


XXXII CONGRESSO NAZIONALE AIRO  
XXXIII CONGRESSO NAZIONALE AIRB  
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# AIRO2022

Radioterapia di precisione per un'oncologia innovativa e sostenibile

BOLOGNA, 25-27 NOVEMBRE  
PALAZZO DEI CONGRESSI

 Associazione Italiana  
Radioterapia e Oncologia clinica

 Società Italiana di Radiobiologia

 Associazione  
Italiana  
Radioterapia  
e Oncologia  
clinica  






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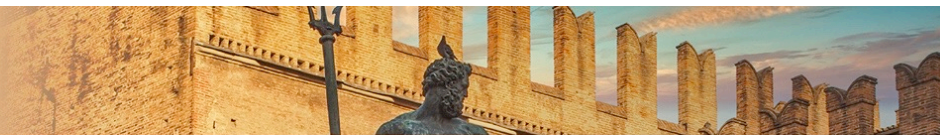
Radioterapia di precisione per un'oncologia innovativa e sostenibile

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## COMPUTED TOMOGRAPHY-BASED RADIOMICS IN OROPHARYNGEAL CANCER PATIENTS TREATED WITH RADIOTHERAPY: A PROMISING TOOL FOR OUTCOME MODELING

Dr. Stefania Volpe

Volpe S, Gaeta A, Colombo F, Zaffaroni M, Vincini MG, Pepa M, Isaksson IJ, Turturici I, Casbarra A, Marvaso G, Ferrari AM, Cammarata G, Santamaria R, Bergamaschi L, Raimondi S, Botta F, Ansarin M, Cremonesi M, Orecchia R, Alterio D, Jerezek-Fossa BA



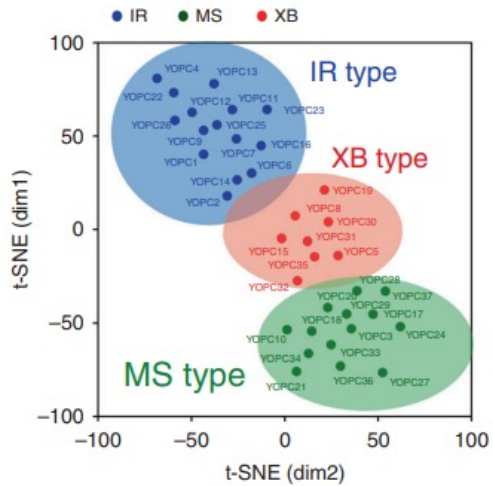
## DICHIARAZIONE

Relatore: STEFANIA VOLPE

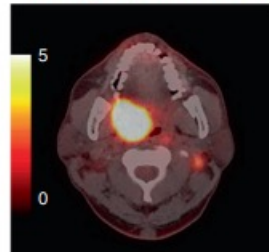
Come da nuova regolamentazione della Commissione Nazionale per la Formazione Continua del Ministero della Salute, è richiesta la trasparenza delle fonti di finanziamento e dei rapporti con soggetti portatori di interessi commerciali in campo sanitario.

- Posizione di dipendente in aziende con interessi commerciali in campo sanitario **(NIENTE DA DICHIARARE)**
- Consulenza ad aziende con interessi commerciali in campo sanitario **(NIENTE DA DICHIARARE)**
- Fondi per la ricerca da aziende con interessi commerciali in campo sanitario **(NIENTE DA DICHIARARE)**
- Partecipazione ad Advisory Board **(NIENTE DA DICHIARARE)**
- Titolarità di brevetti in compartecipazione ad aziende con interessi commerciali in campo sanitario **(NIENTE DA DICHIARARE)**
- Partecipazioni azionarie in aziende con interessi commerciali in campo sanitario **(NIENTE DA DICHIARARE)**
- Altro **(NIENTE DA DICHIARARE)**

