

Prostate-Specific Membrane Antigen PET-CT findings in biochemical relapse after prostatectomy

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Background

Surveillance for recurrence after radical prostatectomy for prostate cancer is carried out by serial measurement of Prostate-Specific Antigen (PSA). PSA is expected to fall to undetectable levels after prostatectomy. A rise is suggestive of so-called 'biochemical relapse', indicating that imaging should be performed to interrogate the potential site of disease recurrence, to determine whether salvage curative treatment (with external beam radiotherapy) is possible. Depending on the risk group of the disease, the incidence of relapse at 15 years is between 16 and 46% (1).

The imaging modality of choice to look for site of recurrence is PSMA PET-CT, which can provide both anatomical and function information (see Images 1 & 2) to accurately determine areas involved by prostatic carcinoma. In the UK, common practice is to use a PSA threshold of 0.2 ng/ml to trigger investigation after radical prostatectomy. In this study, we investigated the PSMA PET-CT findings of patients with biochemically recurrent prostate cancer and the PSA values at which these scans were performed to assess the utility of PSMA-PET at even very low PSA values and determine whether a PSA trigger of 0.2 ng/ml is rational.

Methods

A retrospective review of all patients undergoing PSMA PET-CT for biochemical relapse after radical prostatectomy at the Royal United Hospital, Bath, UK between August 2020 and February 2024.

PSMA-PET Result	No. of Patients	Minimum PSA	Median PSA
Negative	14	<0.1	0.2
Equivocal	4	0.3	0.5
Positive	19	0.04	0.7
Total	37	0.04	0.4

Table 1: PSA values by PET-CT result

Chart 1: PSMA PET Results - All Patients

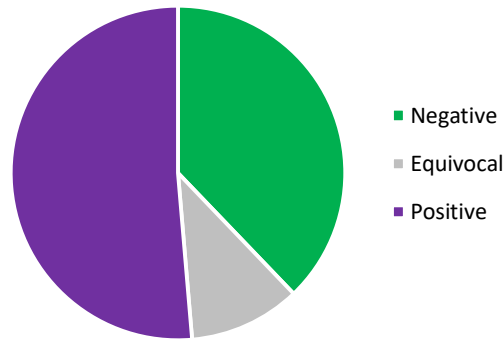


Chart 2: Positive PET-CT - Sites of PSMA-Avid Disease

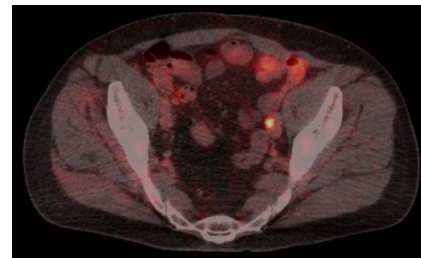
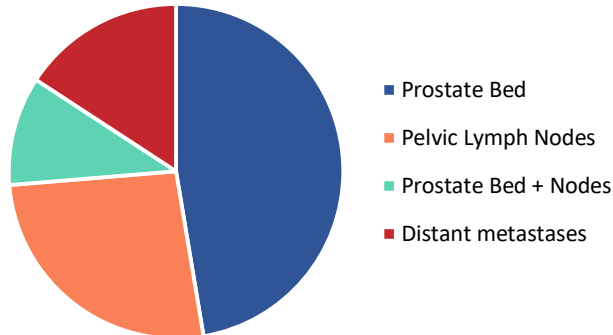


Image 1: PSMA PET-CT image showing avid disease recurrence in a left external iliac lymph node, encompassable in a pelvic nodal radiotherapy field

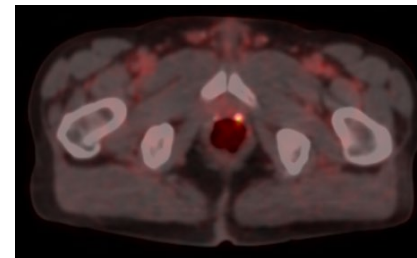


Image 2: PSMA PET-CT image showing avid disease recurrence in the prostate resection bed, encompassable in a prostate bed radiotherapy field

Results – Radiotherapy

10 of the 16 patients with potentially salvageable PET-avid disease went on to have curative-intent radiotherapy to the prostate bed +/- pelvic lymph nodes. On the basis of a PSA rise, but with either negative or equivocal PET findings, a further 8 patients received salvage prostate bed radiotherapy.

PSMA-PET Result	Proportion of Patients Receiving Radiotherapy
Negative	50%
Equivocal	25%
Positive	53%

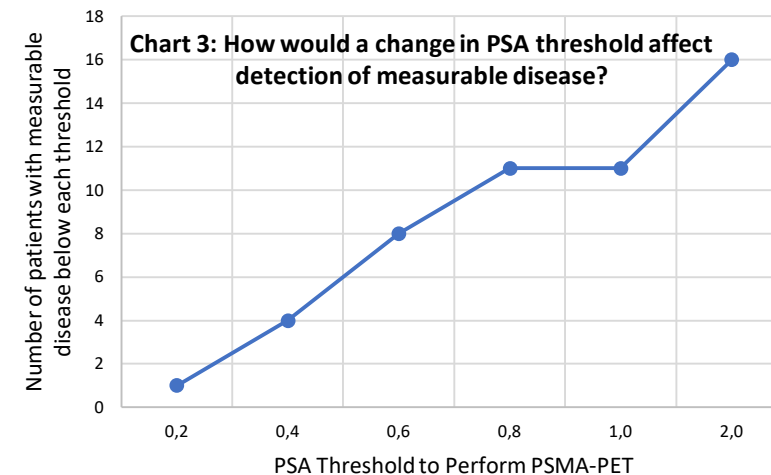
Table 2: Patients receiving radiotherapy by PET-CT result

Discussion and Conclusion

PSMA PET-CT was able to detect prostate cancer even at very low PSA levels, though the median PSA of patients with a positive scan result was 0.7 ng/ml. Use of PET-CT assisted the decision to allow 51% of patients to delay or avoid radiotherapy, either because their disease was non-radically treatable or because PSA surveillance could be offered.

In Chart 3, we show that in the hypothetical scenario of raising the PSA threshold to trigger performing a scan, a consistently increasing number of patients would fall below the threshold to scan, so the current UK practice of imaging when PSA reaches ≥ 0.2 ng/ml seems appropriate.

There was no clear threshold at which PSMA PET-CT scans were unhelpful. Notably, the highest minimum PSA value (0.7 ng/ml) and median PSA value (2.1 ng/ml) occurred in patients with distant metastatic disease.



1. Falagarío et al. Biochemical Recurrence and Risk of Mortality Following Radiotherapy or Radical Prostatectomy. JAMA Netw Open. 2023;6(9):e2332900.

Results – PSA and PET findings

37 PSMA PET-CT scans were performed to look for relapse after radical prostatectomy. The lowest PSA that triggered a scan was 0.04 ng/ml, although this was the only reading that was measured to this degree of precision. The highest PSA in this cohort was 9.1 ng/ml.

The minimum and median PSA values for patients categorised by presence of disease on PET is shown in Table 1.

14 patients had no disease evident, and 19 patients had clear PET-avid disease on the scan (Chart 1). 16 of the 19 PET-positive patients had disease in the prostate bed, pelvic lymph nodes or both, but no distant disease (Chart 2), therefore making them potentially suitable for salvage treatment with radiotherapy. Only a small proportion (8.1%) had evidence of distant metastatic disease, that would preclude curative treatment.