



MOLECULAR IMAGING NEWS

Phoenix Molecular Imaging

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Carbon-11 Acetate PET/CT Imaging for Prostate Cancer

The treatment landscape for prostate cancer has been revolutionized by the arrival of multiple novel treatment approaches and agents over the last few years. After initial treatment with surgery or radiation however, up to 40% of patients will experience PSA relapse. Knowing the location of a cancer recurrence is important since recurrence in the prostate bed or pelvic lymph nodes may be amenable to additional focal therapy. Finding lesions outside of the pelvis (distant metastases) may require systemic treatment with hormones combined with radiation or other focal treatment.

The primary difficulty in this situation is that standard imaging techniques such as technetium bone scan, CT scans and MRI are usually unable to see small recurrent tumors or metastases. On the other hand, PET scans that work by exploiting various aspects of cancer metabolism, can often visualize and locate these small tumors.

Carbon-11 (C11) Acetate PET/CT is an imaging technique that has been shown to be very useful in patients with prostate cancer. In prostate cancer, there is an increase in fatty acid metabolism which is due, in part, to the up-regulation of intracellular fatty acid synthase. C11-Acetate is able to visualize this metabolic process and can thereby detect and localize recurrent prostate cancer and prostate cancer metastases. Lymph node lesions as small as 4-5 mm can be identified by this technique.

Phoenix Molecular Imaging and C11-Acetate

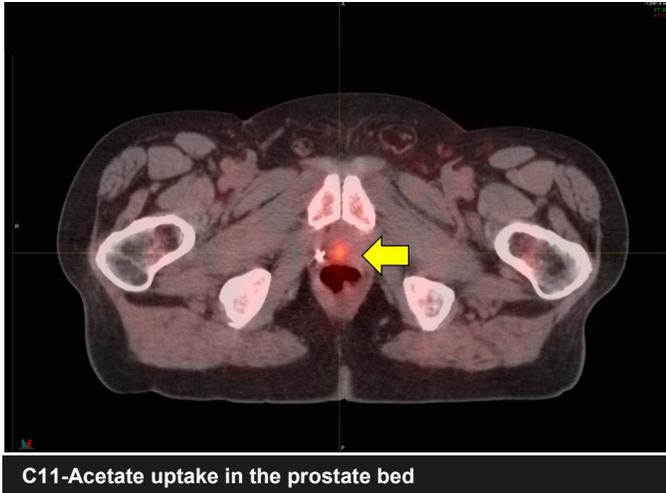
A open access clinical trial study evaluating C11 Acetate PET/CT has been conducted by Phoenix Molecular Imaging under the direction of Fabio Almeida MD. In this study, over 1000 patients with recurrent prostate cancer (as evidenced by a rising PSA) have been studied using a high resolution PET/CT camera. The study has demonstrated an overall detection rate of 88%. The PSA level is being shown to have an influence on the detection rate. When the PSA is > 1.0 ng/mL the detection rate is 90%. With a PSA of 0.2 - 1.0 ng/mL the detection rate is 74%. The doubling time (or rate of PSA rise) also appears to have an influence, such that when the PSA is <1.0 and the doubling time is < 3 months, the detection rate is increased to 90%.



PET/CT Camera at Phoenix Molecular Imaging

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C11-Acetate uptake in the prostate bed

Case Example 1

Mr. V is 76 years old and was diagnosed with Prostate Adenocarcinoma (PCa) in 2000. His Gleason score was 8 (4+4) and his PSA was 4.0. He underwent a prostatectomy in 2001 and his PSA remained <0.1 for several years.

His PSA then began to rise and by 2011 his PSA was 3.3 ng/mL and doubling at a rate of 10.9 months.

A C11-Acetate PET/CT imaging study was performed which showed a small recurrence of the cancer in the prostate bed (yellow arrow on image above). No involved lymph nodes were detected and no lesions were seen on the C11 study to suggest distant metastatic disease.

Based on the results of the C11-Acetate imaging study, Mr. V proceeded with Intensity Modulated Radiation Therapy (IMRT) to the prostate bed. The radiation therapy plan was modified from the typical “blind” application of radiation to this region. Instead, the area of recurrent cancer identified on the imaging study was centered on by the radiation and less radiation was then given to the surrounding areas, including the urinary bladder and rectum.

How has he done?

After his radiation treatment, the PSA fell to <0.1 ng/mL and has remained stable at that level for 4 years. He experienced no side effects from the radiation treatment and no other treatment has thus far been necessary. He is happy that he has not yet needed to start hormone therapy.

Case Example 2

Mr. S is 69 years old and was diagnosed with PCa in 2010. His Gleason score was 8 (4+4) and his PSA was 4.8ng/mL. He underwent a prostatectomy at which time extracapsular extension was found.

