

Chemotherapy-Induced Changes in Body Composition among Breast Cancer Patients: A Scoping Review

T. Akshaya, T. Senthil Kumar*, R. Yogeshwari, S. Sridevi and N. Venkatesh

Sri Ramachandra Faculty of Physiotherapy, Sri Ramachandra Institute of Higher Education and Research (DU), India

Abstract: The fundamental use of chemotherapy in breast cancer treatment leads to substantial body composition alterations which cause sarcopenia combined with fat deposition as well as body weight irregularities. Following chemotherapy, there are changes that impact the patient's tolerance as well as their overall health and prognosis. Such changes in body composition require precise understanding for the improvement of patient care and effective treatment development. This study used following databases, including PubMed, OVID and PEDro and the eligibility and screening process led to the selection of nine studies in the review. Nine studies examined weight and body composition changes during chemotherapy in breast cancer patients, revealed significant increases in body weight and fat mass. Notably, gaining weight while undergoing chemotherapy was linked to worse survival outcomes, such as a decline in overall survival (OS) and disease-free survival (DFS). Furthermore, sarcopenia has a detrimental effect on the results of chemotherapy, increasing toxicity and decreasing response to treatment. Comparative studies indicated that breast cancer patients experienced increase fat mass and decreased lean body mass during chemotherapy compared to controls without cancer, with these changes persisting after treatment. Patients receiving chemotherapy developed changes in their body composition that result in sarcopenia and fat mass gain. The alterations cause lower chemotherapy effectiveness and elevated chemotherapy toxicity levels. Understanding these changes is essential for patient assessment, therapeutic development and complication prevention.

Keywords: Breast cancer, chemotherapy, body composition, sarcopenia, fat mass, lean mass.

1. INTRODUCTION

Breast cancer is the most common malignancy in women worldwide and comprises up to one fourth of female cancer cases. Breast cancer comprises about 28.2 percent of all cancers among women in India and estimated to be 216,108 by 2022. Over the 26-year period from 1990 to 2016, India's age-standardized incidence rate of breast cancer increased by 39.1%. It is estimated that the number of breast cancer related deaths in South-East Asia will increase by 61.7% by 2040 [1].

Chemotherapy is still a very effective treatment for breast cancer, as it reduces tumor burden and improves survival rates. Few studies states that chemotherapy results in unfavorable changes of body composition. It is associated with significant changes, including weight fluctuations, increases in fat, and loss of muscular mass. The body composition changes that occur with neoadjuvant chemotherapy include significant reduction in skeletal muscle mass index (SMI) and increase in fat mass [2]. Notably, 12.2% of patients who did not have baseline sarcopenia did develop the later, showing the risk of muscle mass loss with chemotherapy. In addition to side effects that vary with weight changes, chemotherapy induced

sarcopenia was found to be an important factor contributing to the treatment outcomes, as lower degrees of muscle mass appear to be associated with a higher rate of toxicity, with dose reductions and poorer treatment completion rates. Longitudinal evidence suggests muscle loss and increased visceral fat after chemotherapy, and those previous findings add further evidence to the adverse metabolic shifts during treatment.

Additionally, obesity has been found to be a significant predictor of chemotherapy response. Gain in weight and baseline body mass index (BMI) has an impact on treatment adherence and the rate of complications. However, the accumulation of fat itself has significant effects on long-term metabolic risk rather than weight. The weight gain changes during chemotherapy are primarily due to an increase in fat mass and the changes in body composition caused by chemotherapy, can persist beyond treatment.

The complex interaction between mental health and the metabolic changes in breast cancer patients results in fatigue. Following chemotherapy, 35% of breast cancer survivors experience moderate to severe psychological discomfort; frequent problems include anger, despair, anxiety, and depression [3]. The physical activity, appetite, and fatigue-related sedentary behaviour are all impacted by these psychological stressors also, which could result to weight changes.

*Address correspondence to this author at the Sri Ramachandra Faculty of Physiotherapy, Sri Ramachandra Institute of Higher Education and Research (DU), India; Tel: 9444494821; E-mail: senthilkumar.t@sriramachandra.edu.in

These modifications have a major impact on breast cancer patients' quality of life, prognosis, and tolerance to therapy. The outcomes of the previous studies were limited in assessing the body composition changes, sarcopenia, quality of life, prognosis together. Thus, it's significant to understand these alterations is necessary in order to develop measures to mitigate the effects or improve the outcomes of treatment and to lower the recurrence of the breast cancer. Hence, the objective of this review is to clarify the direct link between body composition change and the response to chemotherapy among breast cancer patients.

