



XXIV Congresso da
Sociedade Brasileira de
RADIOTERAPIA

17 A 20 DE AGOSTO | **2022** | FLORIANÓPOLIS/SC

Encontro de Dosimetristas

Reirradiação com SBRT em região de CP

*Eder Babygton Alves
Hospital Erasto Gaertner
Radion
Curitiba PR*



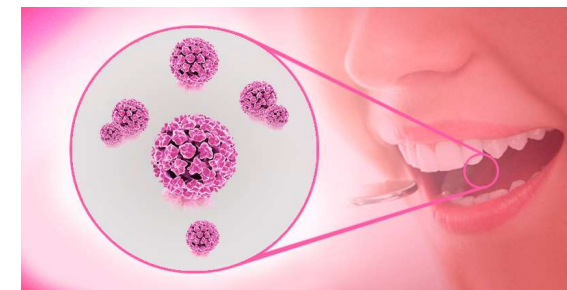
Declaração de Conflitos de Interesse

De acordo com RDC 96/2008 ANVISA

- Nenhum conflito de interesses

Introdução

- Tumores de cabeça de pescoço
- Nasofaringe / orofaringe / cavidade oral / laringe
- Tabagismo / etilismo
- HPV – orofaringe
- EBV – Ásia - nasofaringe



Introdução

- Tratamento
 - Cirurgia exclusiva
 - Cirurgia seguida de adjuvancia
 - Químio e radioterapia



Introdução

- ~50% falha locorregional
- ~15% terão segundo primário de CP
- Ressecção cirúrgica é a melhor opção de resgate
 - mOS = 1,3 anos
 - 5y OS = 23%
 - 9% desenvolvem MTX

Bachar GY, Goh C, Goldstein DP, O'Sullivan B, Irish JC. Long-term outcome analysis after surgical salvage for recurrent tonsil carcinoma following radical radiotherapy. Eur Arch Otorhinolaryngol 2010;267(2):295–301.

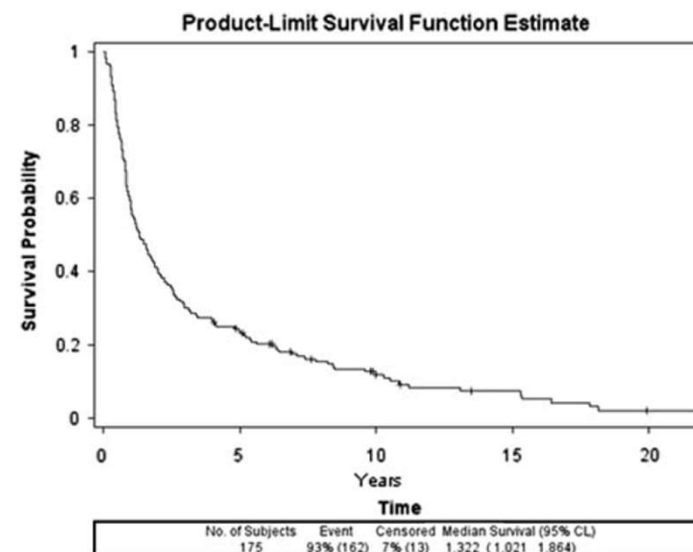


Fig. 1 Overall survival following salvage surgery

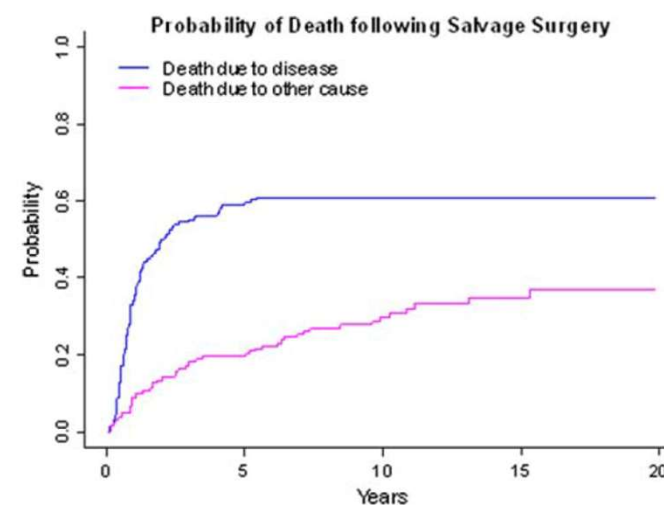


Fig. 2 Probability of death following salvage surgery

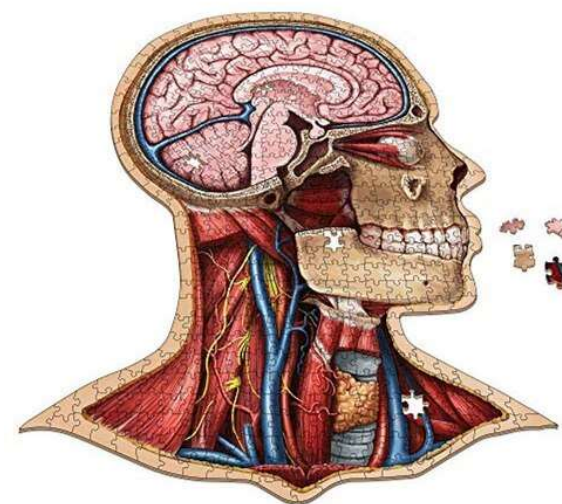


Resposta completa

Recidivou

Introdução

- Anatomia difícil
- Tumores irresssecáveis
- Pacientes inoperáveis
- Quimioterapia paliativa
- Radioterapia paliativa

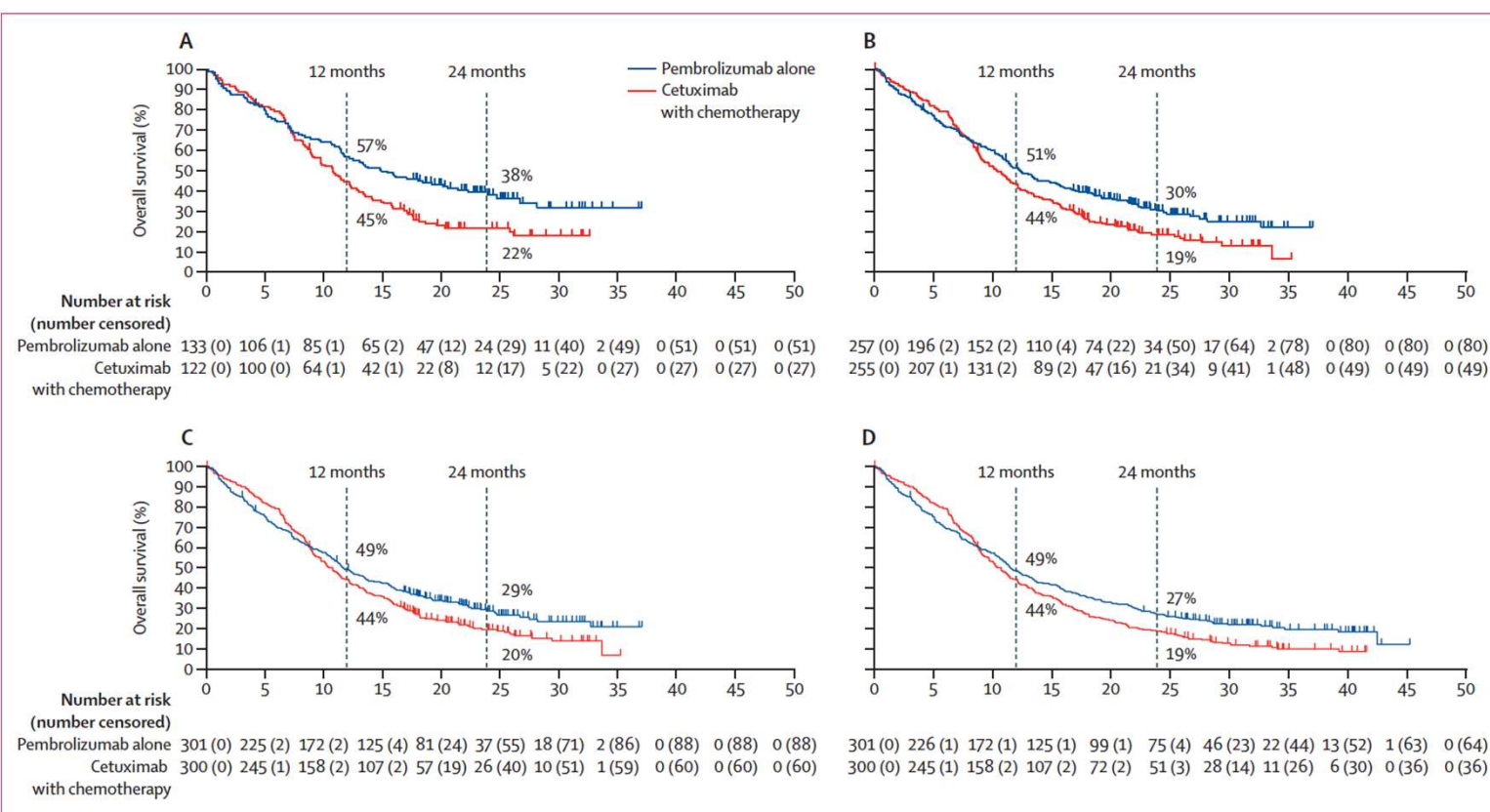


Papel da quimioterapia

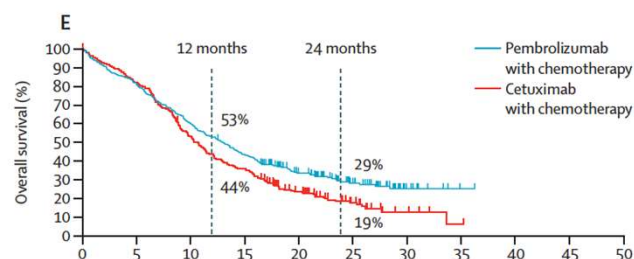
- Keynote – 048
 - Plattina + 5FU Vs Platina + 5FU + Pembro
 - Ganho de mOS = 10,7 x 13 meses (P=0,0034)
- PDL1 negativo
 - Não se faz Pembro mOS = 10,7 meses
- Já fez platina nos últimos 6 meses e não pode fazer Pembro
 - Taxano, MTX, Cetuximab

