



Diagnostic Accuracy of Core Needle Biopsy versus Surgical Biopsy in Breast Cancer: Evidence-Based Case Report

Ita Marlita Sari^{1*}, Fitri Arianti², Muhammad Ilham Saputra², Hana Fajri Alfian², Dhergy Hildan², Yasmin Nur Aqila², Muhammad Fitrullah³

¹Department of Community Medicine and Epidemiology, Medicine and Health Science Faculty, Sultan Ageng Tirtayasa University, Banten, Indonesia

²Medical Study Program, Medicine and Health Science Faculty, Sultan Ageng Tirtayasa University, Banten, Indonesia

²Department of Metallurgy, Engineering Faculty, Sultan Ageng Tirtayasa University, Banten, Indonesia

*Corresponding Author: ita.marlita.sari@untirta.ac.id

DOI: 10.33086/iimj.v8i1.8284

ARTICLE INFO

Keywords:
breast cancer,
core needle
biopsy, diagnosis

Submitted: Nov
12th 2025

Reviewed: Dec
23th 2025

Accepted: Feb 3rd
2026

ABSTRACT

Introduction: Breast cancer is the most common type of cancer in women. A definitive diagnosis of breast cancer is made through histopathological examination, considered the gold standard, which involves performing a biopsy. Several biopsy techniques are available, including core needle biopsy and surgical biopsy. Currently, more cost-effective and minimally invasive biopsy methods are needed to improve patient comfort without compromising diagnostic accuracy. This study aims to assess the accuracy level of the core needle biopsy procedure in establishing a diagnosis of breast cancer, especially in determining the type and grade of tumor, by comparing it with surgical biopsy. This Evidence-Based Case Report was conducted through a literature search in PubMed, Cochrane, and ProQuest databases, using previously formulated keywords.

Case: A 45-year-old woman presented to Hospital Z complaining of breast pain. A physical examination revealed a lump in her right breast that had been steadily enlarging for the past two months, accompanied by nipple discharge. The patient was unmarried and had a family history of breast cancer, including her grandmother. Based on these findings, the doctor suspected breast cancer and recommended a biopsy to confirm the diagnosis. Hospital Z offers two biopsy options: core needle biopsy (CNB) and surgical biopsy. The patient chose the core needle biopsy because, based on information obtained online, it was considered more affordable than surgical biopsy.

Discussion: The accuracy of core needle biopsy was evaluated based on sensitivity and specificity values. In assessing the accuracy of estrogen receptor determination, the first article showed a sensitivity of 95% and a specificity of 67%, while the second article reported a sensitivity of 100% and a specificity of 92%. For progesterone receptors, sensitivity and specificity were 98% and 69%, respectively, in the first article, and 94% and 86% in the second article. Meanwhile, for HER2 receptors, sensitivity and specificity were recorded at 75% and 98% in the first article, and 83% and 100% in the second article.

Conclusions: The core needle biopsy procedure demonstrated a high level of accuracy, both in terms of sensitivity and specificity, in determining tumor type and grade through estrogen, progesterone, and HER2 receptor examination, when compared with surgical biopsy. Therefore, core needle biopsy can be an effective, minimally invasive, and more cost-efficient diagnostic alternative in breast cancer evaluation.

Introduction

Breast cancer is the most commonly diagnosed cancer in women, accounting for more than one in ten new cancer cases each year. It also ranks second as the leading cause of cancer death in women worldwide. In 2022, approximately 2.3 million women worldwide were diagnosed with breast cancer, resulting in 670,000 deaths (Menon et al., 2025; WHO, 2025).

Various factors can increase a woman's risk of developing breast cancer, including increasing age, obesity, excessive alcohol consumption, a family history of breast cancer, previous radiation exposure, reproductive history (e.g., age at first menstruation and age at first pregnancy), tobacco use, and postmenopausal hormone therapy. However, about half of breast cancer cases occur in women with no clear risk factors other than gender (female) and age (over 40). The risk of developing breast cancer increases with age. While having a family history of breast cancer can increase the risk, most women who develop breast cancer have no known family history. However, the absence of a family history does not automatically mean a woman's risk is lower (Menon et al., 2025; WHO, 2025; Łukasiewicz et al., 2021).

To establish an accurate diagnosis, a thorough examination is required, starting with a physical examination and followed by supporting examinations. Early

detection has been shown to increase patient survival rates, while breast cancer that has metastasized generally has a poor prognosis. This condition emphasizes the importance of implementing regular breast cancer screening programs (Ginsburg et al., 2020; Cassidy et al., 2025).

