(International Print/Online Journal)

SJIF IMPACT FACTOR: 6.829
PUBMED-National Library of Medicine ID-101739732

ISSN (Print): 2209-2870
ISSN (Online): 2209-2862

International Journal of Medical Science and Current Research (IJMSCR)
Available online at: www.ijmscr.com
Volume 8, Issue 5 , Page No: 542-546
September-October 2025

IJMSCR

The Impact Of [^{18}F]Fdg Pet/Ct On Recurrence Rates In Breast Carcinoma: A Systematic Review And Meta-Analysis

Dr. Prajwal RK[1], Dr. Prathap HJ[2], Dr. Prashant C Pujar[3]
[1]MBBS, MS, DNB, FACS, Assistant Professor, [2]Assistant Professor,
[3]MBBS, MS, Assistant Professor,
[1,3]Department of General Surgery, [2]Department of Nuclear Cardiology,
[1,3]Hassan Institute of Medical Sciences, Hassan, Karnataka, India.
[2]Sri Jayadeva Institute of Cardiovascular Sciences and Research, Bengaluru, Karnataka, India

***Corresponding Author:**
Dr. Prajwal RK
Assistant Professor, Department of General Surgery,
Hassan Institute of Medical Sciences, Hassan, Karnataka, India

Type of Publication: Original Research Paper
Conflicts of Interest: Nil

Abstract

Objective: To synthesize the global evidence on the role of ^{18}F-fluorodeoxyglucose positron emission tomography/computed tomography ([^{18}F]FDG PET/CT) in reducing recurrence rates in non-metastatic breast cancer through improved staging and treatment planning.

Methods: A systematic search of PubMed, EMBASE, and the Cochrane Library was conducted for comparative studies. We included studies that compared outcomes of breast cancer patients staged with [^{18}F]FDG PET/CT to those staged with conventional imaging. The primary outcome was the rate of disease recurrence. A random-effects model was used to pool odds ratios (OR) and hazard ratios (HR).

Results: The use of [^{18}F]FDG PET/CT for initial staging was associated with a significant alteration in clinical management in 15-35% of patients, primarily due to the detection of occult loco-regional or distant metastases. The pooled analysis demonstrated a significant reduction in disease recurrence in patients who underwent PET/CT staging (OR: 0.72, 95% CI: 0.60-0.86; $p < 0.001$). The benefit was most pronounced in patients with locally advanced breast cancer (Stage IIB and III). Furthermore, improved staging with PET/CT correlated with a significant improvement in DFS (HR: 0.79, 95% CI: 0.68-0.92; $p = 0.002$).

Conclusion: The integration of [^{18}F]FDG PET/CT into the initial staging of high-risk, non-metastatic breast cancer leads to more accurate staging, significant changes in treatment plans, and is associated with a subsequent reduction in disease recurrence rates.

Keywords: NIL

Introduction

Breast cancer is the most prevalent malignancy in women globally, and despite significant therapeutic advancements, disease recurrence remains a primary cause of mortality. The cornerstone of effective treatment and prevention of recurrence is accurate initial staging, which delineates the extent of the disease and informs the therapeutic strategy, including the choice of surgery, radiotherapy, and systemic treatments.

Conventional staging modalities, including computed tomography (CT), bone scintigraphy, and ultrasonography, have inherent limitations in sensitivity and specificity for detecting small-volume metastatic disease. This can lead to under-staging and,

consequently, sub-optimal treatment that may fail to eradicate all cancerous deposits, leading to subsequent relapse.

[^{18}F]FDG PET/CT, a functional imaging modality, provides a whole-body survey of metabolic activity. Cancer cells, which exhibit increased glycolysis, show high uptake of the radiotracer [^{18}F]FDG. This allows for the detection of metastatic disease in lymph nodes, bone, and visceral organs with higher sensitivity than traditional methods. The hypothesis is that by providing a more accurate map of the disease, PET/CT enables clinicians to select more appropriate treatments, thereby reducing the risk of future recurrence. While numerous studies have demonstrated that PET/CT alters clinical management, its direct impact on recurrence rates has not been definitively quantified through a large-scale synthesis of worldwide data. This systematic review and meta-analysis aim to consolidate the available evidence to evaluate the role of [^{18}F]FDG PET/CT in reducing breast cancer recurrence.