After surgery his PSA was initially undetectable, but it began to rise a few months later and within a year his PSA had risen to 0.5 ng/mL, with a doubling rate of 3.18 months.

Mr. S’s urologist told him it was most likely that the cancer had metastasized, and probably involved the bone given how quickly his PSA was rising. A technetium bone scan was performed, which was negative for bone metastasis. Even so, he was advised to begin hormone therapy as his best option.

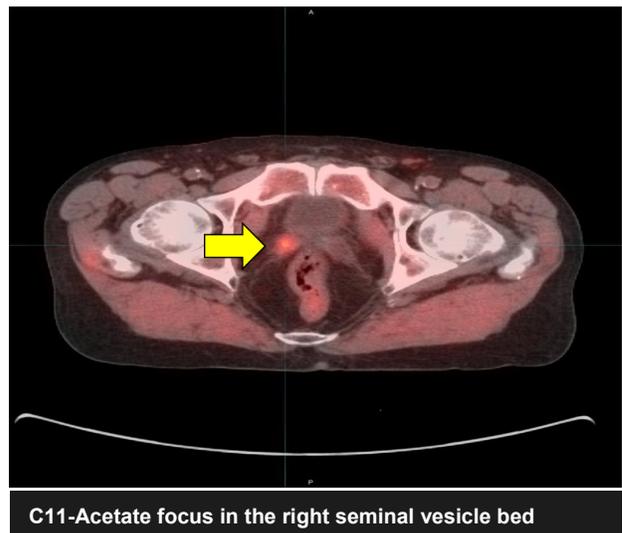
Mr. S was not ready to start hormone therapy based on the above information...

A C11-Acetate PET/CT imaging study was performed which showed a small focus of increased metabolism in the right seminal vesicle bed (yellow arrow on image below). This indicated locally residual cancer left behind after surgery which was now growing. There were no involved lymph nodes on the scan and no lesions were seen on the C11 study to suggest distant metastatic disease to the bone or elsewhere.

Based on the C11-Acetate imaging study, Mr. S underwent IMRT. The radiation therapy was performed to the entire prostate bed region but also with a radiation “boost” to the area of cancer noted on the imaging study.

How has he done?

After his radiation treatment, his PSA fell to <0.1 ng/mL and has remained stable at that level for 3 years so far. He experienced no side effects from the radiation treatment and has not yet had to start any hormone therapy.



C11-Acetate focus in the right seminal vesicle bed

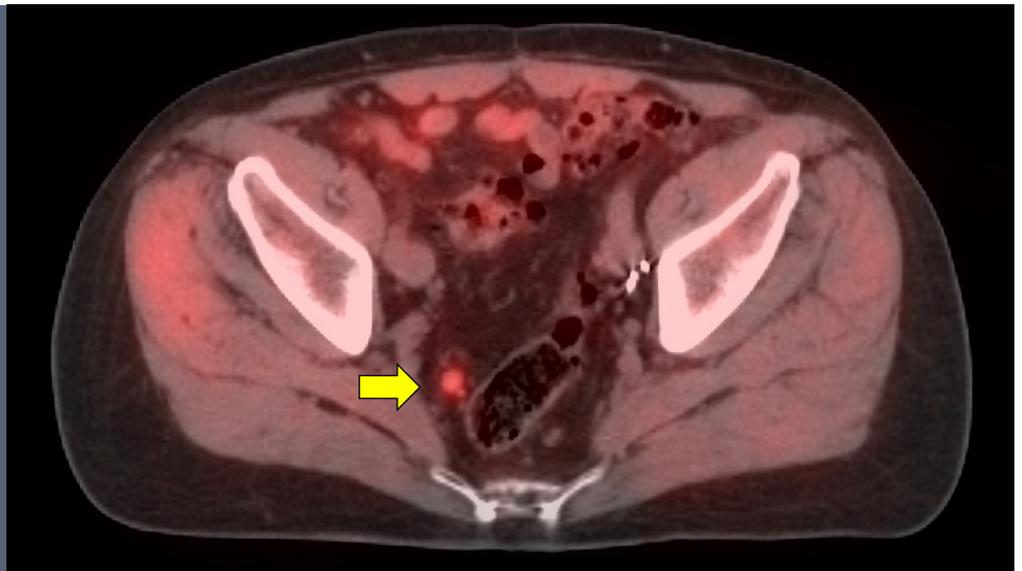
C11-Acetate appears superior to C11/F18 Choline

The overall detection rate for cancer recurrence or metastatic disease with C11-Acetate is 88% which compares to 74% for C11-Choline - as reported by Mitchell et.al [*J Urol* 189(4): 1308-1313].