Core Needle Biopsy (CNB) is a diagnostic method used to obtain tumor tissue samples by inserting a special needle into the suspected area. This technique has the advantage of producing intact tissue samples, enabling more detailed histopathological analysis, including determination of the tumor's histological subtype. Meanwhile, Surgical Biopsy is performed by making a small incision in the skin and breast tissue to remove part or all of the lump. This procedure is usually performed when a needle biopsy is not possible, for example, when no palpable mass is found, or as a follow-up after a needle biopsy to ensure no malignancy has been missed. Surgical Biopsy is divided into two types: (1) incisional biopsy, which aims to remove a portion of abnormal tissue for diagnostic purposes, and (2) excisional biopsy, which removes the entire lesion or tumor, with or without some surrounding normal breast tissue, depending on the purpose of the procedure (Feng et al., 2018; Chetry et al., 2025; Lin et al., 2025).

Histopathology is the gold standard for diagnosing breast cancer. To obtain these

results, a biopsy is required. The findings from this examination not only help determine a definitive diagnosis but also serve as a basis for monitoring the effectiveness and progress of the patient's therapy (Tseng et al., 2023; Shadrina et al., 2024).

Case(s)

Clinical Scenario

A 45-year-old woman presented to Hospital Z complaining of breast pain. A physical examination revealed a lump in her right breast that had been steadily enlarging for the past two months, accompanied by nipple discharge. The patient was unmarried and had a family history of breast cancer, including her grandmother. Based on these findings, the doctor suspected breast cancer and recommended a biopsy to confirm the diagnosis. Hospital Z offers two biopsy options: core needle biopsy (CNB) and surgical biopsy. The patient chose the core needle biopsy because, based on information obtained online, it was considered more affordable than a surgical biopsy.

Clinical Question

Is the Core Needle Biopsy (CNB) procedure as accurate as a surgical biopsy in diagnosing breast cancer in individuals with suspected breast cancer?

Article Search Methods and Strategy

A literature search was conducted through three major online databases: PubMed, ProQuest, and the Cochrane Library. The keywords used were organized based on Medical Subject Headings (MeSH) and a combination of Boolean operators as follows:

(Breast neoplasms OR Breast carcinoma OR Breast cancer OR Mammary cancer OR Breast malignancy OR Carcinoma mammae)

AND (Biopsy, large core needle OR Core Needle Biopsy)

AND (Surgical specimen OR Surgical biopsy OR Open surgical biopsy OR Excisional biopsy OR Incisional biopsy)

AND (Diagnosis OR Accuracy OR Specificity OR Sensitivity OR Determining)

Article Selection Strategy

The article selection process was conducted by searching PubMed, ProQuest, and Cochrane databases using predetermined keywords. The retrieved articles were then selected based on topic suitability through a review of the title, abstract, methods, and study design. Only articles that met the criteria for addressing the clinical question formulated using the PICO (Patient, Intervention, Comparison, Outcome) framework were included in the analysis. PICO components relevant to the clinical question, using primary keywords,

Medical Subject Headings (MeSH terms), and synonyms for each component.

Eligibility Criteria

Inclusion criteria included articles with a systematic review, meta-analysis, or cross-sectional study design, articles published within the last 10 years, studies discussing Core Needle Biopsy (CNB) and Surgical Biopsy in breast cancer cases. Exclusion criteria included articles not available in full text, animal-based studies, and articles without an abstract.

Critical Review Method

Critical evaluation of the selected articles was conducted using a diagnostic worksheet. The critical appraisal process includes three main components: validity, significance, and clinical application. Studies evaluating Core Needle Biopsy and Surgical Biopsy were conducted independently and blindly. The patient spectrum in the study must be similar and clinically relevant. All study subjects must undergo both examinations (CNB and Surgical Biopsy). Assessment was conducted on the results of sensitivity, specificity, predictive value (positive/negative predictive values), and likelihood ratio. Research results were assessed based on their potential application in clinical practice, taking into account the

suitability of the patient spectrum to conditions commonly encountered in the field.

Level of Evidence

The level of evidence criteria used in this study refer to the 2011 Oxford Centre for Evidence-Based Medicine (OCEBM) Levels of Evidence guidelines. The clinical questions studied fall within the realm of diagnosis, so the relevant levels of evidence are as follows: Level I: Systematic review of cross-sectional studies with a consistent reference standard and Level II: Individual cross-sectional studies assessing diagnostic accuracy with an adequate reference standard (Oxford, 2011).