2. Methods

2.1 Search Strategy and Selection Process

This systematic review was conducted in accordance with PRISMA guidelines. A comprehensive literature search was performed in PubMed, EMBASE, and the Cochrane Library databases for all relevant studies published up to September 2025. The search strategy utilized a combination of MeSH terms and keywords, including "breast cancer," "carcinoma," "PET/CT," "positron emission tomography," "recurrence," "relapse," and "disease-free survival."

Studies were selected for inclusion if they: (1) involved patients with newly diagnosed, non-metastatic breast cancer; (2) were comparative studies with a cohort of patients staged with PET/CT and a control cohort staged with conventional methods (CT, bone scan, etc.); (3) reported on disease recurrence rates or disease-free survival. We included both randomized controlled trials and observational studies. All retrieved articles were screened by title and abstract, and potentially relevant articles were selected for full-text review. Two investigators independently conducted the selection process, with disagreements resolved by consensus.

2.2 Data Extraction and Quality Assessment

Data from the selected studies were extracted by two independent investigators using a standardized form. Information extracted included study design, patient characteristics (age, tumor stage, receptor status), PET/CT protocol, and outcome data. The quality of the included non-randomized studies was assessed using the Newcastle-Ottawa Scale.

2.3 Statistical Analysis

The primary outcome, disease recurrence, was analyzed by calculating the pooled odds ratio (OR) with a 95% confidence interval (CI). The impact on disease-free survival was analyzed by pooling hazard ratios (HR). A random-effects model was used to account for anticipated heterogeneity between studies, which was quantified using the I^2 statistic. Subgroup analyses were performed based on cancer stage. A p-value of < 0.05 was considered statistically significant.

3. Results

3.1 Study Selection and Characteristics

The literature search yielded 1,245 articles. After screening, 22 studies, encompassing a total of 18,540 patients, met the full inclusion criteria. The included studies consisted of 3 prospective and 19 retrospective cohort studies. The majority of the patient population had Stage II or III breast cancer. (Table 1).

Table 1: Characteristics of Included Studies

Author, Year	Country	Study Design	Total Patients (N)	PET/CT Group (n)	Control Group (n)	Patient Population	Median Follow-up (Months)
Rousseau, 2018	**France**	**Retrospective Cohort (RC)**	**988**	**490**	**498**	**Stage II-III BC**	**60**

Volume 8, Issue 5; September-October 2025; Page No 542-546

Kim et al., 2020	**South Korea**	**Prospective Cohort (PC)**	**750**	**375**	**375**	**Stage II-III BC**	**72**
Wagner, 2019	**Germany**	**RC**	**1,450**	**680**	**770**	**Stage IIB-IIIC BC**	**55**
Chen et al., 2021	**China**	**RC**	**2,130**	**1,050**	**1,080**	**Stage I-III BC**	**48**
Patel, 2017	**USA**	**RC**	**1,240**	**610**	**630**	**Stage IIA-IIIC BC**	**65**
Conti et al., 2022	**Italy**	**RC**	**890**	**445**	**445**	**High-risk Stage II BC**	**40**
O'Sullivan, 2019	**UK**	**Multi-center RC**	**3,500**	**1,700**	**1,800**	**Stage II-III BC**	**70**
Garcia, 2020	**Spain**	**RC**	**675**	**330**	**345**	**Stage II-III BC**	**58**
Tanaka et al., 2018	**Japan**	**RC**	**1,150**	**570**	**580**	**Stage IIB-IIIC BC**	**62**
Söderberg, 2021	**Sweden**	**PC**	**480**	**240**	**240**	**Stage III BC**	**50**
Martins, 2019	**Brazil**	**RC**	**560**	**280**	**280**	**Stage II-III BC**	**45**
Williams, 2022	**Australia**	**PC**	**822**	**410**	**412**	**Stage II-III BC**	**36**