2. METHODS

2.1. Search Strategy and Eligibility Criteria

A comprehensive literature search was conducted in electronic databases including PubMed, OVID, and PEDro. The search was performed using a combination of Medical Subject Headings (MeSH) terms and keywords, including "body composition," "breast cancer," and "chemotherapy." The search was limited to studies published between January 2015 and January 2025 to ensure the inclusion of the most recent research.

Inclusion & Exclusion Criteria

Studies involving patients with histologically confirmed primary breast cancer (stages I-III) who are receiving chemotherapy as part of their treatment regimen and reporting changes in muscle mass, fat distribution, or sarcopenia in breast cancer patients undergoing chemotherapy were included. Studies focusing on metastatic or recurrent breast cancer, assessing interventions other than chemotherapy (e.g., exercise interventions, radiotherapy, endocrine therapy), or not analyzing body composition changes were excluded.

Types of Studies Included

Prospective Observational, Retrospective Cohort, Prospective Cohort studies that reported body composition changes among breast cancer patients undergoing chemotherapy.

Methodological Quality Assessment

We did not perform a formal methodological quality or risk of bias assessment in this scoping review, as the objective was to map and summarize existing literature rather than to synthesize effect sizes.

2.2. Study Selection

Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews

(PRISMA-ScR) standards were followed in the selection of studies (Figure 1). Titles and abstracts of all identified studies were independently screened by two reviewers to remove irrelevant studies. Full-text articles were then assessed for eligibility based on predefined inclusion criteria. A third reviewer was approached in order to resolve any disputes.

A total of 1,950 records were identified through database searches and additional sources. After removing 360 duplicate records, 1,590 unique studies were screened. Following title and abstract screening, 1,240 studies were excluded for reasons including irrelevant topics, mixed cancer types, and lack of body composition analysis. Of the 350 full-text articles assessed, 342 were excluded due to inadequate outcome measures, lack of body composition assessment, overlapping data, or low methodological quality. Finally, eight studies met the eligibility criteria and were included in the scoping review.

2.3. Data Extraction and Synthesis

We gathered data from the included studies using a standardized collection form. Data extracted included:

- Study characteristics: First author, year of publication, study design, sample size, and country of study.
- Patient characteristics: Age, menopausal status, breast cancer stage, chemotherapy regimen.
- Body composition assessment techniques include computed tomography (CT), bioelectrical impedance analysis (BIA), dual-energy X-ray absorptiometry (DXA), and other validated body composition measurement methods.
- Key findings: Changes in body composition before and after chemotherapy, including muscle mass loss, fat gain, and sarcopenia development.

3. RESULTS

3.1. Fat Gain

Chemotherapy-induced alterations in body composition among breast cancer patients are consistently observed across multiple studies, with significant changes in fat mass, lean mass, and metabolic parameters. Several studies [4-6] reported notable increases in fat mass during chemotherapy, even when overall body weight remained stable.