Lesion detect at lower PSA levels (<1.0ng/mL) are of particular clinical interest, as it is at this range where many treatment decisions are made, such as otherwise “blind” radiation to the prostate bed or the initiation of hormone therapy. C11—or F18 Choline performance in this range is poor, with a detection rate of only 44%. This compares to a much higher detection rate of 74% for C11-Acetate.

Additionally, when performed in the context of a low doubling time (<3 months), the detection rate for C11-Acetate in this low PSA range is 90%.

C11-Acetate can be useful to assist with treatment decisions by providing targets for focal salvage treatment, adding treatment options at least 40% of the time.



C11-Acetate uptake in a right peri-rectal lymph node

Case Example 3

Mr, W is 72 years old and was diagnosed with PCa in 2006. His Gleason score was 9 (5+4) and his PSA was 10.8. He underwent a prostatectomy and his PSA remained <0.1 for 7 years.

His PSA then began to rise, and by 2013 it was 0.63 ng/mL with a doubling rate of 9.3 months. An abdominal and pelvic CT scan as well as technetium bone scan were negative.

A C11-Acetate PET/CT imaging study was performed which showed a small metabolic 9 mm lymph node to the right of and next to the rectum (yellow arrow on image above). No metabolic lesions were seen in the prostate bed and no lesions were seen on the C11 study to suggest distant metastatic disease.

Radiation treatment to the prostate bed with radiation extending to the pelvic lymph nodes is technically viable. His case was complicated, however, by a history of ulcerative colitis, making standard radiation problematic. He opted to undergo Intensity Modulated Proton Therapy. The proton therapy was administered to the pelvic lymph nodes detected on the C11-Acetate imaging alone. The C11-Acetate images were electronically integrated into the treatment plan to help guide the proton therapy.

How has he done?

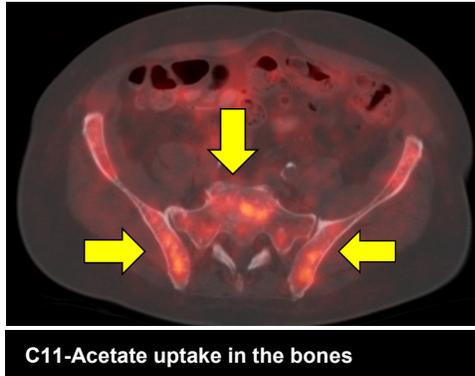
His PSA decreased to <0.1 ng/mL and has remained at that level for 20 months so far after his proton radiation treatment,. He experienced no side effects from the radiation treatment and has not had any exacerbation of his ulcerative colitis. He will continue to follow his PSA.

Case Example 4

Mr. SE is 74 years old and was diagnosed with PCa in 2003. His Gleason score was 6 (3+3) and his PSA was 10.4 ng/mL. He underwent a high dose brachytherapy to the prostate (HDR). In 2008 his PSA began to rise and a Combix study showed involvement of left pelvic lymph nodes. He had IMRT radiation to the lymph nodes but his PSA did not respond. He was treated with Cytoxan, Luekine, and Metformin. His PSA continued to rise. A CT scan in 2013 showed no evidence of metastatic disease. By 2015 his PSA had risen to 7.46 ng/mL with a doubling rate of 7.9 months.

A C11-Acetate PET/CT imaging study was performed which showed diffusely increased metabolism in the bone associated with innumerable tiny areas of scarring/sclerosis (yellow arrows on image to the right). This was indicative of diffuse bone metastasis.

Based on the C11-Acetate imaging study, Mr. SE underwent a bone biopsy which confirmed the presence of bone metastasis. He was started on systemic treatment with hormone therapy.



C11-Acetate uptake in the bones

C11 Acetate guided Treatment & Response

In our study, salvage radiation treatment to the lesions identified by C11-Acetate was performed either alone or conjunction with hormone therapy in a large number of patients (40%). Follow up of these patients to assess the duration of PSA response is ongoing. Thus far, in those treated with radiation treatment alone, 50% have shown a persistent drop in PSA for at least 1 year. In those patients for which greater than 3 years of follow up is available, 29% continue to have a durable PSA response to treatment and have not yet required additional treatment. These results are very encouraging. An even larger number of durable PSA responses will be expected in those who receive C11 Acetate guided radiation treatment and also at least a short course of hormone therapy.

Summary

C11-Acetate PET/CT imaging appears highly useful in men with recurrent prostate cancer. It has a high detection rate even at low PSA levels, and in many cases identifies areas of recurrent or regionally metastatic disease that can be treated with radiation or other focal therapy. Treatment with hormone therapy may be avoided or significantly delayed. In other cases, C11-Acetate may show evidence of distant metastatic disease not seen by other techniques, thereby helping to better identify situations where systemic/hormone therapy is the most appropriate course of action.

Contact Us

Give us a call for more information about C11-Acetate PET/CT Imaging

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