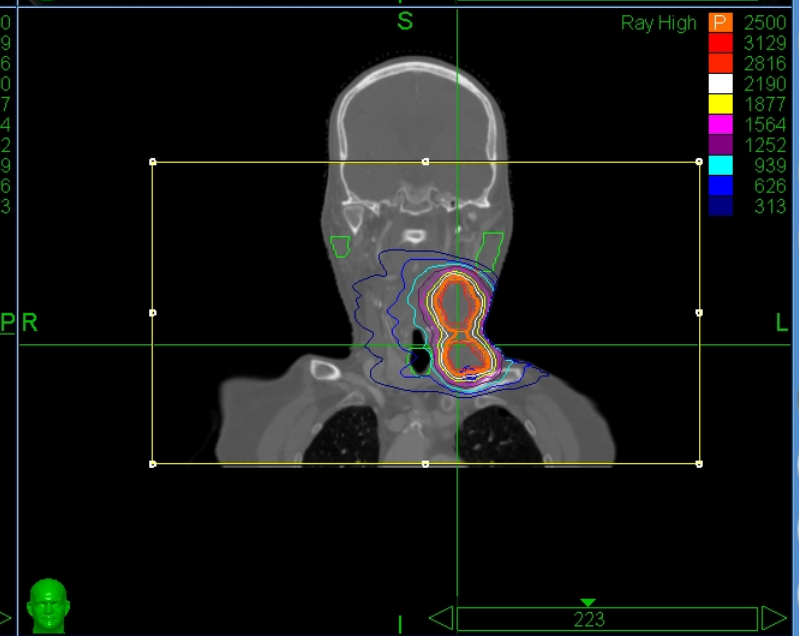
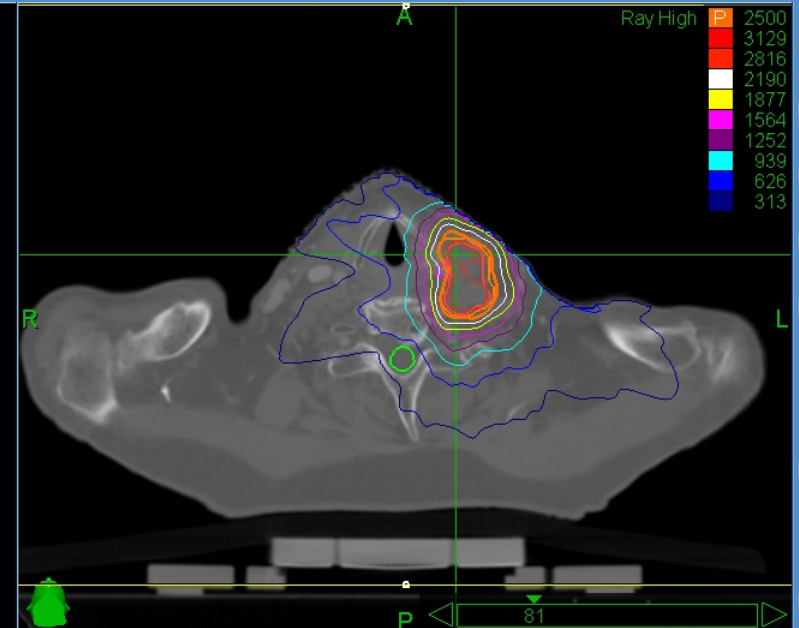
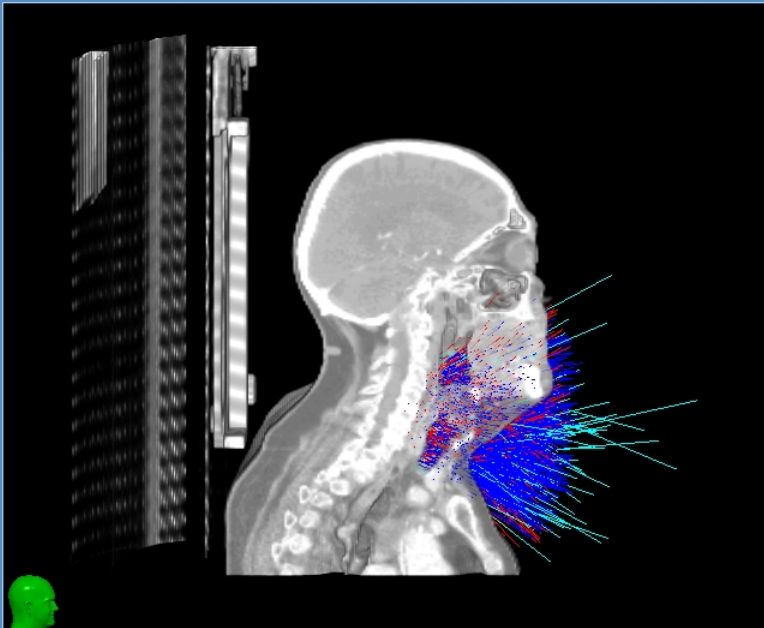
- | Show | VOI |
|--------------------------|----------------|
| <input type="checkbox"/> | PTV |
| <input type="checkbox"/> | GTV |
| <input type="checkbox"/> | Left Eye |
| <input type="checkbox"/> | Right Eye |
| <input type="checkbox"/> | Skin |
| <input type="checkbox"/> | carotid artery |
| <input type="checkbox"/> | Brain Stem |
| <input type="checkbox"/> | midollo |
| <input type="checkbox"/> | parotide sx |
| <input type="checkbox"/> | parotide dx |
| <input type="checkbox"/> | OAR |
| <input type="checkbox"/> | blocchi |
| <input type="checkbox"/> | VolRilColonna |
| <input type="checkbox"/> | esofago |
| <input type="checkbox"/> | trachea |
| <input type="checkbox"/> | cristallino sx |
| <input type="checkbox"/> | cristallino dx |