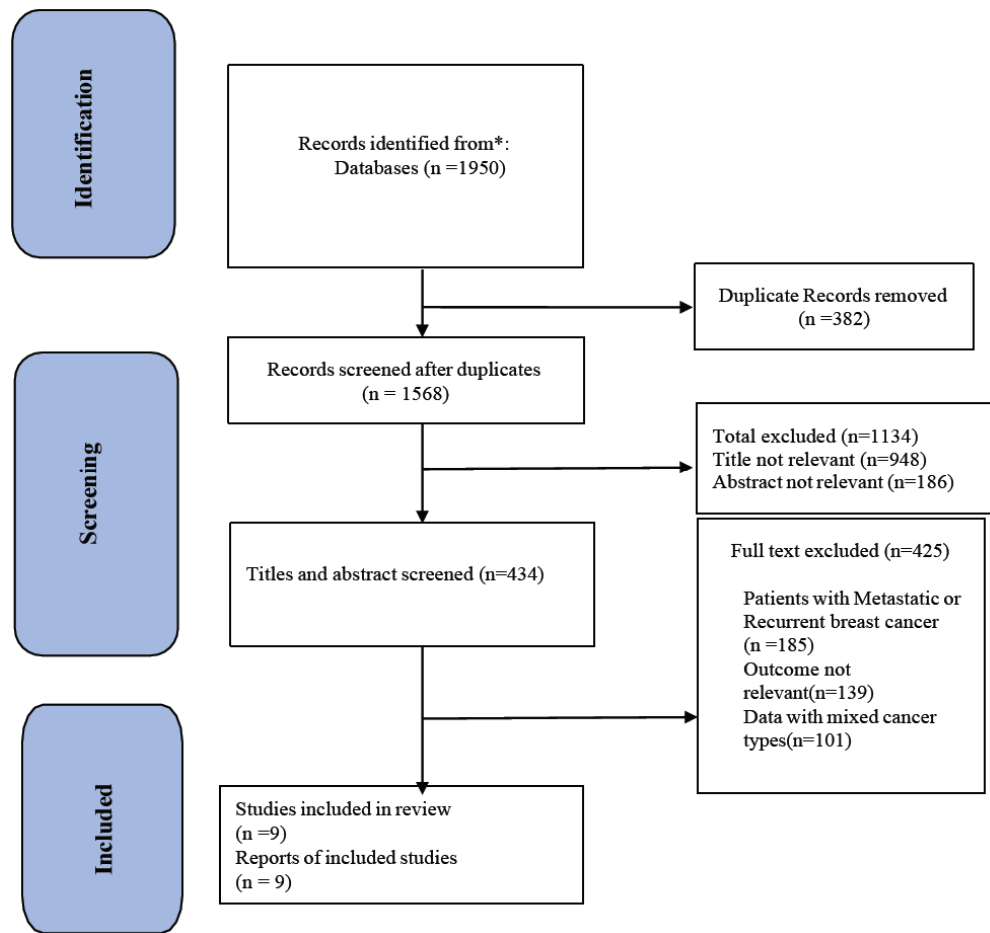


Figure 1: PRISMA-ScR Flow chart presenting the screening method.

Body fat percentage significantly increased post-chemotherapy, particularly in patients with a higher baseline BMI [5]. Similarly, [6] observed substantial weight gain, primarily driven by fat accumulation, while lean body mass remained relatively stable.

Breast cancer patients receiving chemotherapy evidenced much higher average increases of fat mass in their bodies, with a significant difference in lean mass losses as compared to women without cancer during the same years. This suggests that these changes to the body composition can be attributed solely to chemotherapy and not to aging, arthritis, or lifestyle factors alone [9].

3.2. Muscle Loss

In contrast, changes in lean mass and muscle composition may also influence treatment responses. While some research revealed that lean mass remained stable [6], others reported the emergence of sarcopenia, which was associated with increased chemotherapy toxicity and reduced efficacy in cancer patients.

Sarcopenia was associated with decreased chemotherapy completion and lower quality of life. These findings suggest that apart from changes in body weight, body composition changes are significant in influencing treatment outcomes.

3.3. Metabolic Disruption

Fat mass increase was accompanied by elevated serum leptin levels and worsening insulin resistance markers, suggesting a potential link between chemotherapy-induced weight gain and metabolic dysregulation [4].

3.4. Prognosis Impact

Weight gain has a negative prognosis, especially when it is a result of chemotherapy medication outcomes, particularly in overweight and obese patients. Patients with weight change $\geq 5\%$ from baseline during chemotherapy can experience decreased disease-free survival (DFS) rates as well as overall survival (OS) rates. This suggests that weight gain, especially fat mass, may be responsible for the

