Evaluation of 68-Ga PSMA PET/CT imaging in individuals with biochemical recurrence following radical prostatectomy

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INTRODUCTION

Prostate specific membrane antigen (PSMA) is a transmembrane protein that is expressed in most prostate cancers, thus presenting a unique imaging target for the detection of prostate cancer recurrence. This study aimed to investigate the correlation between prostate specific antigen (PSA) level and positive findings on the 68Ga-PSMA PET/CT (PSMA PET) scan in patients with biochemical recurrence following radical prostatectomy.

METHOD

We conducted a retrospective analysis of our institutional prospective database between February 2015 to August 2017 to identify patients with biochemical recurrence (BCR) who underwent PSMA PET scans following radical prostatectomy for prostate cancer.

The probability of a positive PSMA scan with BCR was then analysed. A maximum SUV of 2.6 in locations not associated with physiologic or reactive uptake on PSMA PET was deemed consistent with a positive scan.

Three hundred and ninety one patients met the inclusion criteria for the study. The median PSA level at the time of the initial PSMA PET was 2.05ng/ml with a range between 0.01-36ng/ml.

The detection rate of PSMA PET increased with higher levels of PSA. With PSA levels lower than 0.5ng/ml, detection rates were less than 50%. This improved to 92% successful detection of a focus of recurrent disease with PSA levels > 2.0ng/ml. Across the range of PSA values, soft tissue (nodal) disease is more frequently identified when compared to local recurrence or skeletal disease.

PSA level	Sample size	Number of positive patients	Detection rate (%)	PSA level	Bone (%)	Nodal (%)	Local (%)
				<0.2ng/ml (n=41)	10 (24%)	26 (63%)	12 (29%)
<0.2ng/ml	97	41	42%	0.2-<0.5ng/ml (n=48)	13 (27%)	26 (54%)	15 (31%)
0.2-<0.5ng/ml	101	48	48%	0.5-<1.0ng/ml (n=36)	7 (19%)	28 (78%)	7 (19%)
0.5-<1.0ng/ml	54	36	67%				
1.0-<2.0ng/ml	39	33	85%	1.0-<2.0ng/ml (n=33)	13 (39%)	22 (67%)	9 (27%)
>2.0ng/ml	100	92	92%	>2.0ng/ml (n=92)	29 (32%)	66 (72%)	36 (39%)
Total (overall)	391	250	64%				

Table 1 (L) Detection rates of PSMA PET following radical prostatectomy based on PSA banding
Table 2 (R) Regions of detection of PSMA PET following radical prostatectomy based on PSA banding
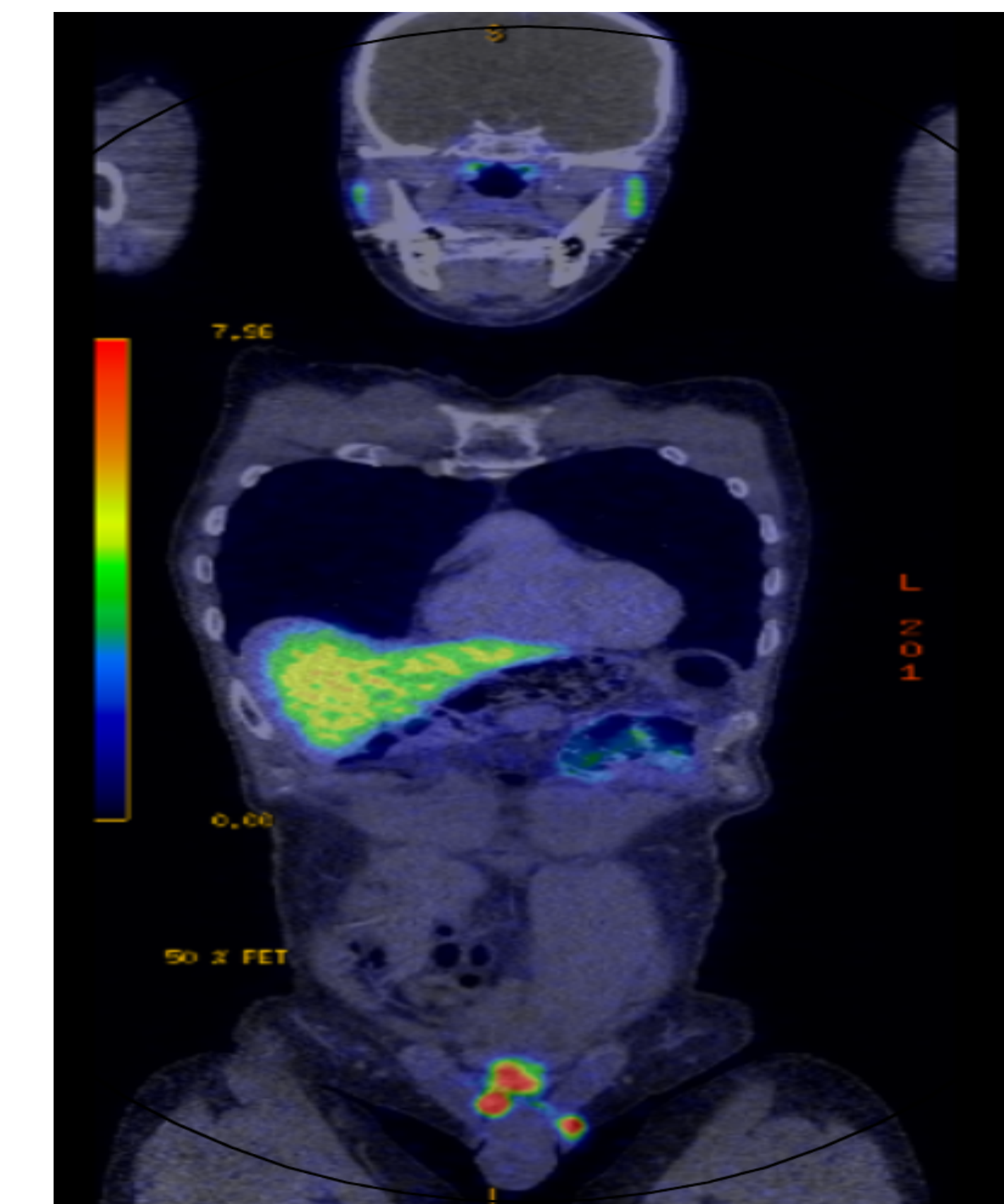

Figure 1. 68yo male with rising PSA on a background of radical prostatectomy in 2010 who was referred for re-staging. 68-Ga PSMA PET/CT demonstrated five foci of avid PSMA positivity in the base of the penis/scrotum in keeping with residual neoplastic disease.

CONCLUSIONS

There is a positive correlation with increasing PSA levels and the detection rates of recurrent prostate cancer utilising PSMA PET. With PSA levels greater than 1.0ng/ml, the clinical utility appears readily noted.

Further analysis of pathological features such as tumour grade, stage, margin status and lymphovascular involvement may provide additional information regarding correlation between PSMA PET results and recurrent disease.

Furthermore, the impact on treatment of PSMA PET results needs to be evaluated for it's use in the management of patients with recurrent disease.