Layouts

3D	DVH	3D	DVH
A	Dose	S	Dose
3D	DVH	3D	A
C	Dose	S	C

Standard Display

Plan
 25Gyal80_Def
 2013-01-16 12:29:26
 Rx
 80%, 2500.00 cGy



Medical Physics, Vol. 37, No. 8, August 2010

Serial tissue	Max critical volume above threshold	Five fractions		End point (\geq Grade3)
		Threshold dose (Gy)	Max point dose (Gy) ^a	
Optic pathway	<0.2 cc	23 (4.6 Gy/5fx)	25 (5 Gy/5fx)	Neuritis Hearing loss
Cochlea			25 (5 Gy/5fx)	loss
Brainstem (not medulla)	<0.5 cc	23 (4.6 Gy/5fx)	31 (6.2 Gy/5fx)	Cranial neuropathy
Spinal cord and medulla	<0.35 cc	23 (4.6 Gy/5fx)	30 (6 Gy/5fx)	Myelitis
Spinal cord subvolume (5-6 mm above and below level treated per Ryu)	<1.2 cc	14.5 (2.9 Gy/5fx)		
	< 10% of subvolume	23 (4.6 Gy/5fx)	30 (6 Gy/5fx)	Myelitis
Cauda equina	≤ 5 cc	30 (6 Gy/5fx)	32 (6.4 Gy/5fx)	Neuritis
Sacral plexus	≤ 5 cc	30 (6 Gy/5fx)	32 (6.4 Gy/5fx)	Neuropathy
Esophagus ^b	≤ 5 cc	19.5 (3.9 Gy/5fx)	35 (7 Gy/5fx)	Stenosis/fistula
Brachial plexus	≤ 5 cc	27 (5.4 Gy/5fx)	30.5 (6.1 Gy/5fx)	Neuropathy
Heart/pericardium	< 15 cc	32 (6.4 Gy/5fx)	38 (7.6 Gy/5fx)	Pericarditis
Great vessels	<10 cc	47 (9.4 Gy/5fx)	53 (10.6 Gy/5fx)	Aneurysm
Trachea and large bronchus ^b	≤ 4 cc			

OAR	Dmax Gy
Spinal Cord	$\leq 8-10$
Larynx	≤ 20
Mandible	≤ 20
Parotid	Variable
Brainstem	$\leq 8-10$
Oral Cavity	Variable
Carotid artery	Variable

- 1) No relation between the carotid wall and tumor;
- 2) $<180^\circ$ of the wall surrounded by the tumor;
- 3) $\geq 180^\circ$ of the wall surrounded by the tumor;
- 4) carotid wall entrapped in the tumor.

