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RUOLO DELLA PET-TC CON ^{11}C -COLINA NEL PLANNING RADIOTERAPICO DEI PAZIENTI CON ADENOCARCINOMA DELLA PROSTATA

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Review – Prostate Cancer

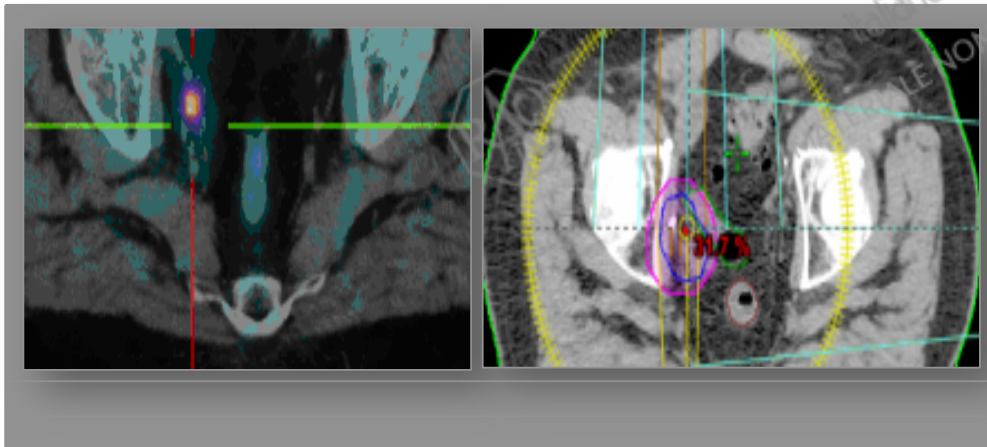
The Role of ^{11}C -Choline and ^{18}F -Fluorocholine Positron Emission Tomography (PET) and PET/CT in Prostate Cancer: A Systematic Review and Meta-analysis

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Patients' Characteristics

From September 2011 to January 2016, 135 consecutive patients referred to our Institution and investigated with ¹¹C-Choline PET prior to radiotherapy, were enrolled.



CHARACTERISTICS	Nr. (%)
No. patients	135
Age Range	69 years (53-89)
Initial PSA Median (range)	3.56 ng/ml (0,19-387)
Post-treatment PSA Median (range)	0.81 ng/ml (0.01-84)
Gleason score Median (range)	7 (5-10)
Planned Radiotherapy	
Radical intent	28 (20,7%)
Adjuvant therapy	13 (9,6%)
Salvage therapy	50 (37.1%)
Re-irradiation	19 (14,1%)
Metastatic treatment	25 (18,5%)

Radiotherapy prescription according to PET results

RT purpose	Indication Confirmed		Indication Changed		Total no. of pts	
	No. pts	%	No. pts	%	No. pts	%
Radical	16	57.2	12	42.8	28	100
Adjuvant/Salvage	30	47.6	33	52.4	63	100
Reirradiation	10	52.6	9	47.4	19	100
Metastases	13	52.0	12	48.0	25	100
Total no. of pts	69	51.1	66	48.9	135	100

