THE SIGNIFICANCE OF DIGITAL STEREOTACTIC BIOPSY IN CORRELATION WITH POSTOPERATIVE PATHOHISTOLOGICAL FINDINGS

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ABSTRACT

Introduction: An important contemporary alternative method to surgical open biopsy is digital stereotaxic breast biopsy. Digital stereotaxy involves the use of a computer to accurately determine the location and take a sample of a suspicious change in the breast based on a mammogram. This research was conducted with the aim of analyzing the accuracy and diagnostic value of digital stereotactic breast biopsy compared to the postoperative histopathological findings.

Methods: A retrospective-prospective study was carried out over a period of 10 months, involving 30 female patients who underwent stereotactic breast biopsy. Data were collected on BI-RADS status, histopathological findings after stereotactic breast biopsy and after surgical excision, basic demographic and relevant medical history data. The patients were divided according to the degree of malignancy into three groups: patients with benign, patients with suspicious and patients with malignant pathohistological findings. The BIS and RIS systems were used for data collection, and the data were statistically analyzed using STATISTICA for Windows.

Results: All patients had a radiological finding of BI-RADS 3 or higher. Histopathological results after stereotactic biopsy showed benign findings in 17 patients (B1 and B2), borderline malignant changes were present in 4 patients (B3), one patient had a lesion suspicious for malignancy (B4), and 8 had confirmed malignant lesions (B5). Out of the total 30 patients, 13 underwent surgical treatment. Postoperative histopathological findings in 4 patients showed benign changes, 6 patients had an invasive form of carcinoma, including 5 with invasive

NST breast carcinoma and one characterized as invasive ductal breast carcinoma, while three patients had Ductal Carcinoma In Situ (DCIS). A correlation test was performed between the estimated degree of malignancy from the pathohistological findings after stereotaxic biopsy and after surgical operation. Spearman's ρ test showed a significant correlation between the two methods ($p < 0.001$).

Conclusion: The results of histopathological analysis of samples obtained through the stereotactic biopsy method largely correlate with the postoperative histopathological diagnosis in patients who underwent surgical treatment.

■ **Keywords:** digital stereotactic breast biopsy, PHD findings, BI-RADS, NST, Ductal Carcinoma In Situ.

INTRODUCTION

Most of the suspicious lesions visualized in the breast through mammographic examination are of a benign nature, which has created pressure to find alternatives to open surgical biopsy. One significant modern alternative method is digital stereotactic breast biopsy. Digital stereotaxis involves using a computer to accurately determine the location and take a sample of a suspicious change in the breast based on mammograms taken from two positions. Today, a core needle biopsy (CNB) with vacuum assistance is used to obtain samples for pathological analysis. Vacuum-assisted biopsy allows for the collection of multiple tissue samples without the need for multiple punctures. A special probe is used during vacuum-assisted biopsy, which is positioned into the breast through a small incision in the skin. Stereotactic vacuum-assisted biopsy can obtain double the sample size compared to core needle biopsy (CNB) without vacuum assistance.[1]

Breast cancer is the most common cancer in women, both in developed and developing countries.[2] Today's classification of breast cancer by the WHO is based on updating the traditional classification of tumors, taking into account molecular and genetic data into a morphologically defined system.[3]

In the diagnostic approach for a patient with a suspicious change in the breast, it is essential to take a detailed medical history, including the patient's previous medical history, lifestyle habits, information about any treatments being used, and potential hormonal therapy. Additionally, data about the first childbirth, breastfeeding history, and family medical history should also be collected. In addition, a clinical examination is of utmost importance, followed by radiological examination methods (mammography, ultrasound, magnetic resonance imaging). If necessary, preoperative cytological or histopathological diagnostics should also be conducted. The final diagnosis is made based on the histopathological findings, which is why every suspicious or positive cytological result is forwarded for histopathological confirmation.[4]

Stereotactic breast biopsy uses mammography to assist in locating abnormalities in the breast and to obtain a tissue sample for microscopic examination. This method is less invasive than surgical biopsy, leaves little to no scarring, and can be an excellent way to evaluate calcium deposits or small masses that are not visible on ultrasound. Imaging-guided procedures and minimally invasive procedures, such as stereotactic breast biopsy, are performed by
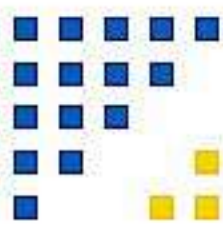
specially trained radiologists and are typically done on an outpatient basis. Stereotactic breast biopsy is performed when a mammogram shows abnormalities in the breast, such as suspicious mass, small clusters of microcalcifications, distortion in the breast tissue structure, an area of abnormal breast tissue, a new mass, or an area of calcifications at a previous surgical site.[5]

RESEARCH METHOD

The study was conducted as a retrospective-prospective clinical trial at the Clinical Center of the University of Sarajevo, Radiology Clinic, Breast Diagnostics Department, and the Clinic for Pathology, Cytology, and Human Genetics. The study involved 30 patients with suspicious radiological findings in the breast who underwent stereotactic breast biopsy between August 2022 and June 2023. Stereotactic breast biopsy was performed using the "Hologic 3D" device. The ACR BI-RADS classification was used to describe the clinical diagnosis. The histopathological diagnosis of breast tissue after stereotactic or surgical biopsy is presented through the B classification of minimally invasive breast biopsy. Based on the histopathological findings, the patients were categorized into three groups: patients with benign findings, patients with suspicious findings, and patients with malignant findings. The results obtained after the stereotactic biopsy of the breast were compared with the postoperative results. The advantages and disadvantages of stereotactic breast biopsy were examined. Data were collected using the so called BIS (Hospital Information System) and RIS (Radiology Information System), from previous radiological and histopathological findings as well as the findings of oncologists and the oncology council. Statistical data processing was done in STATISTICA FOR WINDOWS, using correlation tests. The data are presented graphically and in the form of tables. The assessment of the accuracy of the pathological findings from stereotactic biopsies compared to the findings after surgery, which are considered the gold standard, was performed using ROC (Response Operating Characteristic) curve analysis. The presented statistical parameter was the area under the curve (AUC). The correlation between the identified degrees of malignancy was examined using Spearman's ρ test. The selected level of significance in statistical hypothesis tests is $\alpha = 0.05$.