Int. J. Radiation Oncology Biol. Phys., Vol. 81, No. 1, pp. 104–109, 2011

MUSTAFA CENGIZ, M.D.

Int. J. Radiation Oncology Biol. Phys., Vol. 82, No. 3, pp. 1083–1089, 2012

MARK W. McDONALD, M.D.,



Median Dmax: 25.5 Gy
Range (11-29 Gy)

Dose Statistics Table							
VOI	Min (cGy)	Mean (cGy)	Max (cGy)	CI	nCI	HI	Coverage
PTV	1806.10	2692.97	3125.00	1.04	1.12	1.25	93.42%
GTV	1936.61	2722.61	3125.00	1.18	1.20	1.25	98.35%
Bloccospalle	7.10	8.90	50.02	n/a	n/a	n/a	n/a
carotide	10.49	1044.73	2671.19	n/a	n/a	n/a	n/a
volricolo	10.35	306.23	3125.00	n/a	n/a	n/a	n/a
Brain Stem	11.44	33.31	257.21	n/a	n/a	n/a	n/a
midollo	15.12	187.41	459.92	n/a	n/a	n/a	n/a
esofago	11.30	16.58	64.76	n/a	n/a	n/a	n/a
occhio sx	11.30	56.82	319.01	n/a	n/a	n/a	n/a
crystallino dx	12.68	18.44	52.98	n/a	n/a	n/a	n/a
crystallino sx	12.35	13.84	16.31	n/a	n/a	n/a	n/a
parotide sx	15.69	171.74	543.22	n/a	n/a	n/a	n/a
parotide dx	12.54	19.28	150.97	n/a	n/a	n/a	n/a