Brasileiro, baixa renda, condição social ruim, apoio familiar IRC, comorbidades, PS ruim

Pembrolizumab alone or with chemotherapy versus cetuximab with chemotherapy for recurrent or metastatic squamous cell carcinoma of the head and neck (KEYNOTE-048): a randomised, open-label, phase 3 study

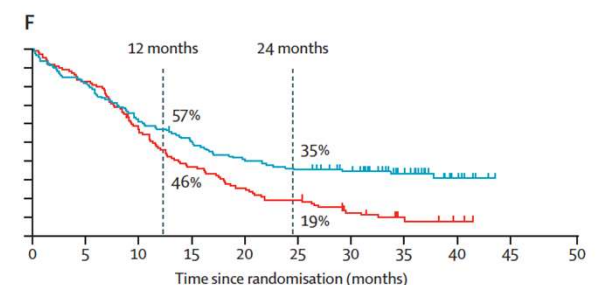


Pembrolizumab alone or with chemotherapy versus cetuximab with chemotherapy for recurrent or metastatic squamous cell carcinoma of the head and neck (KEYNOTE-048): a randomised, open-label, phase 3 study

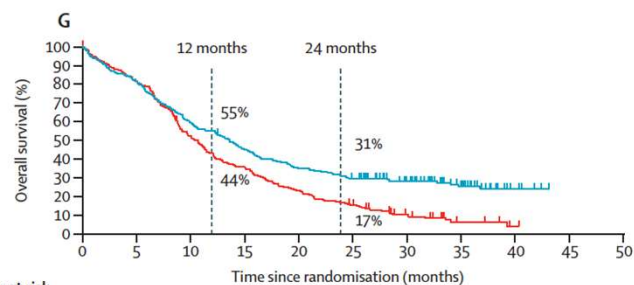


Number at risk
(number censored)

Pembrolizumab with chemotherapy	281 (0)	227 (0)	169 (0)	122 (1)	75 (22)	40 (47)	10 (74)	1 (83)	0 (84)	0 (84)	0 (84)
Cetuximab with chemotherapy	278 (0)	227 (1)	147 (2)	100 (2)	51 (19)	20 (40)	5 (51)	1 (54)	0 (55)	0 (55)	0 (55)



Pembrolizumab with chemotherapy	126 (0)	102 (0)	77 (0)	60 (1)	50 (1)	44 (1)	36 (8)	21 (22)	4 (38)	0 (42)	0 (42)
Cetuximab with chemotherapy	110 (0)	91 (0)	60 (1)	40 (1)	26 (1)	19 (2)	11 (4)	4 (8)	1 (11)	0 (12)	0 (12)



Number at risk
(number censored)

Pembrolizumab with chemotherapy	242 (0)	197 (0)	144 (0)	109 (1)	84 (1)	70 (2)	52 (17)	29 (37)	5 (60)	0 (65)	0 (65)
Cetuximab with chemotherapy	235 (0)	191 (1)	122 (2)	83 (2)	54 (2)	35 (3)	17 (11)	5 (18)	1 (21)	0 (22)	0 (22)

ADICÃO DE IMUNO À QT

MELHORES DESFECHOS EM QQ
CENÁRIO PDL1

IMUNO ISOLADA – BOA OPCAO EM
PDL1 MAIS ALTO E IMPOSSIBILIDADE
DE QT

A Multi-institutional Comparison of SBRT and IMRT for Definitive Reirradiation of Recurrent or Second Primary Head and Neck Cancer



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 Jimmy J. Caudell, MD, PhD,[‡] Nadeem Riaz, MD, MS,[§]
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 Joshua Dault, MD,^{**} Musaddiq J. Awan, MD,^{††} Kristin A. Higgins, MD,^{‡‡}
 Comron Hassanadeh, BS,^{§§} Jonathan J. Beitler, MD, MBA, FACR,
 FASTRO,^{‡‡,|||} Chandana A. Reddy, MS,[†] Samuel Marcrom, MD,^{¶¶}
 Drexell H. Boggs, MD,^{¶¶} James A. Bonner, MD,^{¶¶} Min Yao, MD, PhD,^{††}
 Mitchell Machtay, MD,^{††} Farzan Siddiqui, MD, PhD,[¶]
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 Robert L. Ferris, MD, PhD,^{*,##} and
 Dwight E. Heron, MD, MBA, FACRO, FACR^{*,##}

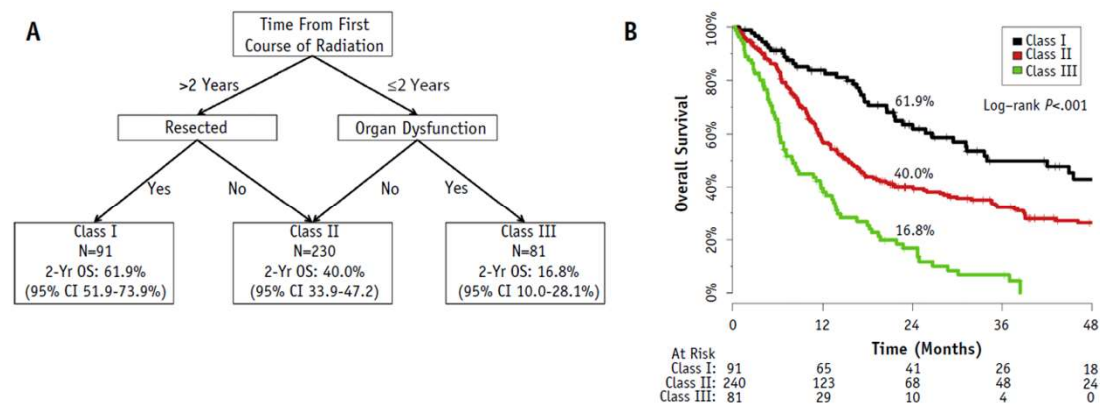
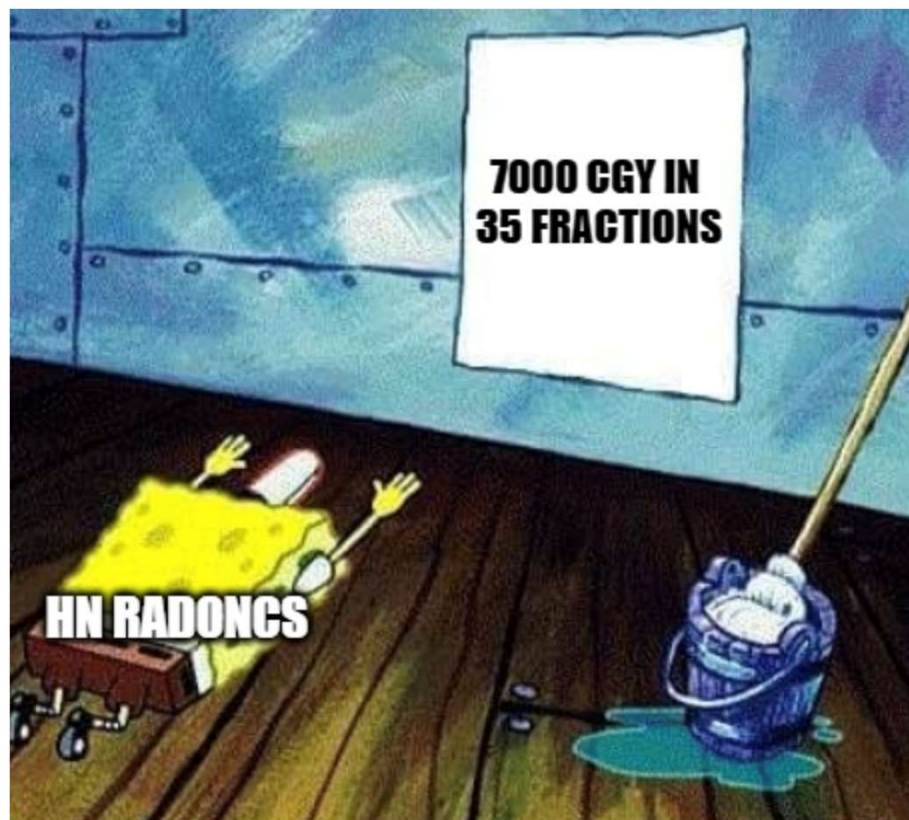