Discussion

A literature search conducted through three online databases yielded the following findings: 1,040 articles from PubMed, 105 articles from the Cochrane Library, and 148 articles from ProQuest. Of the 1,293 articles retrieved, 32 duplicates were identified, leaving a total of 1,261 unique articles. Of these, six met the initial inclusion criteria. However, after further review of the study design and the alignment of the outcomes with the focus of the Evidence-Based Case Report (EBCR), four articles were eliminated due to inconsistency. Therefore, the final number of articles used for the critical review process was two (figure 1).

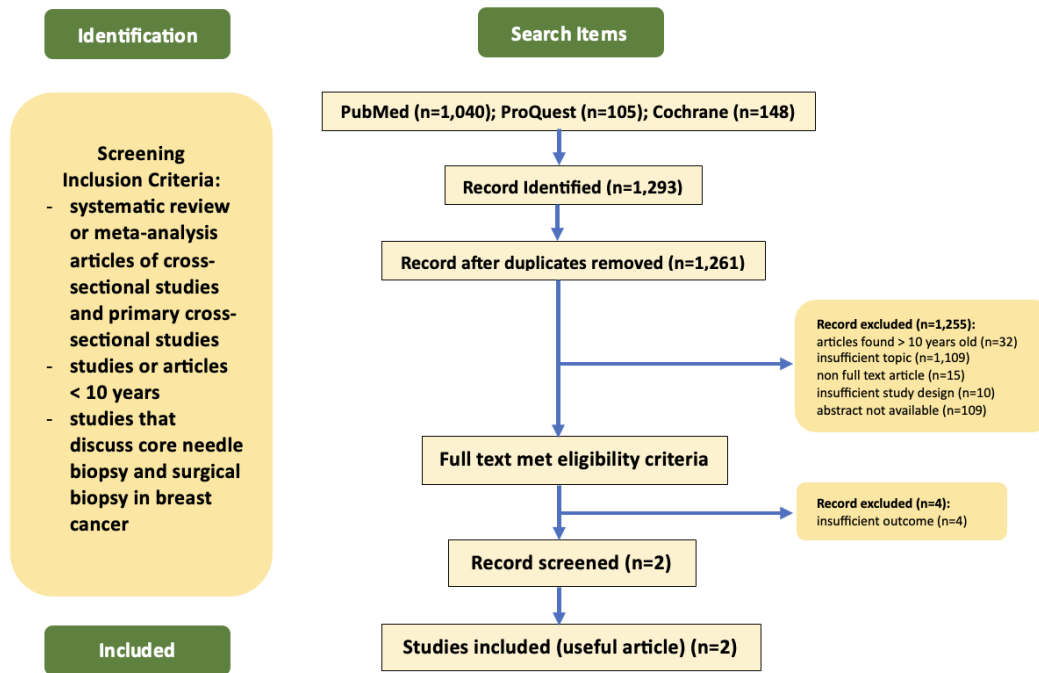


Figure 1. Flowchart of article search results from 3 databases

Table 1. Critical Review Result of Article

No	Article Title and Authors	Critical Review Result			
		Validity	Importance	Applicability	Level of Evidence
1	Comparison of the molecular profiling of core biopsy with surgical specimens in breast cancers and the effect of neoadjuvant therapy on the same – A North Indian study (Verma et al., 2023)	An independent, blind comparison with a reference (“gold”) standard of diagnosis unclear, because there is no explanation regarding whether this study was blinded or not and whether this study was conducted by > 1 researcher independently or not. The diagnostic test was evaluated in	Sensitivity (%) : ER 95; PR 98; HER2/neu 75 Specificity (%) : ER 67; PR 69; HER2/ neu 98 Likelihood Ratio (+) : ER 2,87; PR 3,2; HER2/neu 37,5 Positive Predictive Value (%) : ER 70; PR 70; HER2/neu 85 Negative Predictive Value (%) : ER 94; PR 97; HER2/neu 97	The diagnostic test was available, affordable, accurate, and precise in our setting because CNB is less expensive, less painful than surgery, and provides more reliable information regarding histological cell type, invasion, nuclear grade, and hormone status. CNB can be used to diagnose breast cancer. CNB has varying sensitivity and specificity based on the hormone receptor	2