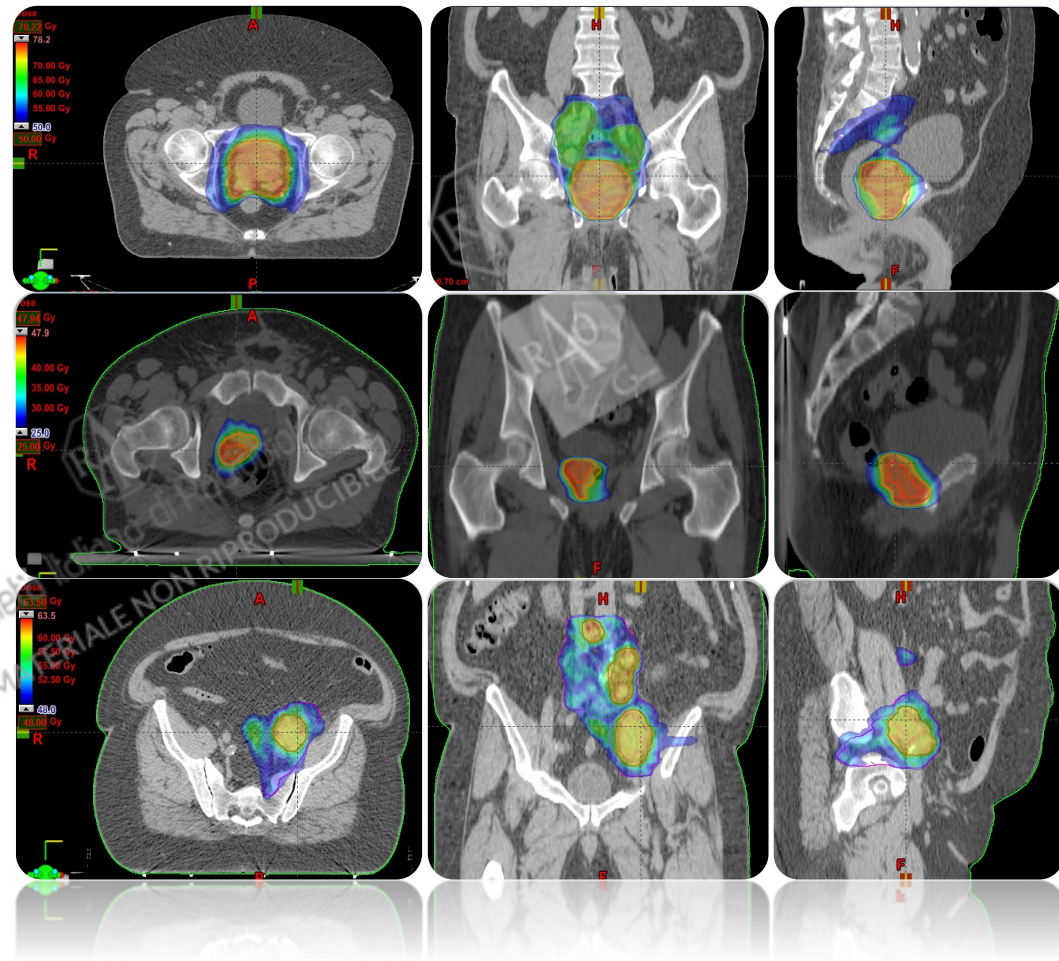
Findings

Radical RT was planned for 28 patients: of these, 11 received an additional boost on positive nodes, while 1 patient presented with metastatic disease and was treated according to the new stage.

Adjuvant or salvage therapy was planned in 63 patients: 22 patients received a boost on positive nodes, 5 oligometastatic patients received RT on visible lesions, while the remaining 6 patients presented multiple metastases.

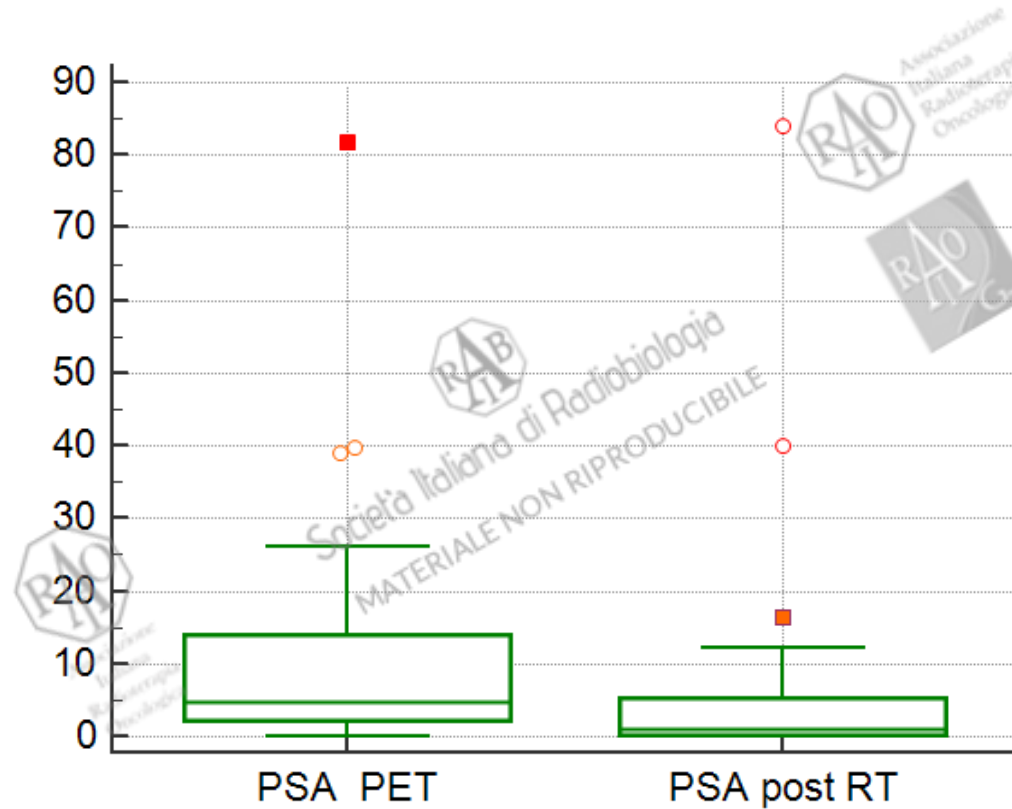
Re-irradiation was planned in 19 patients: 4 were upstaged for distant metastases and excluded, 5 were excluded because of a negative scan.

Out of 25 patients scheduled for target **RT on metastatic** lesions, 12 had a change in their treatment plan .



Choline PET determined a change in treatment management in 48.9% of the cases: in 42.8% of patients candidate to radical RT, 52.4% of patients undergoing adjuvant or salvage RT, 47.8% of patients with relapsed or metastatic disease.

