Linking PET to Pathology: FES SUVmax Aligns with ER IHC and Accurately Classifies ER at Reduced Cutoffs

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Introduction

Breast cancer subtyping and receptor expression analysis by immunohistochemistry (IHC) is critical in determining treatment strategy.

^{18}F-16α-Fluoroestradiol (FES) positron emission tomography (PET) allows for noninvasive characterization of the estrogen receptor (ER) in patients with inaccessible biopsy sites, multiple lesions, or non-diagnostic pathology.

Though prior literature has shown FES SUVmax thresholds of 1.5-2.0 provide accurate classification of ER positivity, such studies are subject to small sample sizes and atypical analytical workflows.[1,2,3]

There remains limited data on the degree of FES uptake, measured by SUVmax, as a function of ER expression in biopsy samples.

Methods and Materials

Via a retrospective single center review, we evaluated 98 breast cancer patients who underwent FES PET-CT or FES PET-MR with existing biopsy ER IHC data within a +/-90-day window from FES PET.

ER IHC data was recorded, including % of cells staining (ER%) and ER staining intensity (1, 2, or 3+). Patients were excluded if surgical excision was performed on the biopsied site prior to FES PET.

SUVmax values of each biopsy site were analyzed via simple 3D ROI by a board-certified nuclear radiologist.

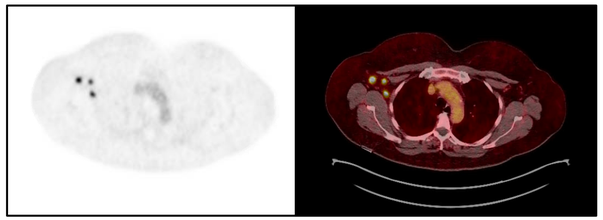


Figure 1. ^{18}F-FES PET-CT showing avid ER+ metastatic disease.

Results

Total Biopsies Included	34
Biopsy Location: Breast	13 (38.2%)
Biopsy Location: Locoregional	7 (20.6%)
Biopsy Location: Metastatic	14 (41.2%)
Time From Biopsy to FES-PET	13.8 ± 34.6 days
ER IHC Positivity	32 (Average ER% 70.8 ± 34.2%, 17 with 3+ staining).
Low Positive Cases (ER 1% - <10%)	3 (8.8%)

Table 1. Cohort Demographics and Characteristics.

ROC analysis determined SUVmax thresholds ≥1.4 accurately predict ER IHC positive status while retaining 100% specificity, with an AUC of 0.938, sensitivity of 87.5%, and overall accuracy of 88.24%.

6 cases were negative by the ≥1.4 threshold, displaying an average ER% of 34.3±49.1. 28 cases that tested positive by the ≥1.4 threshold displayed an average ER% of 78.6±25.1.

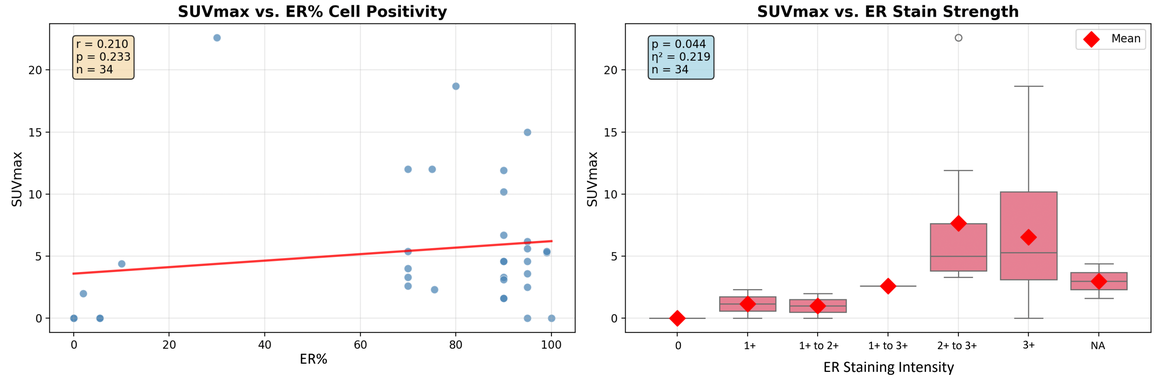


Figure 2. ER Analysis Results: FES SUVmax vs. ER% Cell Positivity and ER Staining.

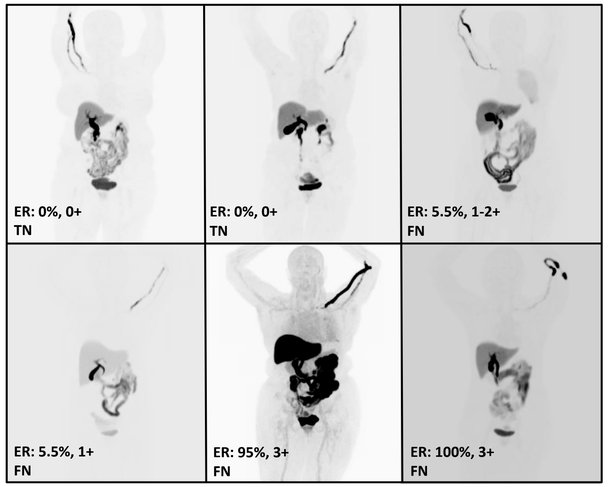


Figure 3. Imaging and ER IHC (%, Stain) of FES-PET SUVmax Negative Cases

Conclusions

FES SUVmax thresholds obtained through standard nuclear medicine workflows preserve sensitivity and accuracy, which may provide additional treatment options to breast cancer patients.

Further investigation with increased statistical power is needed to fully understand the relationship between SUVmax and ER IHC pathology.

SUVmax thresholds are lower than reported and provide excellent ER classification in a large heterogenous cohort.

FES-PET will continue to provide critical adjunct information and may advance non-invasive receptor characterization strategies.

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