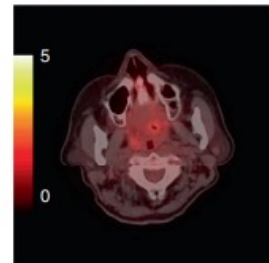




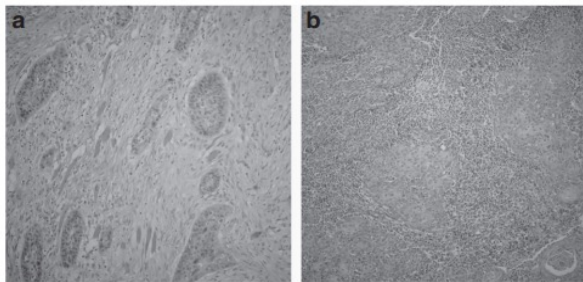
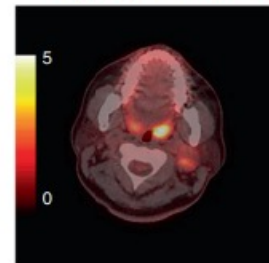
**XB type (TLR = 9.25)**



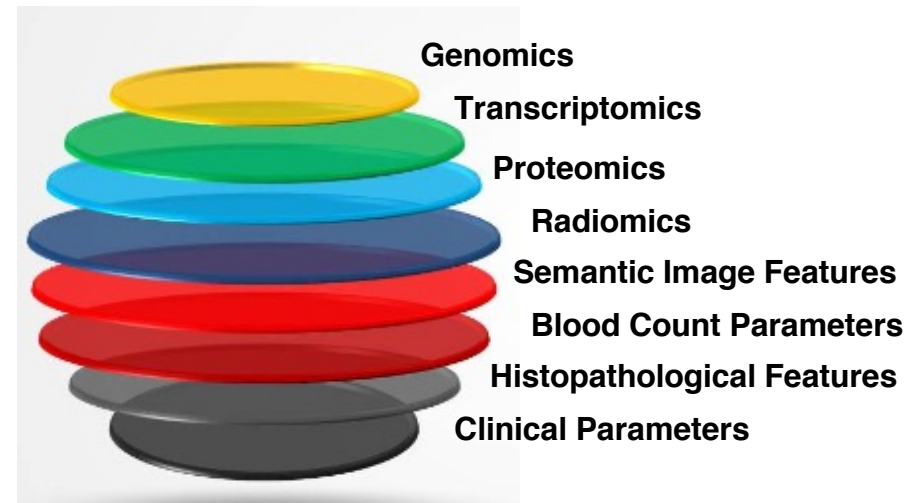
**MS type (TLR = 2.21)**



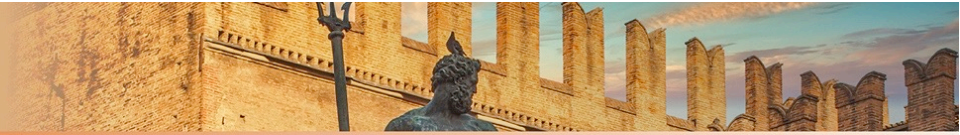
**IR type (TLR = 6.20)**



Kim et al, 2022; Almangush et al., 2022;  
 Huang et al., 2015

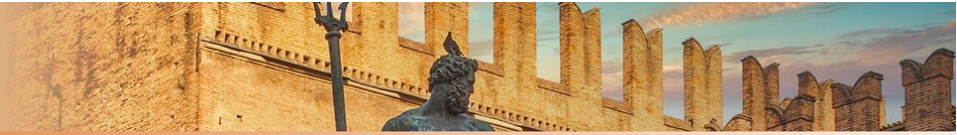


Leukocyte Type		HPV(+) x 10 <sup>9</sup> /L	HPV(-)	P value
CNC	Median (range)	4.7 (1.1-17.1)	5.5 (1.1-16.1)	<0.001
	Mean (SD)	5.0 (1.9)	5.9 (2.4)	
CMC	Median (range)	0.6 (0.2-1.5)	0.7 (0.1-1.4)	<0.001
	Mean (SD)	0.6 (0.2)	0.7 (0.2)	
CLC	Median (range)	1.7 (0.2-5.6)	1.7 (0.2-5.0)	0.410
	Mean (SD)	1.8 (0.7)	1.8 (0.8)	
Correlation Coefficients	CNC and CMC	0.45	0.48	
	CNC and CLC	0.09	0.11	
	CMC and CLC	0.27	0.20	