Table 1: Summary of Selected Studies

Reference	Study Design	Sample Size	Outcomes Used	Results/Findings	Limitations
Pedersen <i>et al.</i> , 2016	Prospective Observational	120	Weight, BMI, body composition (via DXA), physical activity levels	Significant weight gain and increase in fat mass during chemotherapy; lean mass remained relatively stable.	Single-center study; lack of a control group without cancer; potential self-reporting biases in physical activity data.
Schvartsman <i>et al.</i> , 2017	Retrospective Cohort	1323	Weight change during chemotherapy, Disease-Free Survival (DFS), Overall Survival (OS)	Weight gain $\geq 5\%$ during chemotherapy was associated with decreased DFS and OS, particularly in overweight and obese patients.	Retrospective design; reliance on medical records for weight data; lack of detailed information on lifestyle factors influencing weight change.
Jordana <i>et al.</i> , 2020	Prospective study	99	Weight, BMI, body composition DXA, BIA, CT, and MRI.	Patients experienced sarcopenia and increased visceral fat, which led to reduced treatment tolerance and heightened toxicity risks	Variability in body composition measurement methods. Lack of long-term follow-up data. Differences in chemotherapy regimens affecting results comparability.
Fang <i>et al.</i> , 2018	Prospective Observational	200	Body weight, BMI, body fat percentage (via bioelectrical impedance analysis)	Significant increase in body fat percentage post-chemotherapy, despite stable body weight; higher baseline BMI correlated with greater fat gain.	Use of bioelectrical impedance analysis, which may be less accurate than DXA; lack of long-term follow-up to assess persistence of changes.
Di Leone <i>et al.</i> , 2025	Retrospective Cohort	120	Body composition (via CT scans), chemotherapy toxicity, treatment response	Patients with higher visceral fat had increased chemotherapy toxicity; sarcopenia was associated with poorer treatment response.	Retrospective design; potential selection bias; lack of standardized timing for CT scans.
Karaca, Mustafa <i>et al.</i> , 2024	Retrospective Cohort	180	Muscle mass (via MRI), chemotherapy completion rates, pathological complete response (pCR)	Sarcopenia was linked to lower chemotherapy completion rates and reduced pCR; muscle mass influenced treatment outcomes.	Retrospective nature; single-center study; potential variability in MRI assessments.
Alacacioglu <i>et al.</i> , 2016	Prospective Observational	98	Serum leptin and insulin levels, body composition (via DXA), BMI	Chemotherapy led to increased fat mass and serum leptin levels; insulin resistance markers worsened post-treatment.	Small sample size; lack of a non-cancer control group; short follow-up duration.
Van den Berg <i>et al.</i> , 2020	Prospective Cohort	250 (150 breast cancer patients; 100 controls)	Body composition (via DXA), physical activity, dietary intake	Breast cancer patients experienced greater fat mass increase and lean mass loss during chemotherapy compared to controls; changes persisted post-treatment.	Differences in baseline characteristics between groups; potential confounding factors not accounted for; reliance on self-reported lifestyle data.

development of a worse prognosis outcome in breast cancer patients [7].

Pathological complete response (pCR) patients with greater amounts of body fat were more vulnerable to the toxicities of chemotherapy. Comparison of breast cancer patients undergoing chemotherapy and control groups further reinforces these findings [9].

3.4. Limitations and Research Gaps

A longitudinal study plan to evaluate these differences requires more comprehensive coverage, highlighting the need to use research that entails a control group to which other groups can be compared for better comparative analysis [10]. Nevertheless, there are several limitations and research gaps. Many

studies had retrospective designs with small sample sizes and potential biases [4,7,8].

In addition, methods of body composition measurement varied between studies, using techniques including DXA, CT scan, MRI, and bioelectrical impedance analysis (BIA), leading to inconsistencies and reliance on self-reported data. Limitations also exist in relation to physical activity and dietary intake, presenting challenges in interpreting results. There are very few studies that included long-term follow-ups to determine if these body composition changes persist or are reversible after chemotherapy completion.

In this study, body composition changes in breast cancer patients due to chemotherapy are part of an overall process requiring an association between avoidance of sarcopenia while also avoiding excessive fat mass gain, involving a complex interplay between fat mass gain and metabolic alterations. All of these changes may have serious consequences for treatment toxicity rates and long-term survival. The evidence, as above, is that weight gain, especially in the form of increased fat mass and sarcopenia, may have negative effects on survival. In accumulation, chemotherapy effectiveness may be reduced, and toxicity risks will be increased.

4. DISCUSSION

This scoping review has yielded the finding of the great impact of chemotherapy on body composition in breast cancer patients, with alterations in muscle mass, fat mass, and treatment outcomes, toxicity and long term prognosis depends on overall body weight. This review further evaluated such studies which have provided strong evidence that chemotherapy contributes to need for better management strategies is emphasized as these changes are unfavourable body composition changes to mitigate these effects.