No	Article Title and Authors	Critical Review Result			
		Validity	Importance	Applicability	Level of Evidence
		an appropriate spectrum of patients because the examination was performed on patients who complained of palpable breast lumps. The reference standard was applied regardless of the diagnostic test result because the methods section explains that the examination was performed on CNB samples and surgical specimens regardless of the patient's malignancy type.	Pretest Probability (%) : ER 40; PR 45; HER2/neu 60 Pretest Odds : ER 0,6; PR 0,8; HER 2/neu 0,063 Post test Odds (+/-) : ER 1,7/0,042; PR 2,56/0,0016; HER2/ neu 2,4/0,0 Post test Probability (+/-) : ER 63/4; PR 72/0,1; HER2/ neu 70/2	tested. The pre-test probability can be determined and varies based on the hormone receptor comparison: 40% (ER), 45% (PR), and 6% (HER2). The consequences of the test help the patient because the CNB test has good accuracy, is less expensive, and is less painful, allowing for more efficient decision-making and patient management.	
2	Accuracy of Prognostic and Predictive Markers in Core Needle Breast Biopsies Compared with Excisional Specimens (Motamedolshariatia et al., 2014)	An independent, blind comparison with a reference ("gold") standard of diagnosis unclear, because there is no explanation regarding whether this research was conducted blindly or not and whether this research was	Sensitivity (%) : ER 100; PR 94; HER2/neu 83 Specificity (%) : ER 92; PR 86; HER2/ neu 100 Likelihood Ratio (+) : ER 12,5; PR 6,7; HER2/neu undefined Positive Predictive Value	The diagnostic test was available, affordable, accurate, and precise in our setting because CNB is considered to reduce costs, prevent unnecessary surgery, and provide information on tumor grade and even prognostic factors, allowing for further treatment.	2

No	Article Title and Authors	Critical Review Result			Level of Evidence
		Validity	Importance	Applicability	
		conducted by > 1 researcher independently or not. The diagnostic test was evaluated in an appropriate spectrum of patients because examination is performed on patients suspected of having invasive breast cancer. The reference standard was applied regardless of the diagnostic test result because In this study, 30 subjects were diagnosed with breast cancer through CNB and subsequently underwent a surgical biopsy (mastectomy).	(%): ER 95; PR 88; HER2/neu 100 Negative Predictive Value (%): ER 100; PR 92; HER2/neu 90 Pretest Probability (%): ER 60; PR 53; HER2/neu 40 Pretest Odds: ER 2,5; PR 1,1; HER 2/neu 0,6 Post test Odds (+/-): ER 31,25/0; PR 7,37/0,08; HER2/ neu undefined/0,1 Post test Probability (+/-): ER 96/0; PR 90/7; HER2/ neu undefined/9	CNB can be used to diagnose breast cancer. CNB has varying sensitivity and specificity based on hormone receptor testing. Pre-test probability can be determined and varies based on hormone receptor comparison: 60% (ER), 63% (PR), 40% (HER2). The results of the post-test are greater than the pre-test, so this examination can confirm the diagnosis and influence subsequent patient management. CNB has relatively good accuracy because it is considered to avoid unnecessary surgery, provide data on the degree of tumor malignancy, and also provide prognostic factors, so that this information can be used as a basis for further steps. However, there are concerns that CNB may have a lower level of reliability compared to excisional biopsy in	

No	Article Title and Authors	Critical Review Result			
		Validity	Importance	Applicability	Level of Evidence
				providing information regarding various prognostic and predictive factors. The increasingly widespread use of core needle biopsy (CNB) on breast masses offers significant benefits in obtaining a preoperative diagnosis. This approach has the potential to prevent and reduce the need for unnecessary surgery, provides cost-effectiveness, and in nearly 90% of cases, is the only diagnostic step required. Our findings confirm that CNB demonstrates a very high level of accuracy in identifying tumor type, ER, and HER2/neu. However, caution is needed when using it to evaluate tumor grade, PR status, and p53.	

The first study conducted by Verma P. et al, involved patients with palpable breast lumps who underwent core needle biopsy (CNB) and surgery to obtain a histopathological diagnosis through

immunohistochemistry (IHC) staining. This article was deemed to meet the criteria of validity, importance, and applicability based on a critical review worksheet for diagnostic studies. This first article was

deemed to have good validity because it involved a suitable patient population, namely patients with palpable breast lumps, and both diagnostic procedures, such as core needle biopsy (CNB) and mastectomy, were performed on the same subjects. However, the study did not explicitly state whether the assessment process was blinded between the biopsy and mastectomy reviewers. This article is considered to have a good level of importance because it demonstrated high sensitivity and specificity, along with a high likelihood ratio (LR) and predictive value for the three receptor markers: ER, PR, and HER2/neu. These findings indicate that the test has strong diagnostic potential in detecting breast cancer.