## Aims

- Build **clinico-radiomic** prognostic model for oropharyngeal cancer patients treated with radiotherapy
- Investigate the association between candidate **prognostic blood count parameters** and computed- tomography derived radiomic features
- Build a **unified prognostic model** encompassing clinical, immunological and quantitative features



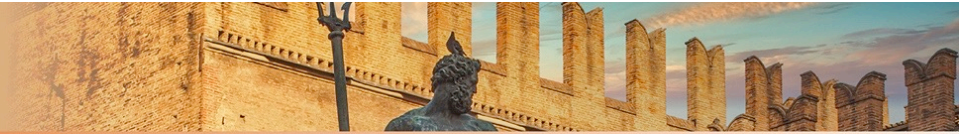
## Patients and Methods- 1

### Inclusion criteria

- Age  $\geq$  18 years
- Histologically-confirmed diagnosis of OPSCC
- Availability of non contrast-enhanced CT simulation scans
- Availability of clinical data including patients' demographics and pre-RT blood count parameters (i.e., baseline hemoglobin levels, neutrophils, monocytes and platelets, and derived measurements)
- Minimum required follow-up 5 years.

### Exclusion criteria

- Patients whose primary lesion could not be assessed (cTx)
- Secondary or recurrent tumors of the head and neck region.



## Robustness

## Reproducibility

## Classification performance

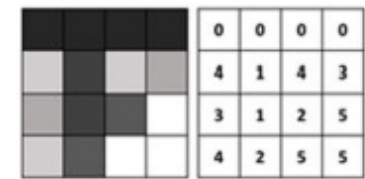
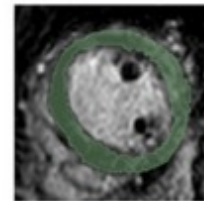
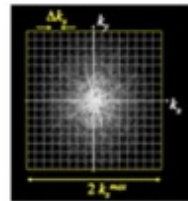
### Image acquisition

### Reconstruction

### Segmentation

### Post-processing

### Feature extraction



## Endpoints:

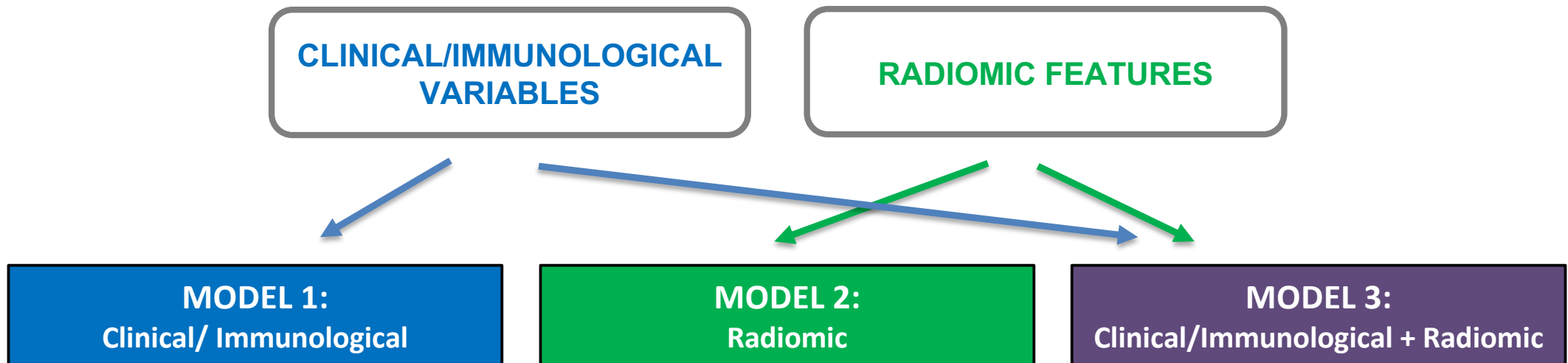
- Overall Survival (OS), defined as the time from diagnosis to death from any cause or last contact at follow up;
- Local Progression-Free Survival (LPFS), defined as the time from diagnosis to disease progression or death from any cause.