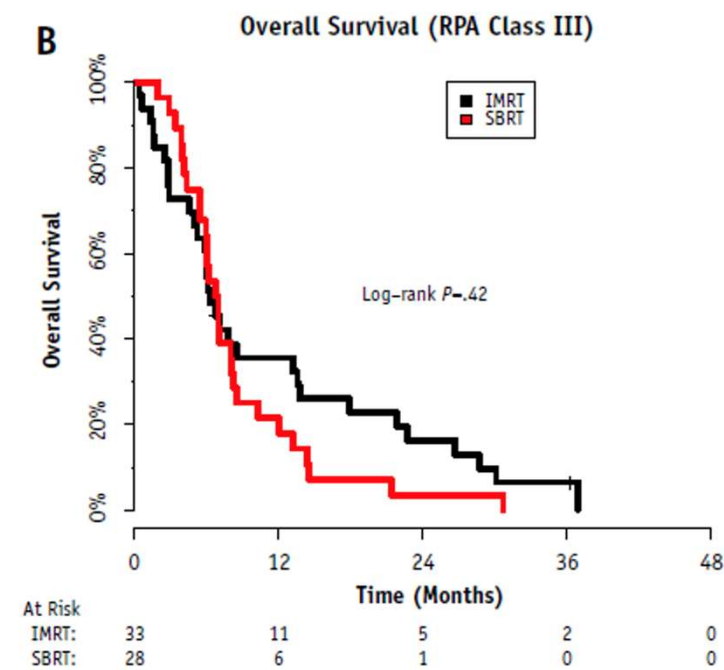
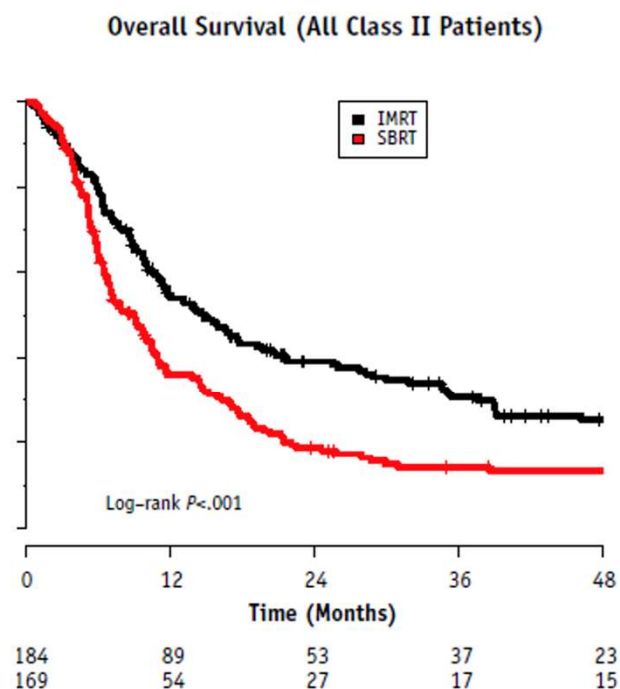
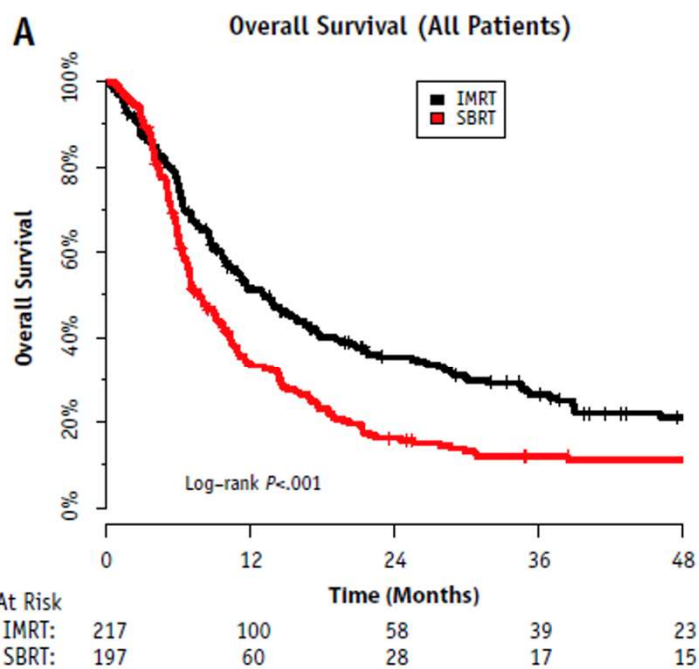
Fig. 3. (A) Recursive partitioning analysis (RPA) for overall survival. Abbreviations: OS = overall survival; CI = confidence interval. Organ dysfunction defined as pretreatment dependence on a feeding tube or tracheostomy. (B) Kaplan-Meier curves for overall survival separated by RPA class.



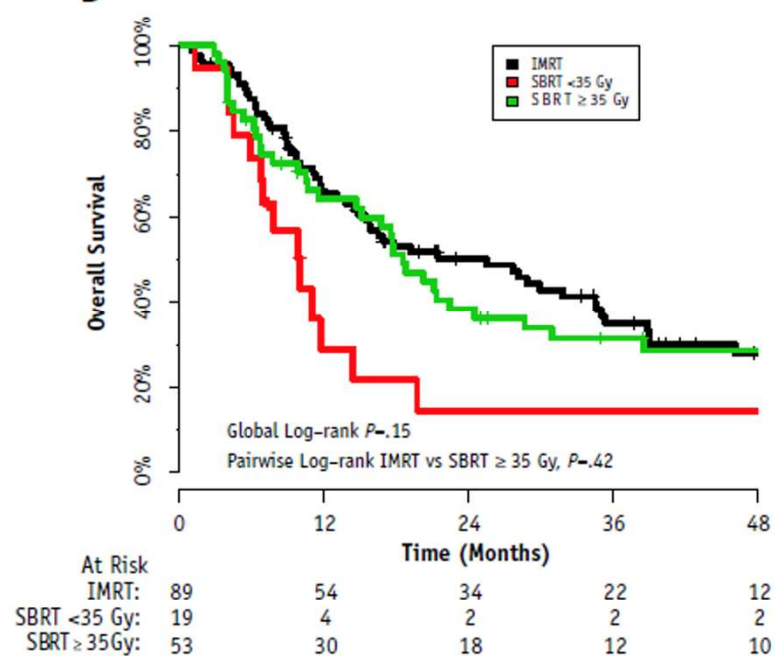
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D Overall Survival (Class II "Small" Tumors: ≤ 25 cc or rT0-2)



E Overall Survival (Class II "Large" Tumors: >25 cc or rT3-4)