Another study conducted by Motamedolshariati M. et al, also met the criteria for validity, importance, and applicability as outlined in the diagnostic study worksheet. This study was deemed to have good validity because it involved a relevant patient population, namely patients with suspected invasive breast cancer, and employed both diagnostic procedures core needle biopsy (CNB) and surgical biopsy (mastectomy) on the same subjects. However, this study did not provide information on whether the results were evaluated blindly between examiners using each method. The second article was also deemed important because it demonstrated

high sensitivity and specificity, along with a high likelihood ratio (LR) and predictive value for the three receptor markers: ER, PR, and HER2/neu. These results indicate that the method used has good diagnostic accuracy in detecting and classifying breast cancer. Neoadjuvant treatment may alter biomarker expression, which could partly explain discordance in ER/PR/HER2 status and represents an important clinical consideration when interpreting CNB results for treatment planning (Rey-Vargas et al., 2020).

Based on a critical review of the literature, it is recommended that a Core Needle Biopsy (CNB) examination be performed as the primary diagnostic step in detecting and determining the type and stage of breast cancer in this patient. This method is considered highly accurate, minimally invasive, and cost-effective, making it suitable for implementation in the context of clinical services in Indonesia. Although CNB demonstrates consistently high diagnostic performance, clinicians should interpret receptor-specific sensitivity values in light of study size, population characteristics, and technological era. CNB should be integrated into clinical decision-making alongside imaging, clinical assessment, and when indicated confirmatory surgical biopsy (He et al., 2020).

Based on the level of evidence criteria referring to the 2011 Oxford Centre for Evidence-Based Medicine (OCEBM) guidelines, both articles are categorized as studies with a cross-sectional design, so they are included in Level 2 evidence. The articles used in this EBCR were deemed valid and relevant to the clinical questions posed. This is evident from the matching of the characteristics of the study subjects with the patient's condition in the case scenario. Furthermore, the critical appraisal results demonstrated findings that support the reliability of the evidence, thus providing a basis for evidence-based clinical decision-making.

The limitation of this study included that neither Verma et al. (2023) nor Motamedolshariati et al. (2014) clearly reported blinding or independent assessment between CNB and surgical specimens. The small sample size in Motamedolshariati et al. (2014), particularly the limited number of HER2-positive cases, restricts statistical power and generalizability. The reported ER and HER2 sensitivity should be interpreted with caution due to the small and potentially unrepresentative case mix. Besides, variability in baseline prevalence influences likelihood ratios and post-test probabilities, emphasizing that diagnostic performance may differ across populations and receptor subtypes, and therefore should be

interpreted in the local clinical context. Then, Motamedolshariati et al. represents older data (2009–2011 cohort, published 2014), which may not fully reflect current diagnostic standards and immunohistochemistry techniques. Regarding database coverage, the Embase and Scopus databases were not included. Future EBCRs could benefit from incorporating these databases to improve comprehensiveness. The larger, contemporary studies and meta-analyses would further strengthen external validity, particularly for HER2 assessment and prognostic marker concordance.

Conclusion

Based on the analysis of the two articles reviewed, it can be concluded that in patients with suspected breast cancer, the Core Needle Biopsy (CNB) procedure demonstrates a high level of sensitivity and specificity in determining tumor type and grade, through the detection of estrogen, progesterone, and HER2 hormone receptors, when compared with surgical biopsy. Both biopsy methods are available in Indonesia, but CNB is recommended as the primary choice due to its minimally invasive nature, affordability, and high diagnostic accuracy in establishing a breast cancer diagnosis.