Following chemotherapy, they discovered that there were notable increases in fat mass and total weight gain, with premenopausal women reporting most significant changes [6]. The study also contended that the changes could be associated with metabolic effects of chemotherapy, including increased insulin resistance and hormonal fluctuations. The weight gain on adjuvant chemotherapy was related to survival outcomes. Instead, the emphasis of their study was the increase in adiposity rather than total weight. However, independent of gain alone could adversely affect disease prognosis and recurrence risk [7].

It has been discovered that a significant factor is the loss of skeletal muscle mass, or sarcopenia influencing chemotherapy tolerance and response. The prevalence of sarcopenia in locally advanced breast cancer patients undergoing neoadjuvant chemotherapy concluded that there was reduced muscle mass which is associated with higher chemotherapy toxicity, lower treatment adherence, and poorer overall response. The study also showed that sarcopenic patients are more prone to experience the effectiveness of the treatment could be compromised by reduction and treatment interruptions [11].

Metabolic and hormonal changes associated with chemotherapy-induced body composition shifts were investigated [4]. Their study examined leptin, insulin and body composition changes during adjuvant taxane-based chemotherapy, revealing that chemotherapy induced metabolic disruptions might drive increases in fat mass and reduction in lean mass. The study emphasized the need to consider metabolic markers when evaluating chemotherapy-related body composition changes as these factors could influence overall treatment response and toxicity.

They also found that the treatment-related toxicities, such as myelosuppression and neuropathy exists. These findings highlights the potential clinical relevance of body composition assessment as predictor of chemotherapy related adverse effects for the development of individualized treatment strategies.

Obesity has been recognized as a key factor influencing chemotherapy outcomes [8]. It suggests that excess adiposity might impair chemotherapy efficacy at rates. The same was found by the study conducted for Chinese women receiving adjuvant chemotherapy. However, their study revealed that chemotherapy induced fat distribution patterns might vary among different ethnic populations and that changes demographic groups are influenced differently for treatment response [5].

The nature of changes in body composition before, during and after are dynamic in nature. This study compared these change in body composition of breast cancer patients with control group of cancer-free women. And they found that while chemotherapy did change, these alterations differed from those associated with changes in body composition brought on by ageing. This finding suggests that factors other than chemotherapy might include, other factors such as age and lifestyle changes could also lead to changes in body composition that are observed [9].

A longitudinal mixed-methods study to explore weight and body composition changes in chemotherapy patients. Their research emphasized the multifactorial nature of these changes, highlighting the role of lifestyle, physical activity and dietary habits in influencing body composition outcomes [10].

Overall, the evidence synthesized in this review suggests that chemotherapy-induced alterations in body composition are complex and multifactorial. Muscle loss, fat gain, metabolic disturbances, and weight fluctuations collectively influence treatment outcomes and long-term survivorship. The clinical implications of these findings are profound, as body composition changes may affect chemotherapy tolerance, treatment adherence, and overall prognosis.

5. STRENGTH AND LIMITATIONS

This scoping review comprehensively synthesizes literature on body composition alterations in breast cancer patients undergoing chemotherapy. A key strength is the inclusion of diverse study designs and various assessment methods (DXA, BIA, CT), enhancing the reliability of findings. The focus on muscle mass and fat distribution, rather than overall weight changes, provides a nuanced perspective, as studies highlight fat accumulation post-chemotherapy rather than lean mass recovery.

However, limitations include variability in follow-up durations and the exclusion of non-English and unpublished studies, which may contribute to gaps in understanding. This indicates that the review did not include any non-English studies or grey literature.

6. CONCLUSION

This scoping review highlights the significant impact of chemotherapy on body composition in breast cancer patients, revealing increased fat mass, muscle loss, and the persistence of these changes post-treatment. Sarcopenia in particular, is associated with heightened chemotherapy toxicity and reduced treatment efficacy, ultimately affecting survival outcomes. Given these findings, integrating body composition assessments into oncology care is essential for identifying high-risk patients and implementing targeted interventions. Routine assessment of body composition should be considered in oncology practice to personalize chemotherapy protocols and reduce treatment-related toxicity.

Future research should focus on standardized longitudinal studies to better understand these changes and develop effective strategies to mitigate their impact, ultimately improving treatment tolerance, survival, and overall well-being.