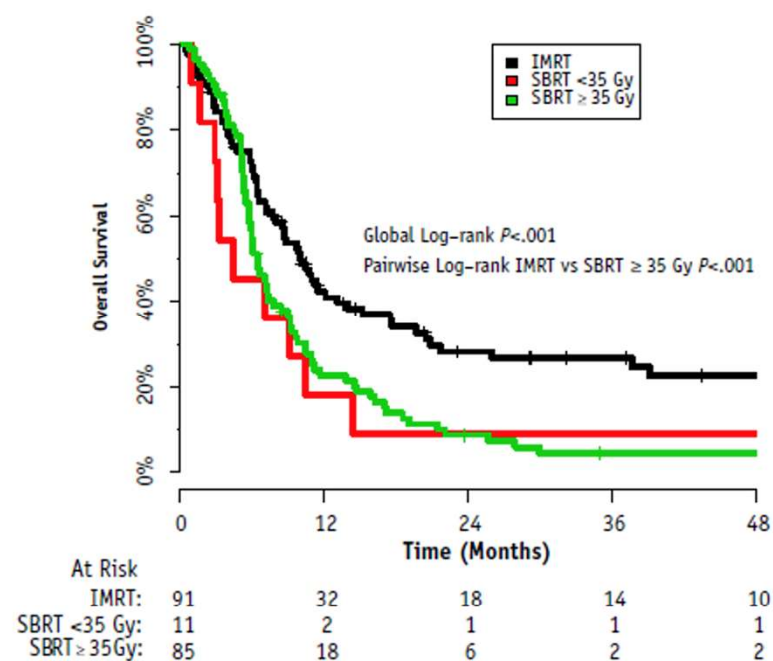
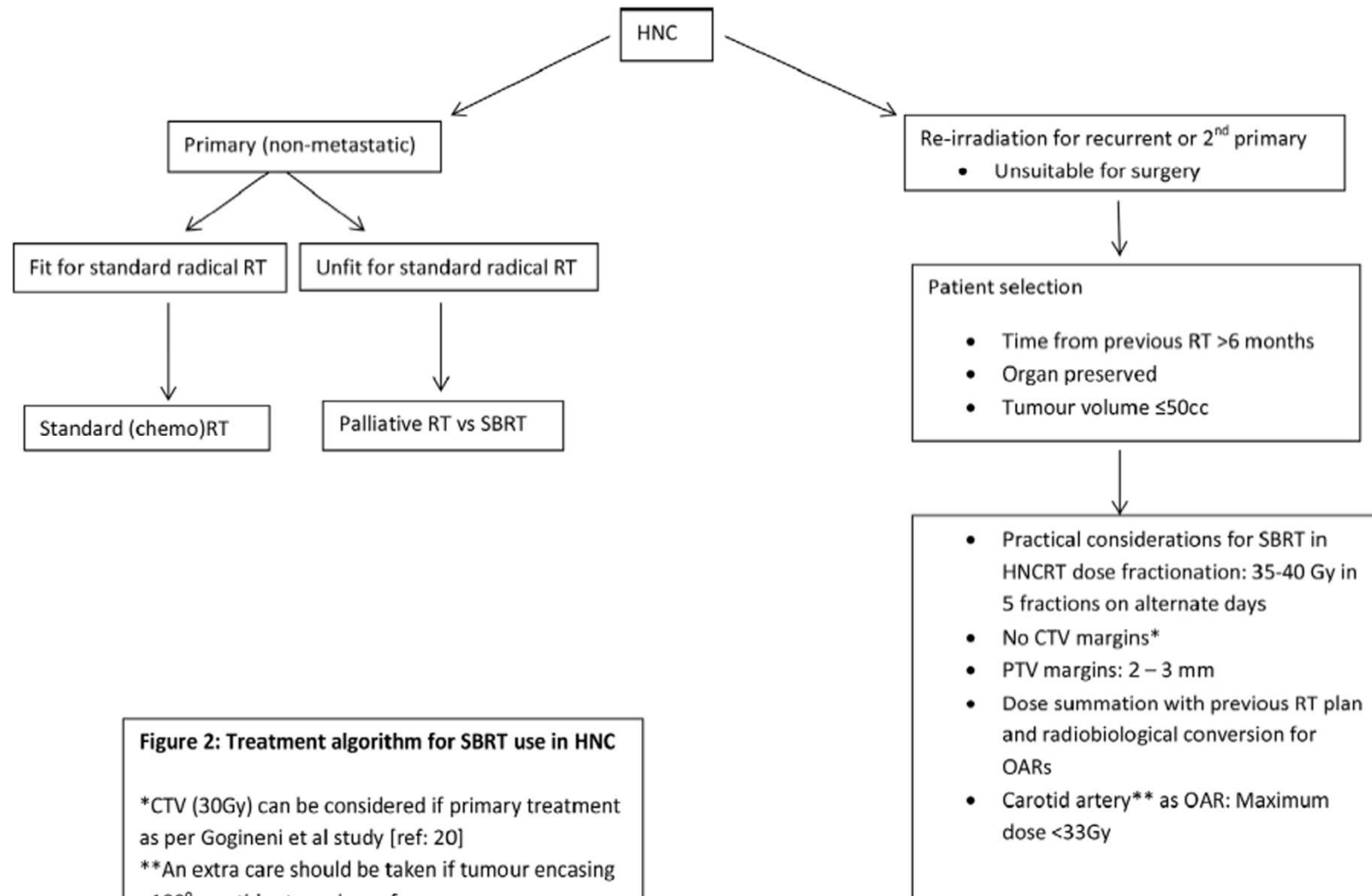


Figure 2. Treatment algorithm for SBRT use in HNC. HNC, head and neck cancer; SBRT, stereotactic body radiation therapy.



REIRRADIAÇÃO COM SBRT E IMRT É MELHOR TOLERADO DO QUE EM SÉRIES HISTÓRICAS

CLASSIFICAÇÃO RPA AJUDA A SELECIONAR CANDIDATOS A IMRT X SBRT

SOBREVIDADE EM RPA III É POBRE – SBRT TEM MAIOR INTERESSE ESTRATÉGICO



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Reirradiation using stereotactic body radiotherapy in the management of recurrent or second primary head and neck cancer: A meta-analysis and systematic review

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SBRT é praticável e eficiente para recidiva ou 2º primário de CP?

- End points
 - 1º = OS
 - 2º = toxicidades tardias G3 ou >, taxas de resposta
- Critérios de inclusão
 - Clinical trials ≥ 20 pacientes com pelo menos 1 dos endpoints
 - SBRT 3m pelo menos $\geq 75\%$ dos pacientes
 - Estudos da mesma instituição, os mais recentes e sem sobreposição de pacientes
- 10 artigos incluídos

Table 1

Characteristics of the included studies.

Author, Year	Institution	N	Details of patient population	Study design	Inclusion period	Histologic population	Age, years	Interval between RT, months	Previous RT dose, Gy	SBRT dose, Gy	SBRT Fx	SBRT GTV, cm ³	OP rate, %	CTx rate, %
							median (range)		agent					
Voynov, 2006	University of Pittsburgh Cancer Institute, US	22		R	2001–2004	100% SCC	65		(BED10) 97.8	24	5	19.1	0.0%	NR
Roh, 2009	Catholic University, Korea	36		R	2004–2006	55% SCC	44–85 54	24	70.1–190.3 70.2	10–36 30	1–8	2.5–140.3 22.6	0.0%	0.0%
Kawaguchi, 2010	Tsurumi University, Japan	22	LN – 14; LN + 8	R	2006–2007	95.5% SCC	17–88 67	3.1–252.6	39.6–134.4	18–40 33.7	3–5	0.2–114.9 24.5	0.0%	100.0%
Rwigema, 2011	University of Pittsburgh Cancer Institute, US	96	HD 45; LD 51	R	2003–2008	100% SCC	42–91 67		40–65 68.4	20–42 35	2–5 5	3.4–74.4 24.3	0.0%	S-1 58.0%
Lartigau, 2013	Multi-institution, France ^a	56		P	2007–2010	100% SCC	39–88 60	38	32–170.7 NR	15–50 36	1–5 6	2.5–162 29 mm (size)	0.0%	cetuximab 100.0%
Shikama, 2013	Saitama Medical University, Japan	28	SBRT 22 (79%); conventional RT 6 (21%)	R	2007–2011	86% SCC	42–87 67	9	60	30	2.9	≤ 66 mm (size) NR	0.0%	cetuximab 0.0%
Yazici, 2013	Hacettepe University, Turkey	75	group 1 43; group 2 32 ^b	P	2007–2011	NR	43–90 53	3–40 35	22–72 65	15–40 30	1–6 5	54 (group 1); 46 (group 2)	0.0%	0.0%
Kress, 2014	Georgetown University, US	85		R	2002–2011	100% SCC	15–87 61	9–300 32	30–478 68	15–35 30	3–6 5	103	28.7%	60.6%
Vargo, 2015	University of Pittsburgh Cancer Institute, US	48		P	2007–2013	100% SCC	39–91 63	1–322 18	36–120 70	16–41 44	3–5 5	7.5–645 36.5		carboplatin, cetuximab, cisplatin, xeloda 100.0%
Yamazaki, 2016	Multi-institutions, Japan ^c	107		R	2000–2010	NR	45–87 63	3–423 14.5	52.5–118.2	40–44 30	5 5	3.6–209.2 (PTV) 28.4	43.0%	cetuximab NR
							35–88	0.7–1180	≥ 40	15–39	3–8	1–339		

Abbreviations: N, number of patients; R, retrospective; P, prospective; RT, radiotherapy; SCC, squamous cell carcinoma; Gy, gray; Fx, fractions; SBRT, stereotactic body radiation therapy; OP, operation; CTx, chemotherapy; BED, biologically effective dose; LN –, without lymph node metastasis; LN +, with lymph node metastasis; HD, high dose (40–50 Gy); LD, low dose (< 40 Gy); GTV, gross tumor volume; PTV, planning target volume; NR, not reported.

^a Multi institutional phase II study including Centre Oscar Lambret, Centre Antoine Lacassagne, and Centre Alexis Vautrin, France.

^b While group 1 included patients who were treated with sequential SBRT, group 2 included patients treated with SBRT every other day.

^c Multi-institutions consisted of Soseikai General, Fujimoto Hayasuzu, Okayama Kyokuto, and Osaka University Hospitals, Japan.

SBRT em CP

- 2006 a 2016
- 3 prospectivos e 7 retrospectivos
- Universidade de Pitsburg – 3 estudos
 - SBRT é a modalidade preferida de tratamento no manejo de recidiva ou de 2º primario
- Número mediano de pacientes = 52 (22 – 107)
- Dose mediana de eRxt inicial 60-70Gy
- Somente 2 estudos tinham pacientes operados – Kress et al (28.7%) e Yamazaki et al (43%)
- Volume mediano variando 19,1 a 103cm³
 - Maioria < 54cm³
- Dose mediana = 30Gy (24 – 36Gy) 2 a 6 frações

Sobrevida Global
mOS= 11,9 meses (8,6 - 16,2 meses)
2-year OS= 30%

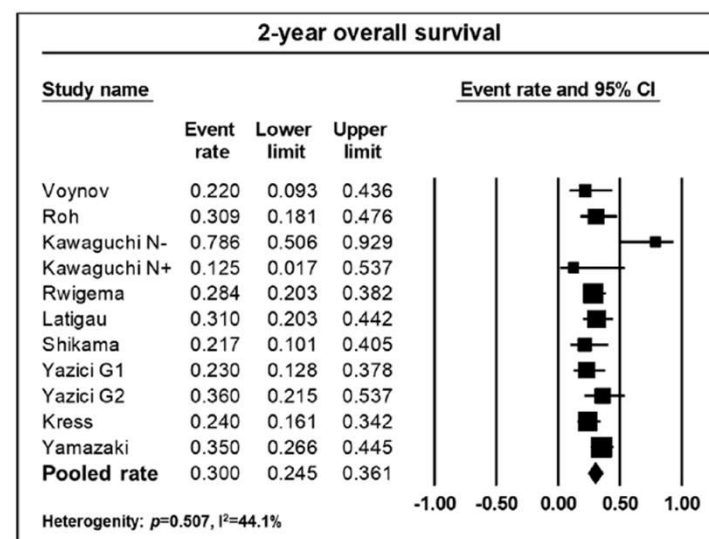


Table 2

Treatment outcomes after reirradiation using SBRT according to included studies.