Paired samples t-test



Mean
95% CI for the mean

9.9 ng/ml
6.2 – 13.7

5.05 ng/ml
1.6 – 8.4

$p = 0.05$

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Review article

Meta-analysis of ^{11}C -choline and ^{18}F -choline PET/CT for management of patients with prostate cancer

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The aim of the study was to evaluate the diagnostic accuracy and clinical aspects of ^{11}C -choline and ^{18}F -choline PET/computed tomography (CT) in patients with prostate cancer. A meta-analysis of original studies from 1998 to September 2013 that described choline PET/CT scans for prostate cancer was conducted. We assessed the main sites of positive findings and the relationship between positive findings and histology, change of treatment and serum prostate-specific antigen (PSA) response to the changed treatment. A total of 3167 patients from 47 eligible articles were assessed with respect to their findings on choline PET/CT during staging and restaging for biochemical recurrence. We examined 661 patients at staging and 158 patients at restaging for biochemical recurrence after external beam radiotherapy. These patients had positive results in the prostate bed more often than did the 2348 patients with biochemical recurrence after radical prostatectomy ($P < 0.001$, χ^2 -test). On assessing 609 patients, the pooled sensitivity of choline PET/CT for pelvic lymph node metastases was found to be 0.62 [95% confidence interval (CI) 0.51–0.66] and the pooled specificity was found to be 0.92 (95% CI 0.89–0.94).

Head-to-head studies of 280 patients showed that more patients had positive findings with choline PET/CT than with bone scanning [127 (45%) vs. 46 (16%), odds ratio 2.8, 95% CI 1.9–4.1, $P < 0.0005$, Wilcoxon rank test]. Choline PET/CT led to a change in treatment in 381 (41%) of 938 patients. The changes yielded complete PSA response in 101 of 404 (25%) patients. ^{11}C -choline or ^{18}F -choline PET/CT is useful as the first imaging examination for patients with prostate cancer and biochemical recurrence with PSA levels between 1.0 and 50 ng/ml. *Nucl Med Commun* 35:221–230 © 2014 Wolters Kluwer Health | Lippincott Williams & Wilkins.

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Keywords: meta-analysis, PET, prostate cancer, staging, treatment

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Guidelines

EAU-ESTRO-SIOG Guidelines on Prostate Cancer. Part II: Treatment of Relapsing, Metastatic, and Castration-Resistant Prostate Cancer

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Conclusions

Theragnostic imaging for radiation oncology: dose-painting by numbers

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Theragnostic imaging for radiation oncology is the use of molecular and functional imaging to prescribe the distribution of radiation in four dimensions—the three dimensions of space plus time—of radiotherapy alone or combined with other treatment modalities in an individual patient. Several new imaging targets for positron-emission tomography, single-photon-emission CT, and magnetic resonance spectroscopy allow variations in microenvironmental or cellular phenotypes that modulate the effect of radiation to be mapped in three dimensions. Dose-painting by numbers is a strategy by which the dose distribution delivered by inverse planned intensity-modulated radiotherapy is prescribed in four dimensions. This approach will revolutionise the way that radiotherapy is prescribed and planned and, at least in theory, will improve the therapeutic outcome in terms of local tumour control and side-effects to unaffected tissue.

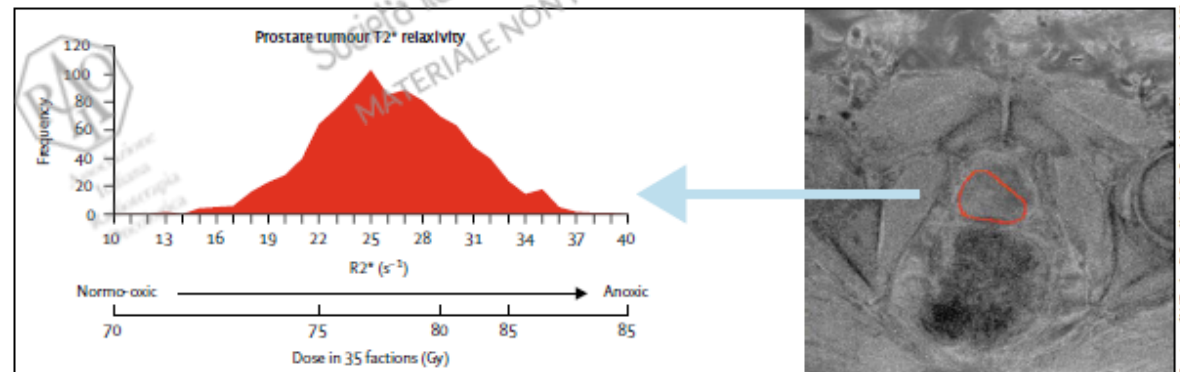


Figure 2: BOLD MR Image of a patient with prostate cancer

The region of interest was defined from haematoxylin-eosin staining of the prostate sections and transferred to the MR Image. The distribution of $R2^*$ values in the region of interest covers the range of oxygenation status from normal to anoxic. Dose-painting by numbers involves the prescription of a specific, physically absorbed dose of radiation on a voxel-by-voxel basis according to a defined prescription function as indicated by the non-linear scale below the histogram.