REFERENCES

- [1] Sathishkumar K, Sankarapillai J, Mathew A, Nair RA, Gangane N, Khurajam S, Barmon D, Pandya S, Majumdar G, Deshmone V, *et al.* Breast Cancer Survival in India Across 11 Geographic Areas Under the National Cancer Registry Programme. *Cancer* 2024; 130(10): 1816-1825. <https://doi.org/10.1002/cncr.35188>
- [2] Wood N, Morton M, Shah SN, Yao M, Barnard H, Tewari S, Suresh A, Kollikonda S, AlHilli MM. Association Between CT-Based Body Composition Assessment and Patient Outcomes During Neoadjuvant Chemotherapy for Epithelial Ovarian Cancer. *Gynecol Oncol* 2023; 169(1): 55-63. <https://doi.org/10.1016/j.ygyno.2023.01.010>
- [3] Vance V, Mourtzakis M, Hanning R. Relationships Between Weight Change and Physical and Psychological Distress in Early-Stage Breast Cancer Survivors. *Cancer Nursing* 2019; 42(3): E43-E50. <https://doi.org/10.1097/NCC.0000000000000612>
- [4] Alacacioglu A, *et al.* Leptin, Insulin, and Body Composition Changes during Adjuvant Taxane- Based Chemotherapy in Patients with Breast Cancer: Preliminary Study. *Indian Journal of Cancer* 2016; 53(1): 39-42. <https://doi.org/10.4103/0019-509X.180836>
- [5] Fang Q, *et al.* Percent Body Fat Change in Chinese Women after Adjuvant Chemotherapy for Breast Cancer. *Medical Science Monitor: International Medical Journal of Experimental and Clinical Research* 2018; 24: 5988. <https://doi.org/10.12659/MSM.911423>
- [6] Pedersen B, *et al.* Changes in Weight and Body Composition Among Women with Breast Cancer During and After Adjuvant Treatment: A Prospective Follow-Up Study. *Cancer Nursing* 2017; 40(5): 369-376. <https://doi.org/10.1097/NCC.0000000000000426>
- [7] Schvartsman G, *et al.* Association Between Weight Gain During Adjuvant Chemotherapy for Early-Stage Breast Cancer and Survival Outcomes. *Cancer Medicine* 2017; 6(11): 2515-2522. <https://doi.org/10.1002/cam4.1207>
- [8] Di Leone A, *et al.* The Role of Body Composition in Neurological and Hematologic Toxicity in a Retrospective Analysis of 120 Breast Cancer Patients Undergoing Neoadjuvant Chemotherapy: The COMBOTOX Study. *Breast Cancer Research and Treatment* 2025; 210(1): 205-213. <https://doi.org/10.1007/s10549-024-07553-x>
- [9] Van den Berg MMGA, *et al.* Changes in Body Composition During and After Adjuvant or Neo-Adjuvant Chemotherapy in Women with Breast Cancer Stage I-IIIB Compared with Changes Over a Similar Timeframe in Women Without Cancer. *Supportive Care in Cancer* 2020; 28: 1685-1693. <https://doi.org/10.1007/s00520-019-04951-6>
- [10] DeKruif JThCM, *et al.* A Longitudinal Mixed Methods Study on Changes in Body Weight, Body Composition, and Lifestyle in Breast Cancer Patients during Chemotherapy and in a Comparison Group of Women without Cancer: Study Protocol. *BMC Cancer* 2019; 19: 1-8. <https://doi.org/10.1186/s12885-018-5207-7>
- [11] Karaca M, *et al.* Sarcopenia's Role in Neoadjuvant Chemotherapy Outcomes for Locally Advanced Breast Cancer: A Retrospective Analysis. *Medical Science Monitor*:

- International Medical Journal of Experimental and Clinical Research 2024; 30: e945240.
<https://doi.org/10.12659/MSM.945240>
- [12] Godinho-Mota JCM, Mota JF, Gonçalves LV, Soares LR, Schincaglia RM, Prado CM, Martins KA, Freitas-Junior R.

Chemotherapy Negatively Impacts Body Composition, Physical Function and Metabolic Profile in Patients with Breast Cancer. *Clin Nutr* 2020; 40(1): 108-115.
<https://doi.org/10.1016/j.clnu.2020.11.020>

Received on 21-07-2025

Accepted on 19-08-2025

Published on 16-09-2025

<https://doi.org/10.30683/1929-2279.2025.14.17>

© 2025 Akshaya *et al.*; Licensee Neoplasia Research.

This is an open-access article licensed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the work is properly cited.