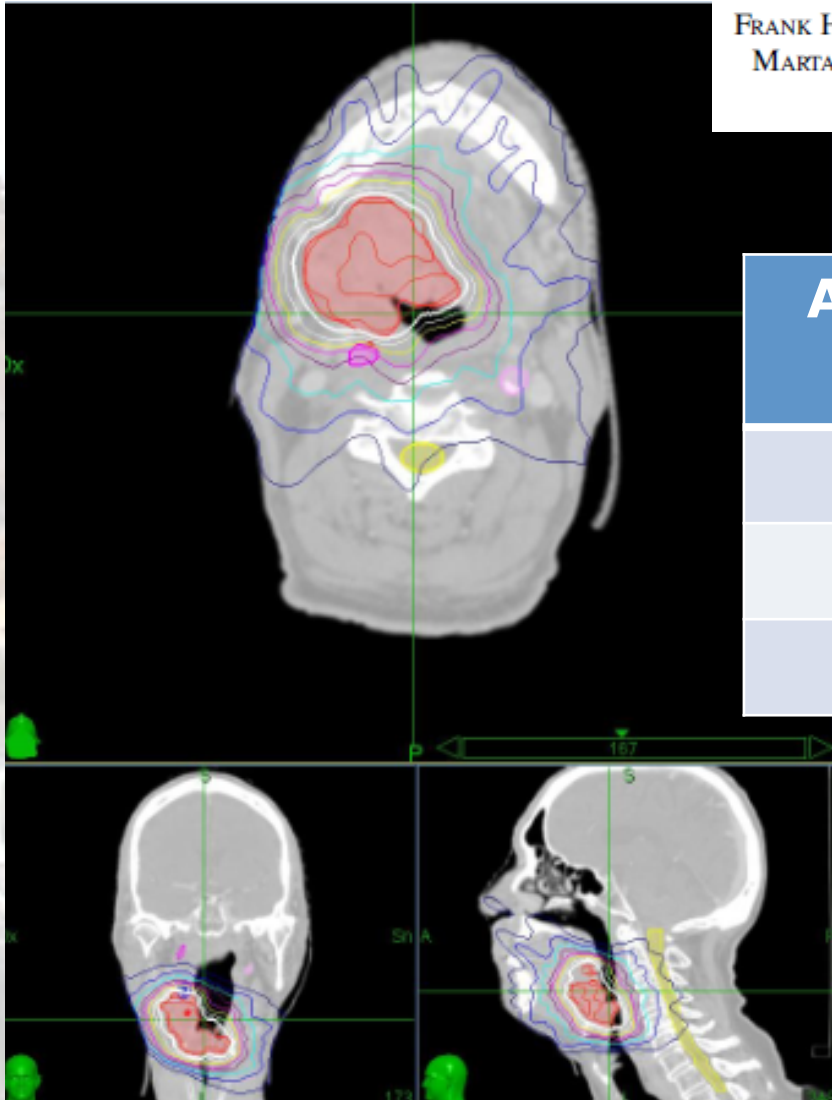
RESULTS

CLINICAL INVESTIGATION

Head and Neck

REIRRADIATION FOR HEAD-AND-NECK CANCER: DELICATE BALANCE BETWEEN EFFECTIVENESS AND TOXICITY

FRANK HOEBERS, M.D., PH.D.,*# WILMA HEEMSBERGEN, PH.D.,*† SUZANNE MOOR, R.T.T.,*
MARTA LOPEZ, PH.D.,† MARTIN KLOP, M.D., PH.D.,‡ MARGOT TESSELAAR, M.D., PH.D.,§
AND COEN RASCH, M.D., PH.D.*



Acute Toxicity Mucositis	N°(%)
G1	7 (44%)
G2	2 (10%)
G3	1 (5%)

RESULTS



**New response evaluation criteria in solid tumours:
Revised RECIST guideline (version 1.1)**

From RECIST to PERCIST: Evolving Considerations for PET Response Criteria in Solid Tumors

Richard L. Wahl^{1,2}, Heather Jacene¹, Yvette Kasamon², and Martin A. Lodge¹

Response	
CR	No visible gross tumor
PR	$\geq 30\%$ decrease
SD	Neither sufficient shrinkage for PR nor sufficient increase for PD
PD	As more than 20% increase of GTV

RESULTS

- ✓ 17/20 patients were evaluable at the moment of the analysis
 - ✓ All completed treatment
- ✓ Median follow-up 7.5 months (range 2-17 months)
 - ✓ PFS 7 months (range 2- 17 months)

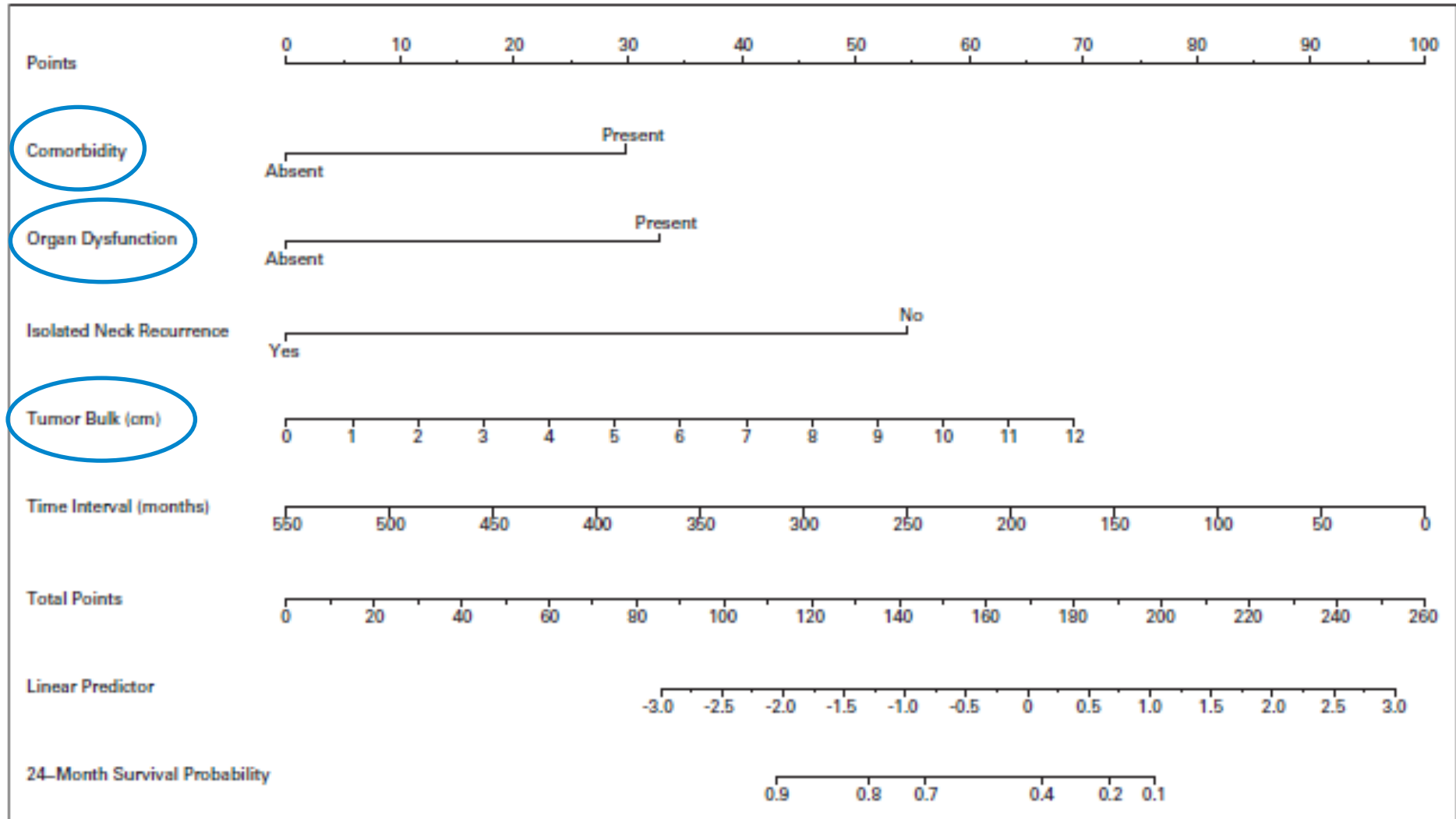
Response	N°	%
CR	4	25
PR	5	31
SD	7	44
ORR (CR+PR)	9	56