Van Timmeren et al., 2020





## Patients and Methods- 3



Associations of clinical variables and radiomic score with the endpoints were tested by univariate Cox Proportional Hazard Regression Models.

The Likelihood-ratio test was used to compare C-index performances across models.





## Results – Patients' characteristics-1

Sample size: 105

Median age 59 ys (IQR 52 – 66)

Gender: 74/105 (70%) male

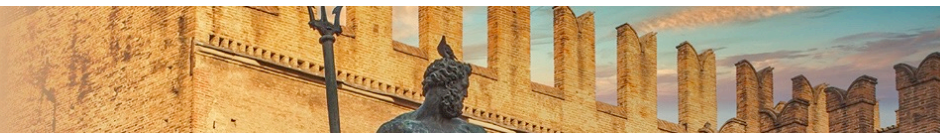
HPV Status:

HPV+: 63/105 (60%)

HPV-: 7/105 (7%)

NA: 35 (33%)

Tumor subsite	n (%)	Clinical T	n (%)
<b>Tonsil</b>	54 (51)	cT1	25 (24)
Base of the tongue	38 (36)	<b>cT2</b>	<b>40 (38)</b>
Glosso-epiglottic vallecula	1 (1)	cT3	10 (9)
Soft palate	7 (7)	cT4	27 (26)
Palatine pillar	2 (2)	NA	3 (3)
Lateral wall	3 (3)	<b>Clinical N</b>	
<b>Smoking habits</b>		cN0	8 (8)
Never-smoked	29 (27)	cN1	14 (13)
Smokers	29 (27)	<b>cN2</b>	<b>65 (62)</b>
Former-smokers	27 (26)	cN3	10 (9)
NA	20 (20)	NA	8 (8)
<b>Grading</b>		<b>Staging (TNM 7th ed, 2010)</b>	
1	2 (2)	I	2 (2)
2	15 (14)	II	4 (4)
3	46 (44)	III	9 (9)
NA	42 (40)	III/IVA	3 (3)
		IVa	73 (68)
		IVb	14 (14)



## Results – Patients' characteristics 2

	Median	IQR
Hemoglobin (g/dl)	13.85	12.53 - 15.20
Neutrophil (cells/ $\mu$ L)	4560	3660 - 6030
Lymphocytes (cells/ $\mu$ L)	1640	1195 - 1995
Monocytes (cells/ $\mu$ L)	580	445 - 760
Platelets ( $10^3$ cells/ $\mu$ L)	233	199 - 297.5
Neutr/Lymph	2.98	2.12 - 4.00
Lymph/Mono	2.64	2.13 - 3.56
PLT/Lymph	153.85	123.73 - 190.41