Author	N	Median FU period, m	Response rate ^a	CR	2-year LC	OS			
						median OS period, m	1-y OS	2-y OS	Predictors related to OS
Voynov	22	19 (survivor)			26%	12	47.0%	22.0%	
Roh	36		80.0%	42.9%	52.2%	16.2	52.1%	30.9%	
Kawaguchi	22 (LN - 14, LN + 8)	24	50% (LN- - 71.4%; LN + 12.5%, RECIST)	45.5% (LN - 64.3%; LN + 12.5%)				78.6% (LN -); 12.5% (LN +)	LN metastasis
Rwigema	96 (HD 45, LD 51)	14	71.8% (HD: 84.4%, LD: 60.7%, RECIST)	35.4% (HD: 46.7%, LD: 25.5%)	HD: 57.8%, LD: 31.7%	15	58.9%	28.4%	SBRT dose
Lartigau	56	11	69.4% (RECIST)	49.0%		11.8	47.5%	31.0%	
Shikama	28	7	46% (RECIST)	18.0%		8.6		21.7%	
Yazici	75 (group 1 43, group 2 32) ^b		38.7%	16.0%		14 [11 (group 1); 23 (group 2)] ^b	42% (group 1); 84% (group 2)	23% (group 1); 36% (group 2)	group (sequential vs. every other day)
Kress	85	17 (survivor)	76% (RECIST)	36.0%		8.6	51.1%	24.0%	RT interval
Vargo	48	18 (survivor)	51.0%	21.0%		10	40.0%		GTV
Yamazaki	107		54.2%	21.5%	64%		55.0%	35.0%	primary site, PTV, ulceration

Abbreviations: RT, radiotherapy; SBRT, stereotactic body radiotherapy; FU, follow-up; CR, complete response; OS, overall survival; LN -, without lymph node metastasis; LN +, with lymph node metastasis; HD, high dose, 40–50 Gy; LD, low dose, < 40 Gy; RECIST, Response Evaluation Criteria in Solid Tumors; GTV, gross tumor volume; NR, not reported.

^a Includes both CR and partial response.

^b While group 1 included patients treated with sequential SBRT, group 2 included patients treated with SBRT every other day.

Clinical Investigation

A Prospective Phase 2 Trial of Reirradiation With Stereotactic Body Radiation Therapy Plus Cetuximab in Patients With Previously Irradiated Recurrent Squamous Cell Carcinoma of the Head and Neck

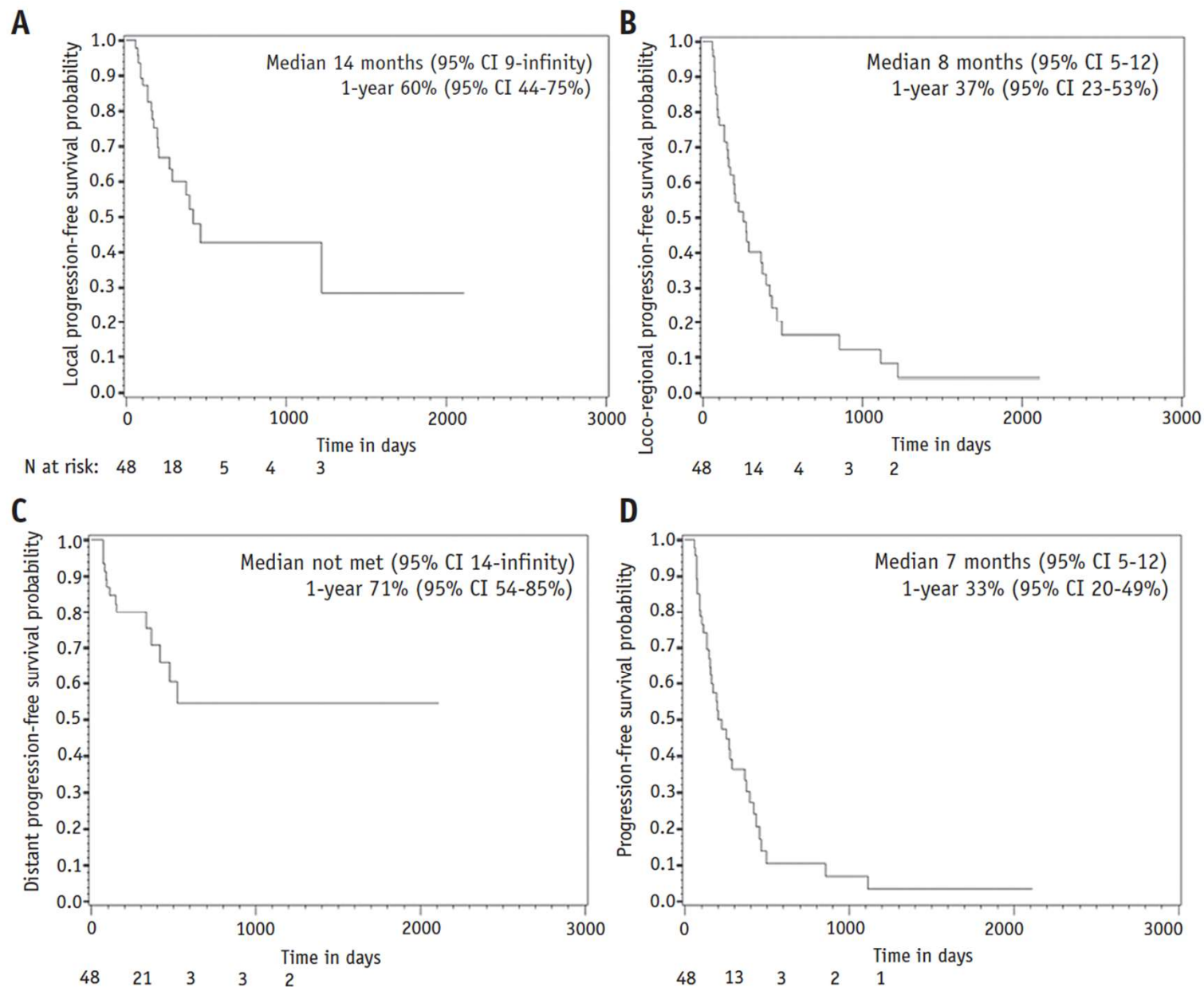
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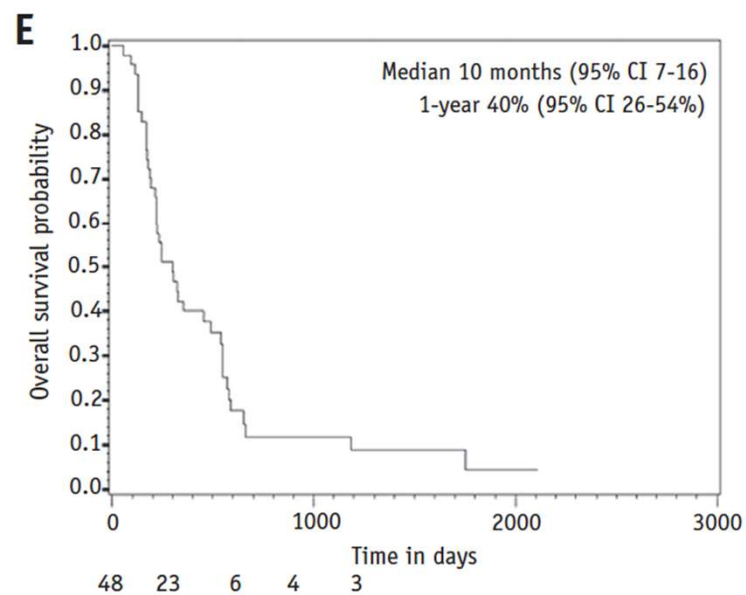
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- GTV < 25cm³ melhora LRPFS e OS
 - 1-year LRPFS= 53% x 22%, p= .029
 - 1-year OS= 70% x 22%, p= <.001
- Metade dos estudos tem volumes ≥ 25cm³

Sari et al. publicou que volumes ≤ 50cm³ está associado a melhores desfechos de sobrevida.