References

- Cassidy, C. M., Choi, C. I., Herdman, B., Kilbane, T. K., Lannen, J. F., McConnell, J. P., Moufawad, M. M., & Bailey, B. A. (2025). Benefits of breast self-examinations for medically underserved populations : A systematic review. *Sage Journal*.
<https://doi.org/10.1177/17455057241311400>
- Chetry, M., Feng, R., Babar, S., & Sun, H. (2025). *Early detection and analysis of accurate breast cancer for improved diagnosis using deep supervised learning for enhanced patient outcomes*. 1–28. <https://doi.org/10.7717/peerj-cs.2784>
- Feng, Y., Spezia, M., Huang, S., Liu, B., Lei, Y., Du, S., Vuppapapati, A., Luu, H. H., Haydon, R. C., He, T., & Ren, G. (2018). Breast cancer development and progression : Risk factors , cancer stem cells , signaling pathways , genomics , and molecular pathogenesis. *Genes & Diseases*, 5(2), 77–106.
<https://doi.org/10.1016/j.gendis.2018.05.001>
- Ginsburg, O., Yip, C., Brooks, A., Cabanes, A., Caleffi, M., Y, J. D., Gyawali, B., McCormack, V., Anderson, M. M. De, Mehrotra, R., Mohar, A., Murillo, R., Pace, L. E., Paskett, E. D., Romanoff, A., Rositch, A. F., Schneidman, M., Unger-saldana, K., Vanderpuye, V., ... Neoplasticas, E. (2020). Breast cancer early detection: a phased approach to implementation. *Cancer*, 126(Suppl 10), 2379–2393.
<https://doi.org/10.1002/cncr.32887>
- He, Z., Chen, Z., Tan, M., Elingarami, S., Liu, Y., Li, T., Deng, Y., He, N., Li, S., Fu, J., & Li, W. (2020). A review on methods for diagnosis of breast cancer cells and tissues. In *Cell Proliferation* (Vol. 53, Number 7). Blackwell Publishing Ltd.
<https://doi.org/10.1111/cpr.12822>
- Lin, Z., Tang, J., Tan, A., Tang, S., Li, Y., Gu, Y., Liu, C., Li, M., Chen, Z., Chen, Y., Zhang, Y., He, P., Deng, Q., Liang, W., & He, J. (2025). Optimizing core needle biopsy specimen collection techniques to enhance molecular testing adequacy in non-small cell lung cancer. *J Thorac Dis*, 17(7), 4782–4793.
<https://doi.org/10.21037/jtd-2025-521>
- Łukasiewicz, S., Stanisławek, A., Czezelewski, M., Forma, A., Baj, J., Sitarz, R., & Stanisławek, A. (2021). Breast Cancer—Epidemiology, Risk Factors, Classification, Prognostic Markers, and Current Treatment Strategies— An Updated Review. *Cancers (Basel)*, 13(17), 4287.
- Menon, G., Alkabban, F. M., & Ferguson, T. (2025). *Breast Cancer*. StatPearls.

- <https://www.ncbi.nlm.nih.gov/books/NBK482286/>
- Motamedolshariatia, M., Memarb, B., Shakeric, M. T., Samadib, M., Aliakbaianb, M., & Jangjoob, A. (2014). Breast Care Accuracy of Prognostic and Predictive Markers in Core Needle Breast Biopsies Compared with. *Breast Care*, 9, 107–110. <https://doi.org/10.1159/000360787>
- Oxford, U. of. (2011). *Explanation of the 2011 OCEBM Levels of Evidence*. Centre for Evidence Based Medicine. <https://www.cebm.ox.ac.uk/resources/levels-of-evidence/explanation-of-the-2011-ocebm-levels-of-evidence>
- Rey-Vargas, L., Mejía-Henao, J. C., Sanabria-Salas, M. C., & Serrano-Gomez, S. J. (2020). Effect of neoadjuvant therapy on breast cancer biomarker profile. *BMC Cancer*, 20(1). <https://doi.org/10.1186/s12885-020-07179-4>
- Shadrina, G., Sepestian, R., & Djannah, F. (2024). Histopathological Features and Diagnosis of Breast Cancer. *Jurnal Penelitian Pendidikan IPA*, 10(11), 793–798. <https://doi.org/10.29303/jppipa.v10i11.8469>
- Tseng, L., Matsuyama, A., & Macdonald-dickinson, V. (2023). Histology: The gold standard for diagnosis? *Can Vet J*, 64(4), 389–391. <https://doi.org/10.1111/vco.12865>
- Verma, P., Sharma, N., Gulati, A., Sharma, R., Parashar, A., & Kaundal, A. (2023). Comparison of the molecular profiling of core biopsy with surgical specimens in breast cancers and the effect of neoadjuvant therapy on the same – A North Indian study. *Journal of Cancer Research and Therapeutics*, 19, 198–202. <https://doi.org/10.4103/jcrt.JCRT>
- WHO. (2025). *Breast cancer*. <https://www.who.int/news-room/fact-sheets/detail/breast-cancer>