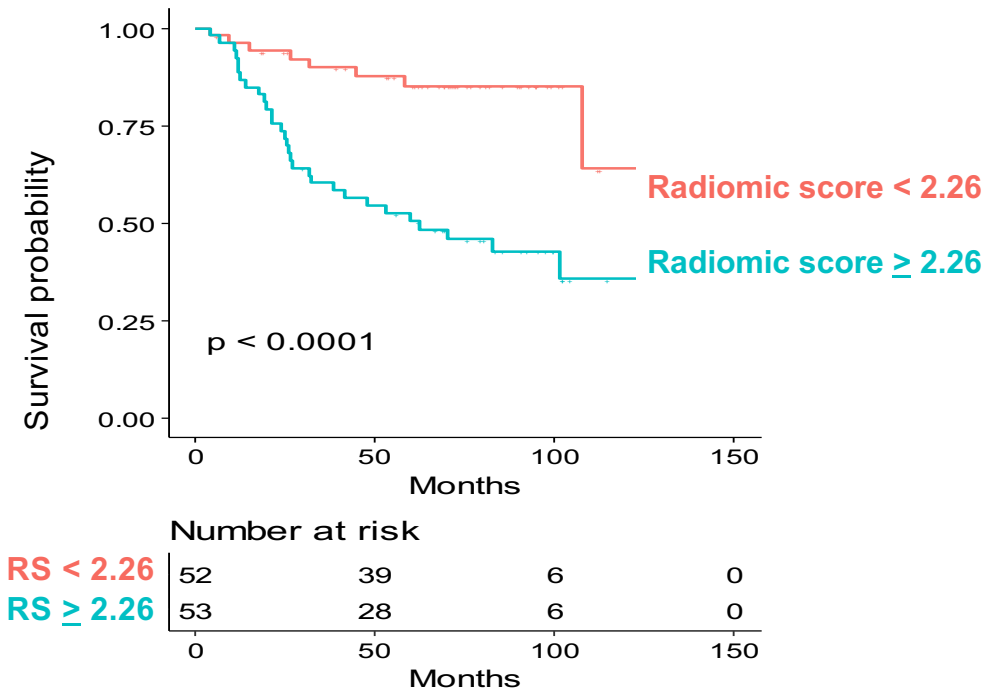


## Results – OS

Median follow-up 6.3 years

**Tumor stage IVA** acted as negative prognostic variable ( $p < .05$ ) both in model 1 (clinical) and model 3 (clinical-radiomic model), and a **high radiomic score** resulted associated as well both in model 2 and 3 (Radiomic model)

Clinical model (C-index 0.82, IQR 0.76 – 0.88)  
 radiomic model (C-index 0.75, IQR 0.66 – 0.83)  
**clinical + radiomic model (C-index 0.86, IQR 0.80 – 0.91)**