36% progrediram
14% estáveis
#0 % resposta parcial
21% resposta completa

Table 2 Patients experiencing grade 3+ treatment-related toxicity

Toxicity description and grade	Time (mo)	Prior treatment	Reirradiation interval (mo)	Site of recurrence	Recurrence volume (cm ³)	Treatment platform
Acute grade 3 rash	<1	Concurrent cetuximab	9	Base of tongue	33	Trilogy
Acute grade 3 mucositis requiring admission and G-tube placement	1-3*	plus RT of 70 Gy				
Acute and late grade 3 dysphagia requiring G-tube dependence	2-death	Concurrent Cisplatin/5FU and RT 64.8 Gy	12	Tonsil	45	TrueBeam
Acute grade 3 moist desquamation	<1	Total laryngectomy and adjuvant concurrent cetuximab plus RT of 59.4 Gy	264	Stoma and submental	45	TrueBeam
Late grade 3 esophageal stricture to tracheoesophageal fistula	6-death					
Late grade 3 leakage extending into neopharynx requiring feeding tube	3.5-death	Definitive RT at 66 Gy Salvage laryngectomy	35	Base of Tongue	135	TrueBeam

Abbreviations: G-tube = gastrostomy tube; RT = radiation therapy.

* The patient died at 3 months with a feeding tube.

EFEITO DA MARGEM SOBRE GTV
SEM MARGEM – MAIORES RECIDIVAS
COM MARGEM – MAIS TOXICIDADE



Phase II trial

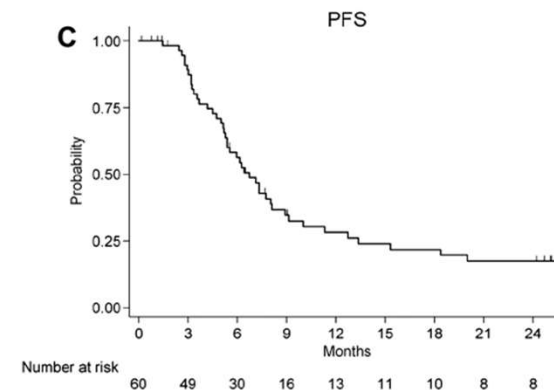
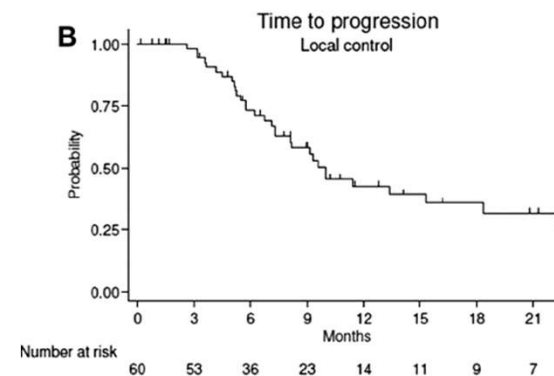
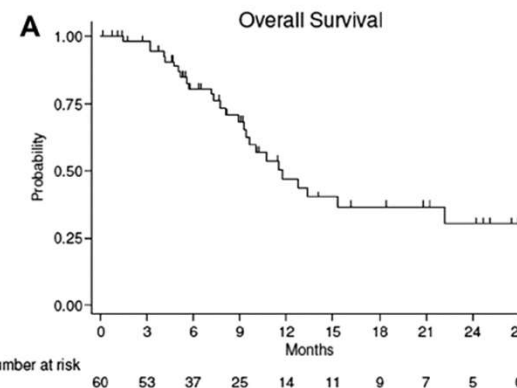
Multi institutional phase II study of concomitant stereotactic reirradiation and cetuximab for recurrent head and neck cancer

Eric F. Lartigau^{a,*}, Emmanuelle Tresch^a, Juliette Thariat^b, Pierre Graff^c, Bernard Coche-Dequeant^a, Karen Benezery^b, Luis Schiappacasse^a, Marian Degardin^a, Pierre-Yves Bondiau^b, Didier Peiffert^c, Jean-Louis Lefebvre^a, Thomas Lacornerie^a, Andrew Kramar^a

^a Centre Oscar Lambret, University Lille II & ONCOLille Consortium; ^b Centre Antoine Lacassagne, Nice; and ^c Centre Alexis Vautrin, Vandoeuvre-lès-Nancy Cedex, France

Grade 3 toxicities and cutaneous toxicity.

Grade ≥ 3 AE related to study treatment (N = 56)		
	n	Appearance of toxicity
Cutaneous		
Rash	4	<3 months
Cutaneous toxicity	1	<3 months
Fibrosis	1	3–6 months
GastroIntestinal		
Mucositis	4	<3 months
Dysphagia	3	<3 months
Xerostomia	2	3–6 months
Fistula (oral cavity)	1	>6 months
Dysgeusia	1	<3 months
Cutaneous toxicity (N = 56)	Related to cetuximab and/or radiotherapy	Related to cetuximab
Cutaneous toxicity, n (%)	47 (84)	41 (73)
NK	1 (2)	1 (2)
Grade 1	14 (25)	14 (25)
Grade 2	27 (48)	22 (39)
Grade 3	5 (9)	4 (7)





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Author manuscript

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Vargo et al.

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Head and Neck Tumor Control Probability: Radiation Dose-Volume Effects in Stereotactic Body Radiation Therapy for Locally Recurrent Previously-Irradiated Head and Neck Cancer: Report of the AAPM Working Group

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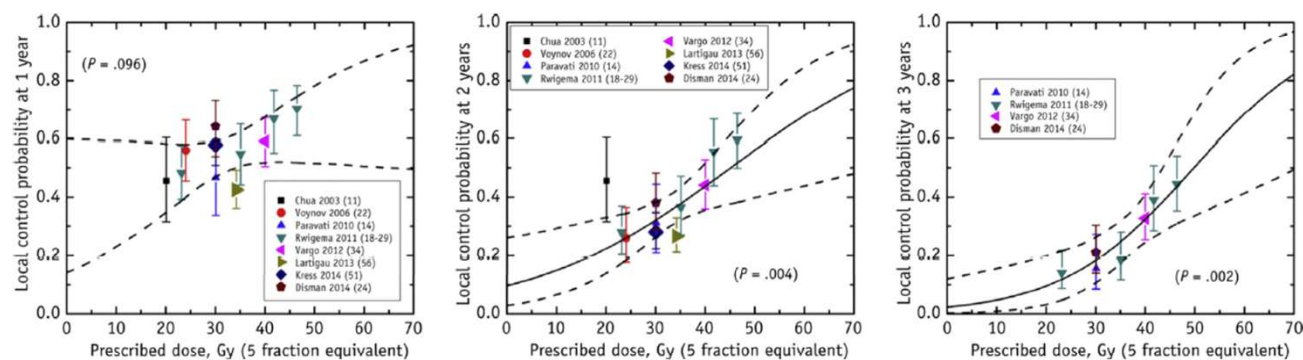


Fig. 2.

Pooled data from the literature reporting local control and dose at 1, 2, and 3 years, as shown. Each data point represents 1 data set, and doses are computed (via the linear-quadratic model) as “5-fraction equivalent total doses” (see text and Tables 1–3) (patient numbers of each study are in parenthesis in the keys of each figure panel). Vertical error bars are 68% binomial confidence intervals. Solid line is the logistic model; dashed lines are 95% confidence intervals for the dose-response.

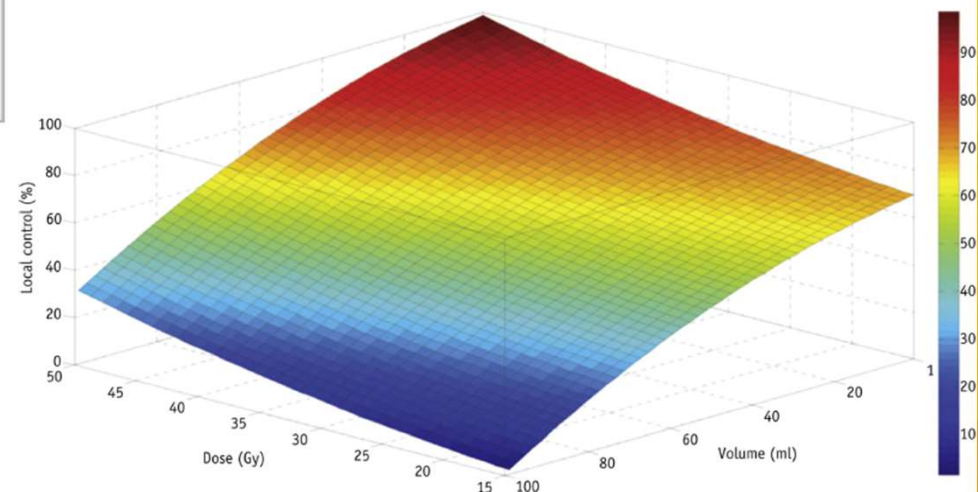


Fig. 1.

Graphic depiction illustrating an association between dose, volume, and 1-year locoregional control after stereotactic body radiation therapy for recurrent head and neck cancer. Reproduced with permission from reference (11).

E SOBRE DOSE????

Melhora no controle local em 2 e 3 anos com doses de 35 a 45Gy quando comparado com <30Gy

Summary of overall survival tumor control probabilities for the included studies

Study (reference)	Patients (n)	Calculated equivalent dose (Gy)	Fractions (n)	Five- fraction equivalent dose (Gy)	1-y OS probability (%)	2-y OS probability (%)	3-y OS probability (%)
Voynov 2006 (9)	22	24	5	24.0	47	22	22
Porceddu 2007 (24)	35	30	5	30.0	32	14	-
Vargo 2012 (12)	34	40	5	40.0	59	42	16
Lartigau 2013 (13)	56	36	6	34.2	47	31	-
Kress 2014 (14)	51	30	5	30.0	51	24	-
Dizman 2014 (15)	24	30	5	30.0	83	43	31

Abbreviation: OS = overall survival.

