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# F-18 Fluciclovine (Axumin™) Positron Emission Tomography: The New Kid On The Block

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# Introduction

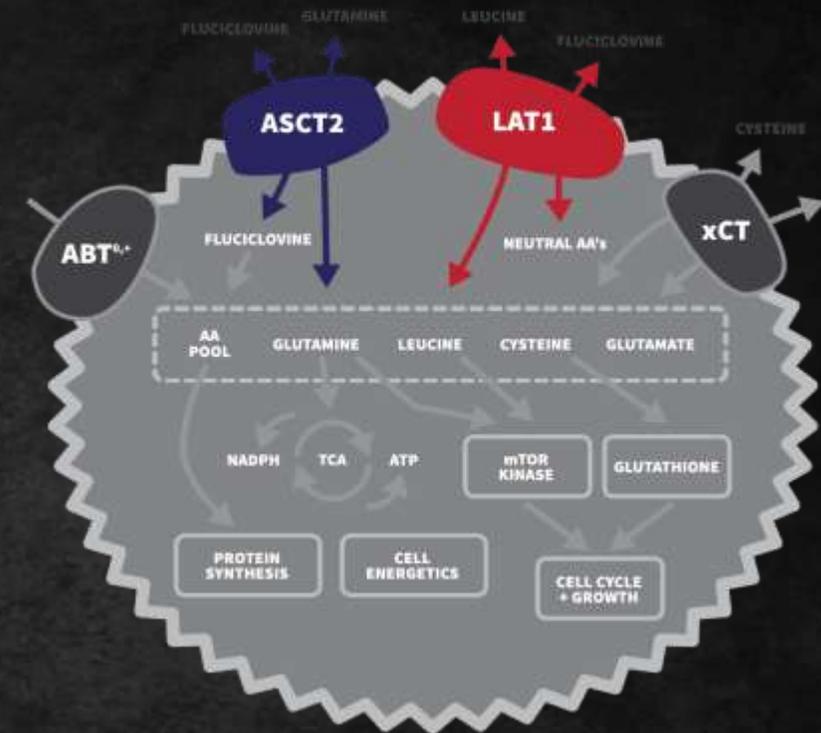
- Prostate cancer is the leading non-skin malignancy in the United States and the second most common cause of cancer-related mortality
- Since the advent of prostate specific antigen (PSA) serum testing, most cases of prostate cancer are detected while still localized to the prostate gland, enabling treatment by surgical prostatectomy and/or radiation therapy
- Following treatment, patients are monitored with PSA testing and although often curative, approximately 30% of patients experience a recurrence of their cancer, detected as a rising PSA, termed biochemical recurrence
- Prostate cancer recurrence may be classified as local, locoregional, or systemic
  - Type of recurrence influences the choice of therapy offered
- Detection of extraprostatic recurrence by conventional imaging is very low, **11%** in one study, and therefore there is a significant need for more sensitive imaging to detect locations of recurrence

# Molecular Imaging Agents

- The first commercially available FDA-approved prostate specific membrane antigen (PSMA) agent is In-111 capromab pendetide (ProstaScint<sup>®</sup>)
- New prostate cancer positron emission tomography (PET) agents have recently been developed
  - F-18 Fluciclovine (Axumin<sup>™</sup>)
  - Ga-68 PSMA
  - C-11 Choline
  - C-11 Acetate
  - F-18 Choline

# F-18 Fluciclovine

- Trade name Axumin™
- Synthetic amino acid most similar to glutamine, an important substrate for tumor metabolism
- Enters cells via amino acid transporters **LAT1** and **ASCT2**, which are upregulated in cancer cells, most notably prostate cancer
  - **LAT1** and **ASCT2** transporters associated with aggressive cancers
- Unlike other amino acids used in metabolic imaging, F-18 Fluciclovine is not metabolized or incorporated into proteins