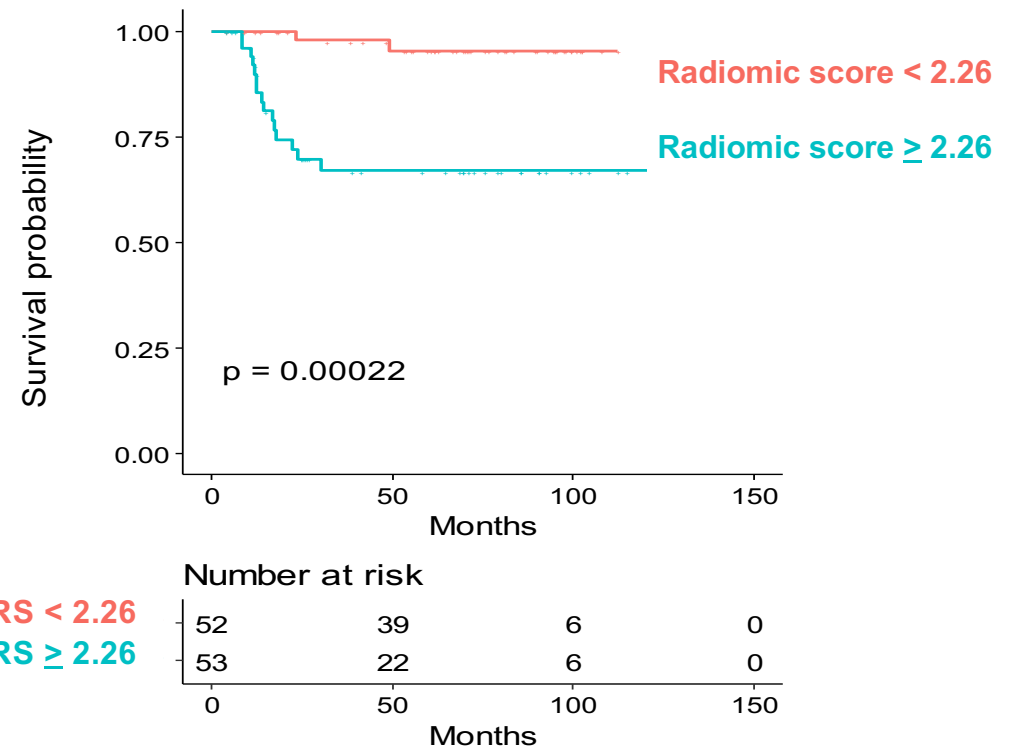


## Results – LPFS

Median follow-up 5.8 years

**Tumor stage IVB and age** acted as negative prognosticators ( $p < .05$ ) in pure clinical model 1, while a **high radiomic score** resulted associated as well both in model 2 and 3.

Performances were as follows: Clinical model (C-index 0.78, IQR 0.65 – 0.86), radiomic model (C-index 0.69, IQR 0.66 – 0.85) clinical + radiomic model C (C-index 0.80, IQR 0.74 – 0.90).



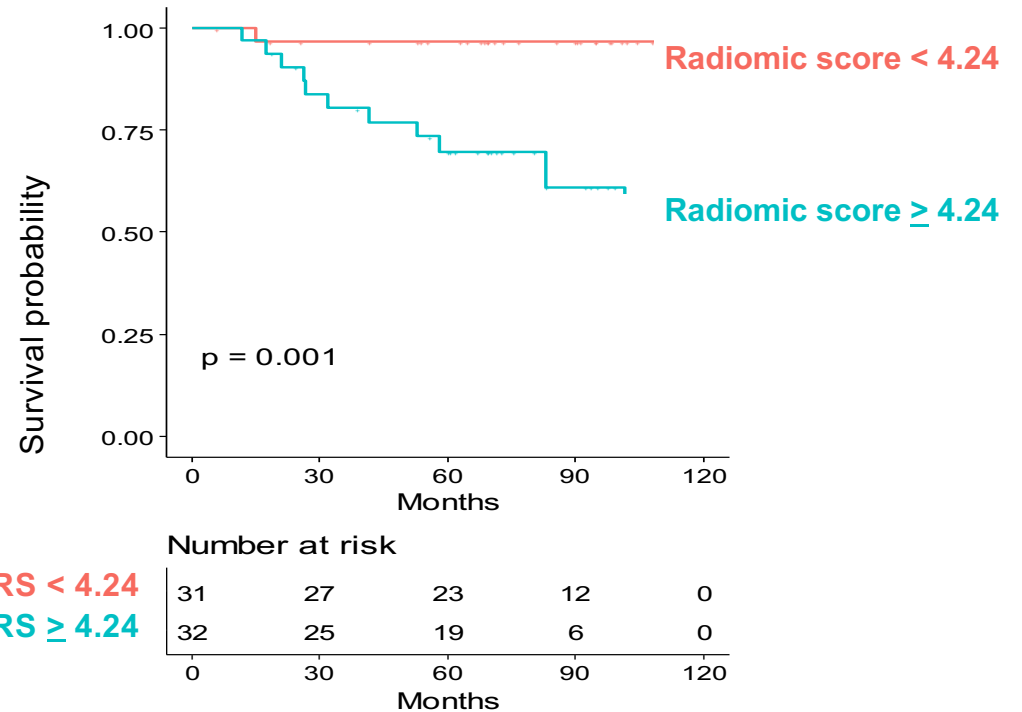




## Results – HPV+ Subgroup (n= 63)- OS

Median follow-up 6.0 years

**Lymphocyte/Monocyte Ratio lower than 2.6** had a detrimental prognostic effect ( $p < .05$ ) in model A (clinical), while a **high radiomic score** resulted associated as well both in models incorporating radiomic information