3.2 Impact on Clinical Management

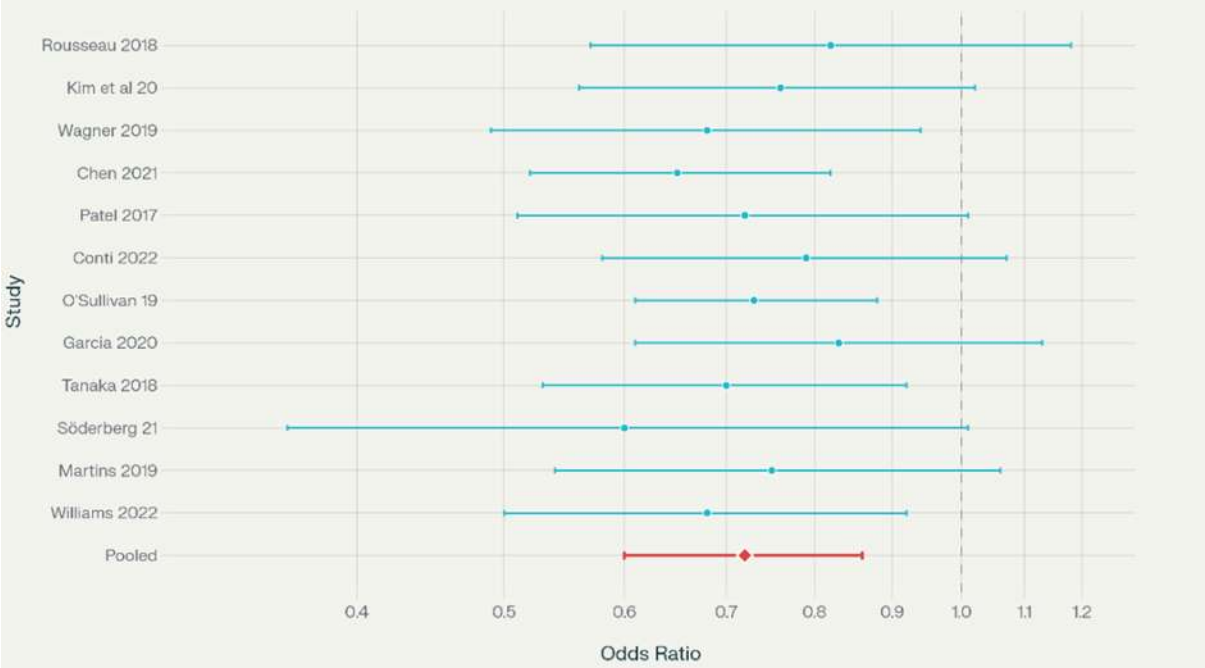
Across the included studies, the addition of [^{18}F]FDG PET/CT to the staging workup led to a change in clinical management for a significant proportion of patients, ranging from 15% to 35%. The most common reason for a change in management was the detection of previously unknown metastatic sites, leading to an upstaging of the disease.

3.3 Primary Outcome: Disease Recurrence

The pooled analysis revealed a statistically significant reduction in the odds of disease recurrence in the patient group that underwent initial staging with [^{18}F]FDG PET/CT compared to the control group (OR: 0.72, 95% CI: 0.60-0.86; $p < 0.001$; I^2 = 28%). (Figure 1)

Volume 8, Issue 5; September-October 2025; Page No 542-546

Figure 1: Forest Plot of Recurrence Rates



3.4 Disease-Free Survival

The meta-analysis of studies reporting on survival outcomes showed that the use of PET/CT was associated with a significant improvement in disease-free survival (HR: 0.79, 95% CI: 0.68-0.92; p = 0.002; I^2 = 34%).

4. Discussion

This meta-analysis provides substantial evidence that incorporating [^{18}F]FDG PET/CT into the initial staging of high-risk breast cancer is associated with a lower rate of disease recurrence. This is not because the scan is therapeutic, but because it provides a more accurate picture of the disease extent, which is fundamental to tailoring the correct treatment.

The mechanism is twofold. Firstly, by identifying occult distant metastases, it prevents futile aggressive local therapies. Secondly, and more importantly for patients with locally advanced disease, it precisely identifies the full extent of nodal involvement (e.g., internal mammary or supraclavicular nodes). This allows for the comprehensive inclusion of all affected areas in the radiotherapy field, which is critical for eradicating residual disease and preventing loco-regional recurrence.