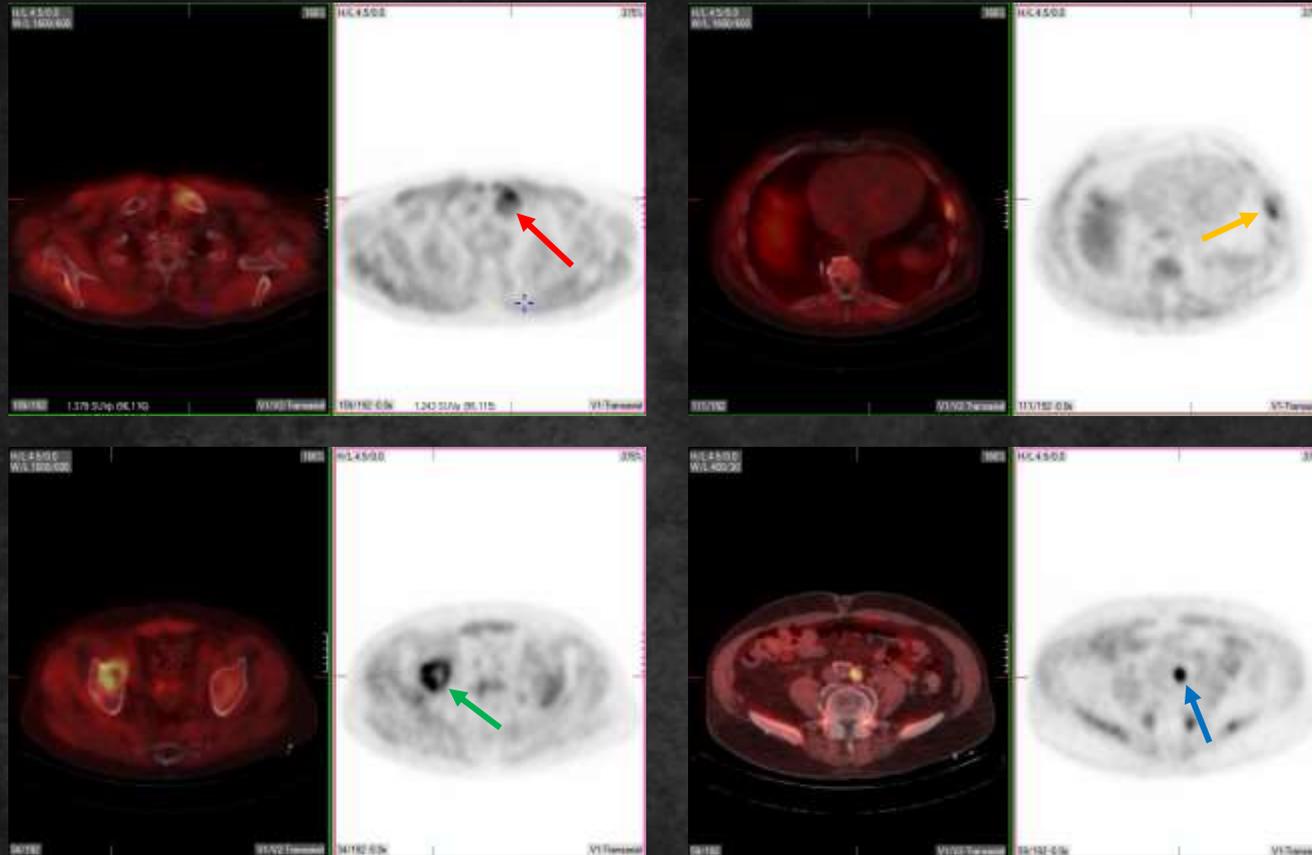
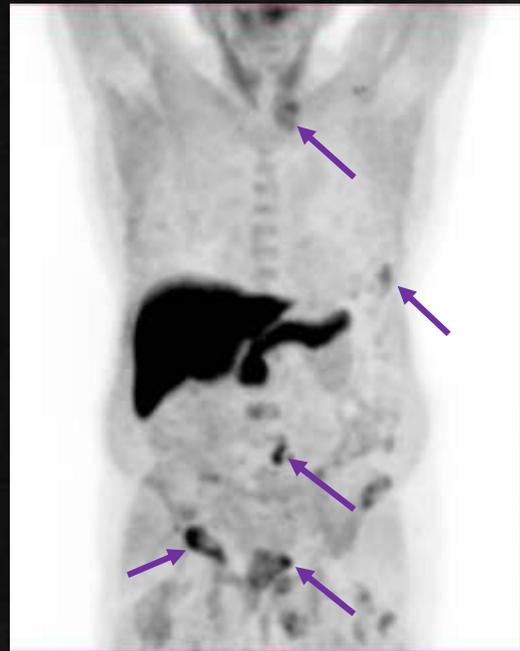
# F-18 Fluciclovine