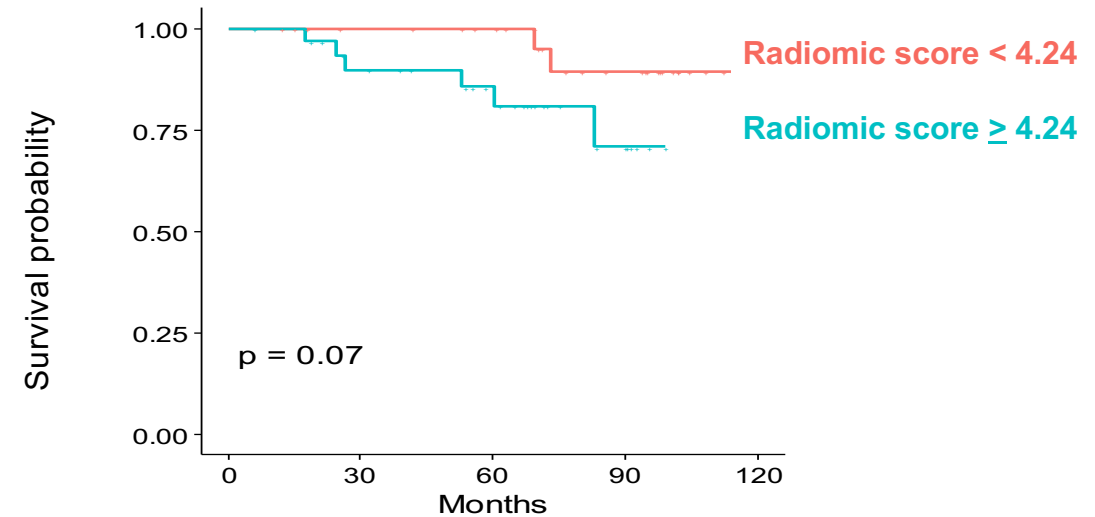




## Results – HPV+ Subgroup (n= 63)- LPFS

Median follow-up 6.0 years

**Hb** was associated with a worse prognosis ( $p < .05$ ) in model A (clinical), while again a **high radiomic score** resulted associated as well both in model B ( $p < .05$ ) and C ( $p < .001$ )

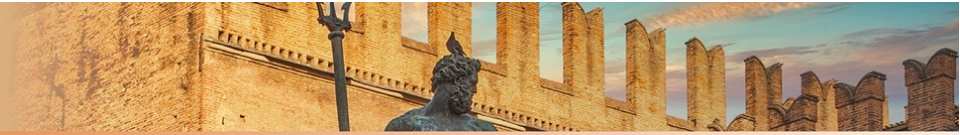


Number at risk

	0	30	60	90	120
RS $< 4.24$	31	27	24	13	0
RS $\geq 4.24$	32	25	18	5	0

Months





## Limitations and Strengths



### Limitations

- Retrospective study (i.e. missing HPV-status data)
- Rather limited sample size
- Lack of external validation (so far)



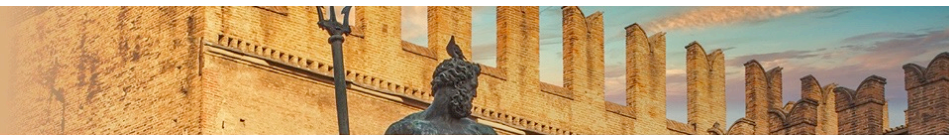
### Strengths

- Homogenous acquisition parameters and ROI segmentations
- Potentially relevant data (radiomics seems to add informative content in this setting)
- Integration of peripheral blood- and imaging- derived parameters

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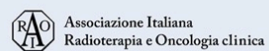
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## *Thanks for your attention!*

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