Last-line local treatment with the Quad Shot regimen for previously irradiated head and neck cancers

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 C. Jillian Tsai^b, Sean M. McBride^b, Nadeem Riaz^b, Daphna Y. Gelblum^b, Brian P. Neal^e,
 James Fetter^f, Lara A. Dunn^f, Loren S. Michel^f, Jay O. Boyle^g, Marc A. Cohen^g,
 Benjamin R. Roman^g, Ian Ganly^g, Bhuvanesh Singh^g, Richard J. Wong^g, Eric J. Sherman^e,
 Nancy Y. Lee^{b,*}

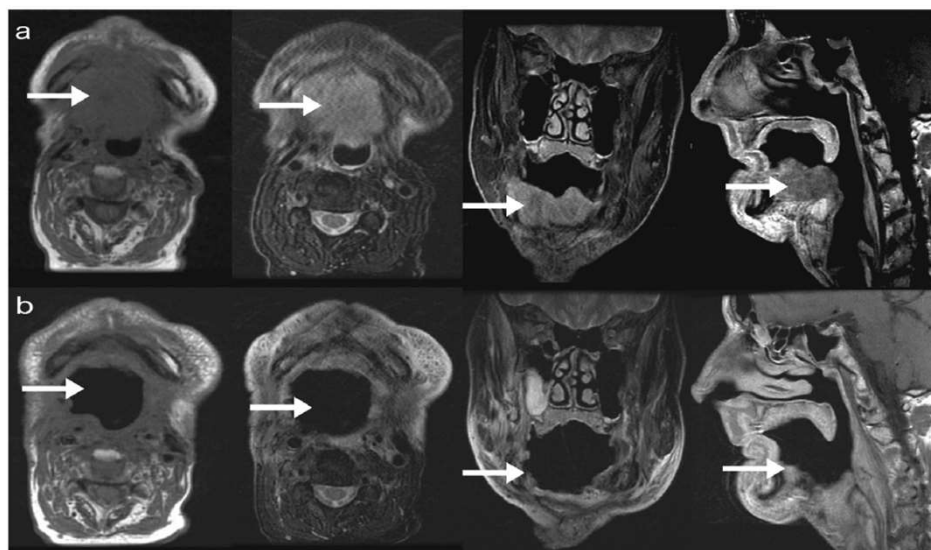


Fig. 1. A 65-year-old male with recurrent oral cavity carcinoma: (a) Baseline pre-treatment MR images demonstrate a large tumor mass (white arrows), (b) MR images after three cycles of Quad Shot demonstrate dramatic reduction of the tumor (white arrows).

Mas eu não tenho SBRT? O que posso fazer?

Quad Shot regimen – 3,7Gy BID
 02 dias consecutivos
 4 semanas de intervalo
 Até 4 ciclos

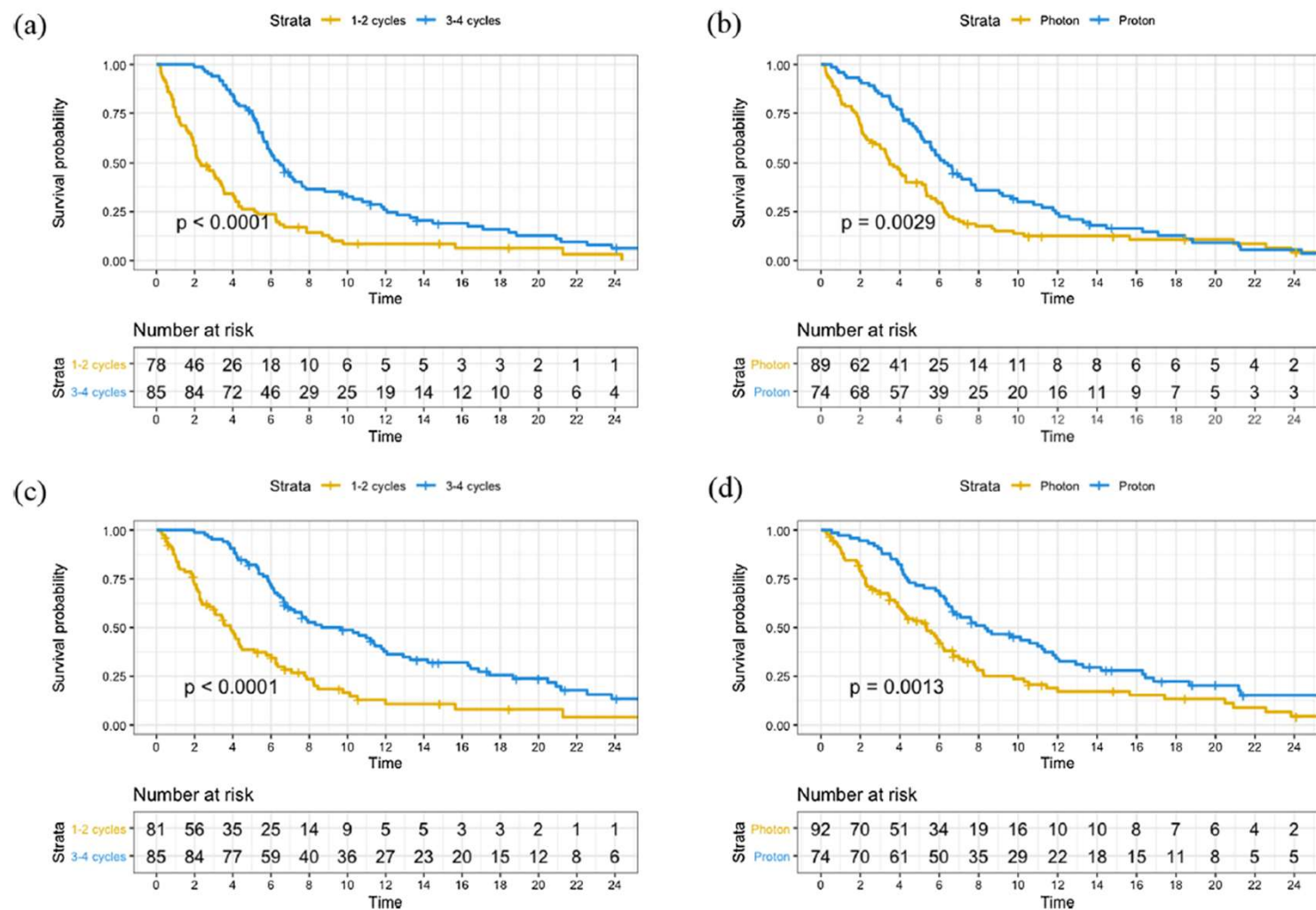


Fig. 2. Kaplan-Meier survival curves: (a) Comparative LPFS in patients by QS cycles, (b) Comparative LPFS in patients by radiation modality, (c) Comparative OS in patients by QS cycles, (d) Comparative OS in patients by radiation modality.

Quality of Life Outcomes Following Organ-Sparing SBRT in Previously Irradiated Recurrent Head and Neck Cancer

Emile Gogineni, Isabella Zhang, Zaker Rana, Mihaela Marrero, Gurtej Gill, Anurag Sharma, Adam C. Riegel, Sewit Teckie and Maged Ghaly*

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60 pacientes
Recidiva in field
Resgate SBRT

Tratamento inicial – dose mediana 63.6Gy
Resgate SBRT – 40Gy em cenário definitivo
35 Gy se pós operatório

	Controle local	regional	controle distancia	OS
1y.	79%.	74%	74%	59%
2y.	79%	70%	71%	45%

3% toxicidade G3

Qol – geralmente estável

Melhora da dor

Alguma piora em deglutição

Todos com piora xerorstomia

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TABLE 1 | Constraints.

OAR	Constraint
PTV	D95% = 98–100%
Larynx	Mean dose < 15 Gy
Mandible	Max dose < 20 Gy
Spinal cord/brainstem	Cumulative max dose < 54 Gy equivalent in 2 Gy/fx Or Max dose < 8 Gy (if records not available)
Cochlea	Mean dose < 15 Gy
Retina	Mean dose < 15 Gy
Lens	Max dose < 5 Gy
Carotid aa	Max dose < 32.5 Gy
Optic nerve/chiasm	Max dose < 25 Gy
Temporal tips	Mean dose < 5 Gy
Skin	D (10 cc) < 39.5 Gy
Thyroid lamina	Max dose < 30 Gy