- F-18 Fluciclovine studies are most likely to be positive with **PSA levels >1 ng/mL**, however can be positive with lower PSA levels
- **82%** positive predictive value for tumor localization when used in combination with MRI
- Demonstrates utility in further workup in the setting of a negative bone scan
- Less sensitive for osseous metastases
- Initial images (<15 minutes) demonstrate most intense activity within the pancreas and the liver
- Interpretation is based predominantly on **qualitative** comparison to tissue background



Normal biodistribution

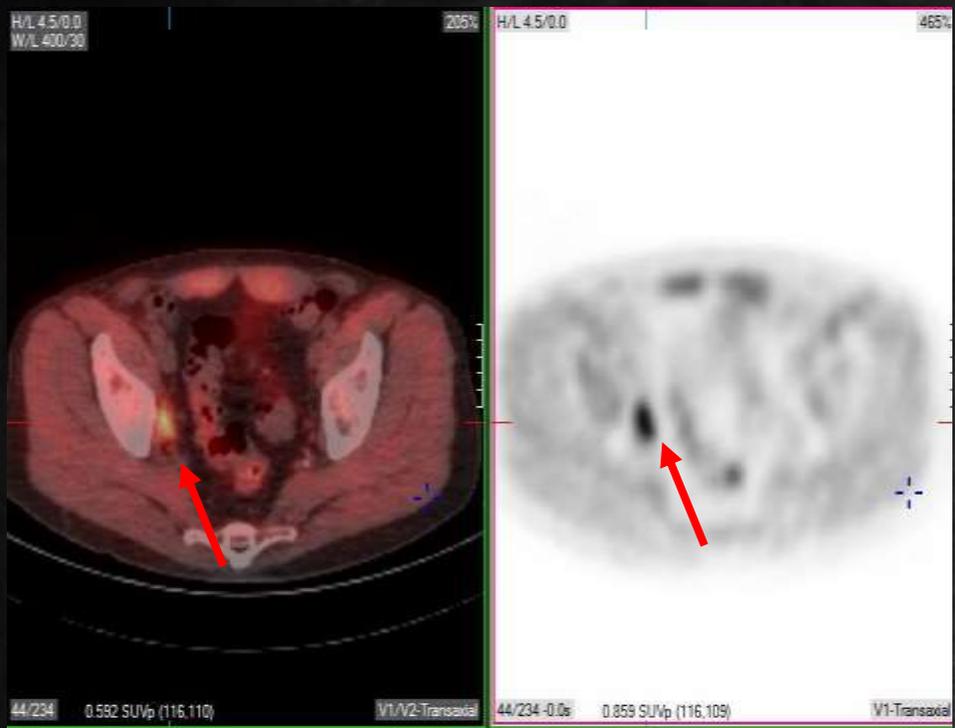
# Case 1: 86-year-old male with history of biochemical recurrence of prostate cancer. PSA 82 ng/mL.



Maximum intensity projection images (left) demonstrate multiple abnormal foci of **increased radiotracer uptake** throughout the chest, abdomen, and pelvis.

Select axial fused and PET-only images (right) demonstrate multiple foci of increased radiotracer uptake within **the left clavicle**, **left rib**, and **right acetabulum**. There is increased radiotracer uptake corresponding with an **enlarged para-aortic lymph node**. Findings compatible with metastatic disease.

Case 2: 57-year-old male with history of biochemical recurrence of prostate cancer status post prostatectomy. PSA = 2.7 ng/mL.