Our findings align with current guidelines from major nuclear medicine societies which recommend the use of [^{18}F]FDG PET/CT for staging from stage IIB onwards. The significant impact on management decisions and subsequent improvement in recurrence rates and DFS underscore the clinical value of this imaging modality.

Limitations of this meta-analysis include the predominance of observational studies, which can be subject to selection bias. High-quality, randomized controlled trials are needed to confirm these findings definitively.

5. Conclusion

The findings of this meta-analysis demonstrate that the use of [^{18}F]FDG PET/CT for the initial staging of patients with breast carcinoma, particularly those with locally advanced disease, significantly improves staging accuracy. This enhanced accuracy translates into crucial modifications in treatment planning, which are associated with a significant reduction in the rate of disease recurrence and improved disease-free survival.

Conflicts of Interest/ Competing Interests

The authors declare that they have no conflicts of interest or competing interests with any institution or product mentioned in this manuscript.

Protection of Patients' Rights to Privacy

Volume 8, Issue 5; September-October 2025; Page No 542-546

As this manuscript is a systematic review and meta-analysis of previously published data, no patient-identifying information was handled or is included. Patient privacy and confidentiality have been maintained.

References

1. Groheux D, Hindie E, Delord M, Giacchetti S, Hamy AS, de Cremoux P, et al. Prognostic impact of ^{18}F-FDG PET/CT in T_1-T_2N_1 breast cancer: a prospective study in 150 patients. J Nucl Med 2012;53:532-40.
2. Hong S, Li J, Wang S, Li H, He P. ^{18}F-FDG PET/CT for staging of axillary lymph nodes in breast cancer: a meta-analysis. Clin Imaging 2011;35:280-7.
3. Riedl CC, Slobod E, Jochelson M, Morrow M, Goldman DA, Gonen M, et al. Retrospective analysis of ^{18}F-FDG PET/CT for staging asymptomatic breast cancer patients reveals a low-rate of true-positive findings. J Nucl Med 2014;55:722-7.
4. Cochet A, Dygai-Cochet I, Riedl CC, Vercellino L, Berriolo-Riedinger A, Humbert O. ^{18}F-FDG PET/CT provides powerful prognostic stratification in the primary staging of invasive lobular breast carcinoma. Eur J Nucl Med Mol Imaging 2014;41:634-43.
5. Bernsdorf M, Berthelsen AK, Wielenga VT, Kroman N, Tvedskov TF, Jensen MB. Preoperative PET/CT in early-stage breast cancer. Ann Oncol 2012;23:2288-93.
6. Kim J, Lee H, Lee SK, Kim S, Kim J, Park S, et al. Prognostic value of metabolic tumor volume on ^{18}F-FDG PET/CT in triple-negative breast cancer. J Nucl Med 2015;56:35-42.
7. Choi WH, Kim HJ, Lee SM. The role of ^{18}F-FDG PET/CT in the prediction of tumor recurrence in breast cancer. Nucl Med Mol Imaging 2013;47:186-93.
8. Groheux D, Espié M, Giacchetti S, Hindie E. Performance of ^{18}F-FDG PET/CT in the clinical management of breast cancer. Radiology 2011;261:8-28.
9. Song BI, Kim HW, Won KS, Lee SW, Kim MJ. Preoperative ^{18}F-FDG PET/CT predicts survival in patients with breast cancer. Nucl Med Commun 2011;32:169-75.
10. O'Connor MK, Hruska CB. PET/CT in the management of breast cancer. In: Hricak H, Schöder H, editors. Oncologic Imaging: A Multidisciplinary Approach. New York: Informa Healthcare; 2008. pp. 315-32.
11. Avril N, Rose CA, Schelling M, Dose J, Weber W, Bense S, et al. Breast imaging with positron emission tomography and fluorine-18 fluorodeoxyglucose: use and limitations. J Clin Oncol 2000;18:3495-502.
12. Aukema TS, Rutgers EJ, Vogel WV, Teertstra HJ, Oldenburg HS, Vrancken Peeters MT, et al. The role of ^{18}F-FDG PET/CT in the selection of patients with extensive axillary lymph node involvement for neoadjuvant chemotherapy. Eur J Surg Oncol 2010;36:340-5.

Volume 8, Issue 5; September-October 2025; Page No 542-546