Mielite?
Não há relatos

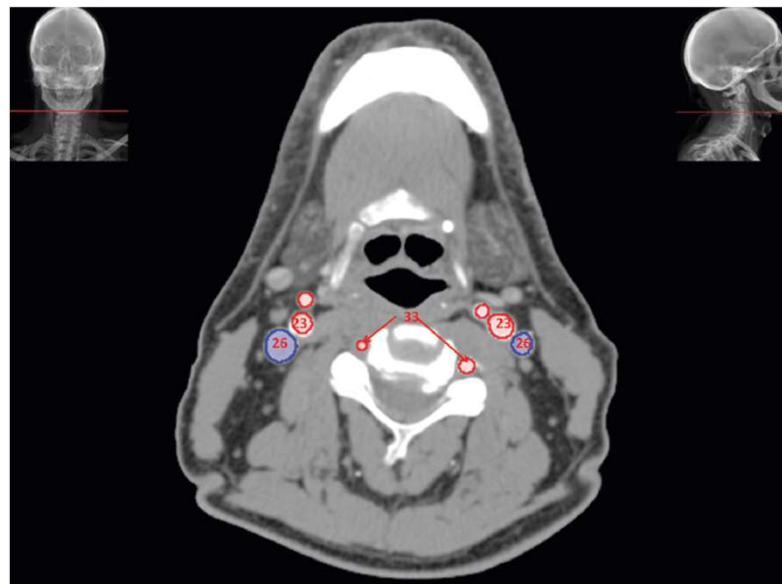
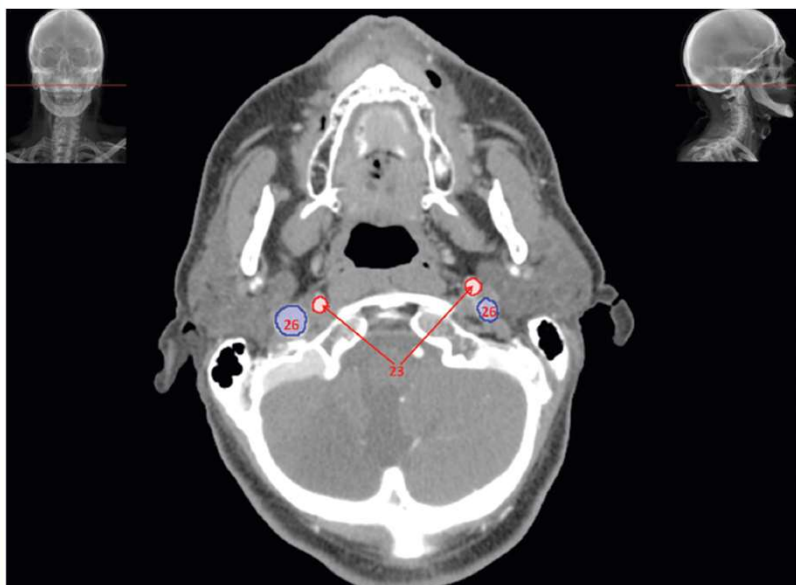
Carotid Blowout Syndrome (CBOS)

- Evento fatal – mas é infrequente
- Toxicidade grau 5 = 4,6%
- CBOS causou 19 das 22 mortes
- Relações
 - Doses altas
 - Dose média na carótida > 33Gy (p = 0,02)
 - 30Gy/5fx não houve casos, a não ser se invasão > 180o
 - Fracionamento em dias alternados ou 2 x semana é fator protetor

Results of Reirradiation with Stereotactic Radiotherapy in Recurrent Head and Neck Cancer



S. Yuce Sari,¹ M. Cengiz,² A. Elmali Dogan,³ M.T. Yilmaz,⁴ G. Yazici,² and G. Ozyigit⁴; ¹Hacettepe University Faculty of Medicine, Department of Radiation Oncology, Ankara, Turkey, ²Hacettepe University Medical School, Department of Radiation Oncology, Ankara, Turkey, ³Hacettepe University Medical School, Ankara, Turkey, ⁴Hacettepe University Faculty of Medicine, Department of Radiation Oncology, Ankara, Turkey

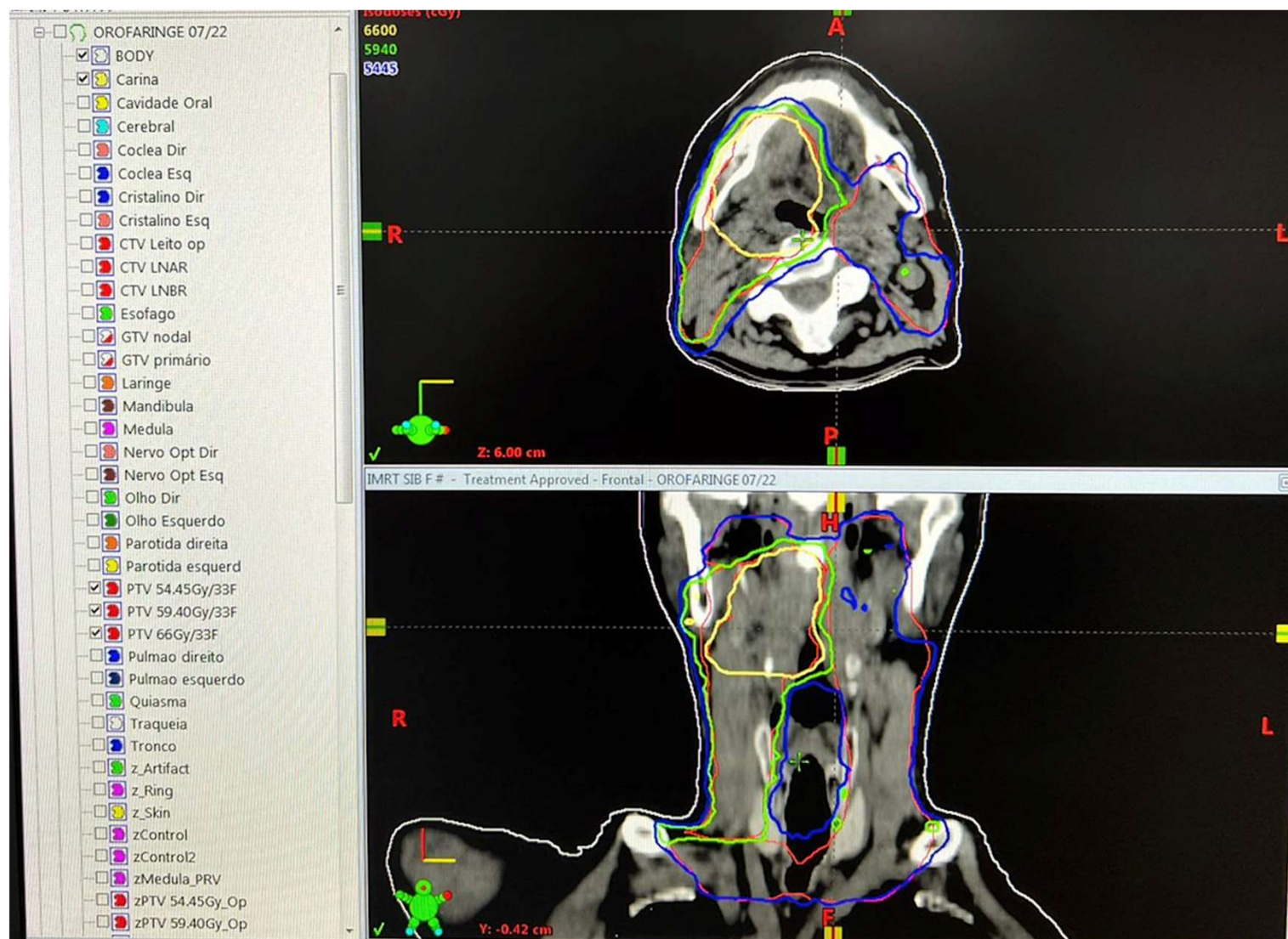


Carótida como importante OAR em reirradiação



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Toxicidade

Osteorradioneecrose

Mandíbula / base de crânio

Disfagia / odinofagia

Estenose de via aérea e/ou digestiva

Fibrose cervical

Lesões cutâneas

Mielite / lesão em tronco

Alterações auditivas

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Quem não é visto não é lembrado



VOLUME
 $\text{GTV} \leq 50\text{cm}^3$

DOSE

35 a 40Gy em 5 fx

Dias alternado ou 2x/semana

DELINEAMENTO
 $PTV = GTV + 3mm$

PRESCRIÇÃO
 $D_{95} = 100\%$

CONSTRAINTS

Table 3. Maximum cumulative BED and EQD₂ values (using an α/β ratio of 3Gy). These calculations are based on 65 Gy in 30 daily fractions as a primary treatment and 35-40 Gy in 5 fractions as SBRT reirradiation.

Organ at Risk	DVH Parameter	α/β	Primary treatment		Reirradiation		Constraint BED [Gy3]	Constraint EQD2 [Gy3]
			Prescription dose (Gy)	Fractions	Constraint dose [Gy]	Fractions		
Carotid artery	Maximum dose	3	65.0	30	32.5	5	214.9	128.9
Lens	Maximum dose	3	10.0	30	5	5	17.8	10.7
Mandible	Maximum dose	3	65.0	30	20	5	158.6	95.2
Optic chiasm	Maximum dose	3	50.0	30	25	5	144.4	86.7
Optic nerves	Maximum dose	3	50.0	30	25	5	144.4	86.7
Larynx	Mean Dose	3	54.0	30	15	5	116.4	69.8
Cochlea	Mean Dose	3	45.0	30	15	5	97.5	58.5
Retina	Mean Dose	3	45.0	30	15	5	97.5	58.5
Temporal tips	Mean Dose	3	54.0	30	5	5	93.1	55.8
Skin	D10cc	3	65.0	30	39.5	5	255.5	153.3
Thyroid lamina	Maximum dose	3	65.0	30	30	5	201.9	121.2
Spinal cord					8			54.0
Brainstem					8			54.0



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