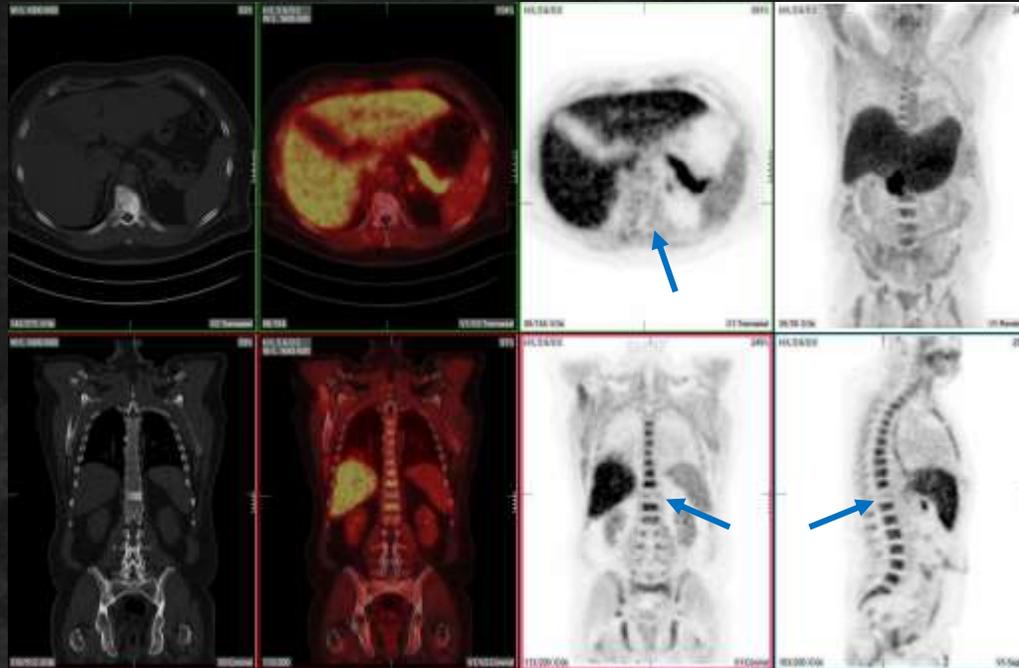
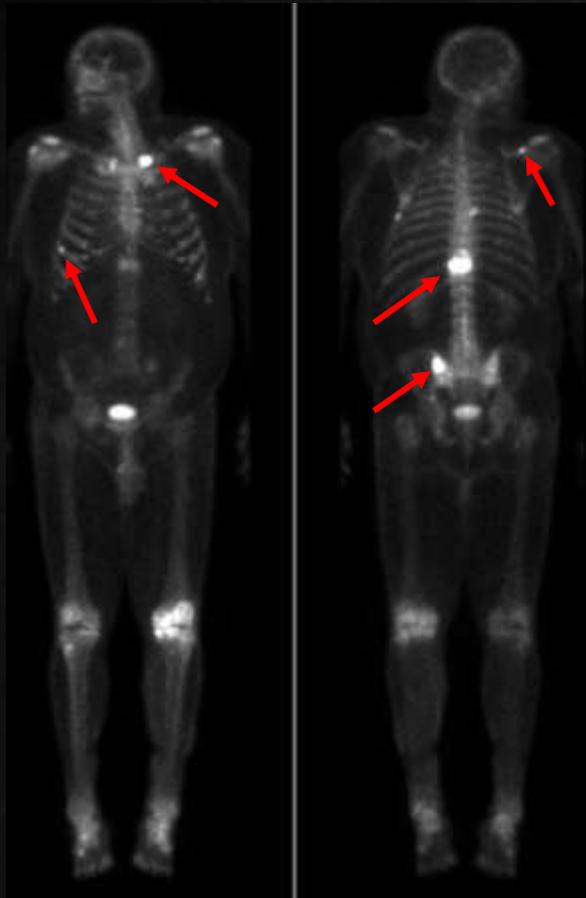


Foci of increased radiotracer uptake in the right obturator region corresponding with prominent but nonenlarged **external iliac chain lymph nodes**. Findings are compatible with metastatic disease.

# Pitfalls

- PSA <1 ng/mL
- Osseous metastases can result in photopenic defects
- Benign prostatic hyperplasia and inflammation (i.e. post radiation) can both result in nonmalignant uptake
- Pituitary adenomas, meningiomas, osteoid osteomas, and adrenal adenomas can result in focal uptake
- Bladder uptake
- Teratoma

# Case 3: 55-year-old male with history of prostate cancer and known osseous metastatic disease. PSA 1.1 ng/mL.



Bone scan (left) demonstrates **increased radiotracer uptake** in the right scapula, left medial clavicle, bilateral ribs, T11 vertebral body, and left pelvis.

F18-Fluciclovine PET (right) demonstrates a **photopenic defect** in the T11 vertebral body corresponding to diffuse sclerosis in the vertebral body and the known osseous metastatic disease.

# Conclusion

- F-18 Fluciclovine is a new and effective PET agent that can be used to diagnose local recurrent or distant metastatic disease in patients with a history of prostate cancer
- Knowledge of pitfalls as well as potential false positive and false negative uptake patterns is crucial for accurate diagnosis in these patients