✓ 4 have died

RESULTS

Prognostic Factors for Survival After Salvage Reirradiation of Head and Neck Cancer

Tawee Tanvetyanon, Tapan Padhya, Judith McCaffrey, Weiwei Zhu, David Boulware, Ronald DeConti, and Andrea Trotti



RESULTS

CRITICAL REVIEW

PRACTICAL CONSIDERATIONS IN THE RE-IRRADIATION OF RECURRENT AND SECOND PRIMARY HEAD-AND-NECK CANCER: WHO, WHY, HOW, AND HOW MUCH?

Int. J. Radiation Oncology Biol. Phys., Vol. 81, No. 5, pp. 1211–1219, 2011

Table 5. Suggested Factors to be considered with respect to risk of toxicity for re-irradiation to head and neck

Variable	Lower risk	Intermediate risk	Higher risk
Interval from previous RT	>3 y	1 y to 3 y	<1 y
KPS	90–100	70–80	<70
Tumor volume	<30 cm ³	30–60 cm ³	>60 cm ³
GT dependence	No	Somewhat	Entirely
Previous RT dose (Gy)	<50	50–60	>60

PRACTICAL CONSIDERATIONS IN THE RE-IRRADIATION OF RECURRENT AND SECOND PRIMARY HEAD-AND-NECK CANCER: WHO, WHY, HOW, AND HOW MUCH? *IJROBP,2011*

Stereotactic body radiation therapy for locally recurrent, previously irradiated nonsquamous cell cancers of the head and neck *Head Neck,2012*

Variable	Lower Risk	Intermediate Risk	Higher Risk
Interval from previous RT	>3y	1y to 3 y	<1y
	12 (60%)	8 (40%)	0 (0%)
KPS	90-100	70-80	<70
	9 (45%)	9 (45%)	2 (10%)
Tumor volume			
ALLEN M. CHEN	<30 cc	30-60 cc	>60cc
	9 (45%)	8 (40%)	3 (15%)
John A. Vargo	<25 cc		>25cc
	9 (45%)		11 (55%)
GT dependence	No	Somewhat	Entirely
	20(100%)	0%	0%
Previous RT	<50 Gy	50-60 Gy	>60Gy
		8 (40%)	12 (60%)

CONCLUSION

- ✓ ROBOTIC STEREOTACTIC RE-IRRADIATION IS FEASIBLE AND SAFE
 - ✓ OVERALL RESPONSE RATE IS 56%
- ✓ NO LATE SIDE EFFECTS \geq G3 WERE OBSERVED DURING FOLLOW-UP
- ✓ ONLY NON-SURGICAL TREATMENT WITH POTENTIAL SALVAGE INTENT IN SELECTED PATIENTS



*Thanks for your
attention!!!*