RESULTS

This study included 30 patients aged 42 to 73 years. Six patients were up to 50 years of age, 16 patients between 50 and 60 years of age and 8 patients over 60 years of age. All patients included in the study (n=30) had a radiological finding according to the BI-RADS classification between BI-RADS 3 and BI-RADS 5. Two patients had BI-RADS 3 findings, four patients had BI-RADS 3/4 findings, most patients had BI-RADS 4, namely 21, while 3 patients had a radiological finding of BI-RADS 5.

The histopathological results after stereotactic biopsy were benign in 17 patients (B1 and B2), benign but borderline malignant changes were present in 4 patients (B3), one patient had a lesion suspicious for malignancy (B4), and 8 patients had confirmed malignant lesions (B5) (Figure
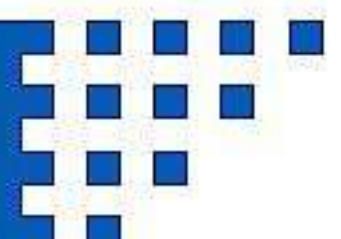
1). Out of a total of 8 malignant lesions after stereotactic biopsy, two were not classified with a specific pathological diagnosis, in 3 cases invasive breast carcinoma NST was confirmed, one mixed type (NST and lobular carcinoma), and in 2 cases ductal in situ carcinoma. (Figure 2).
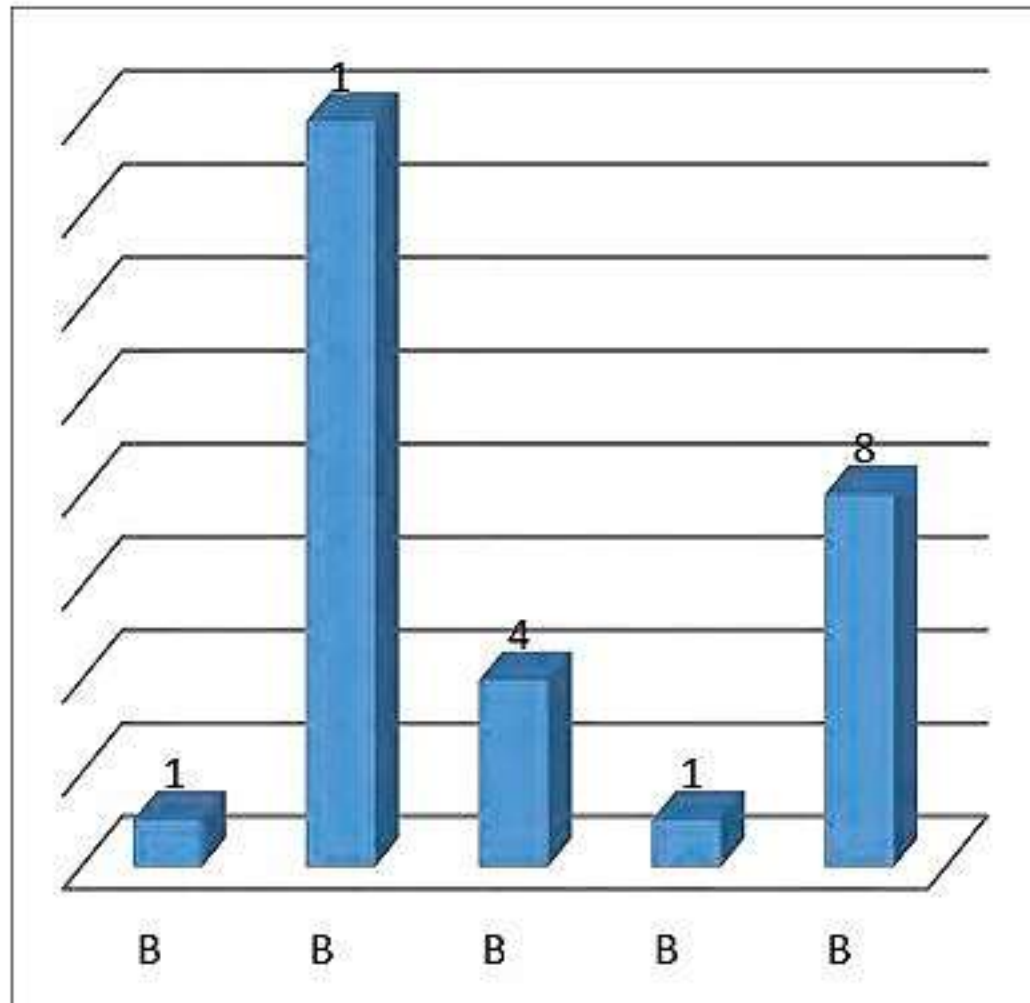

Figure 1 Histopathological findings
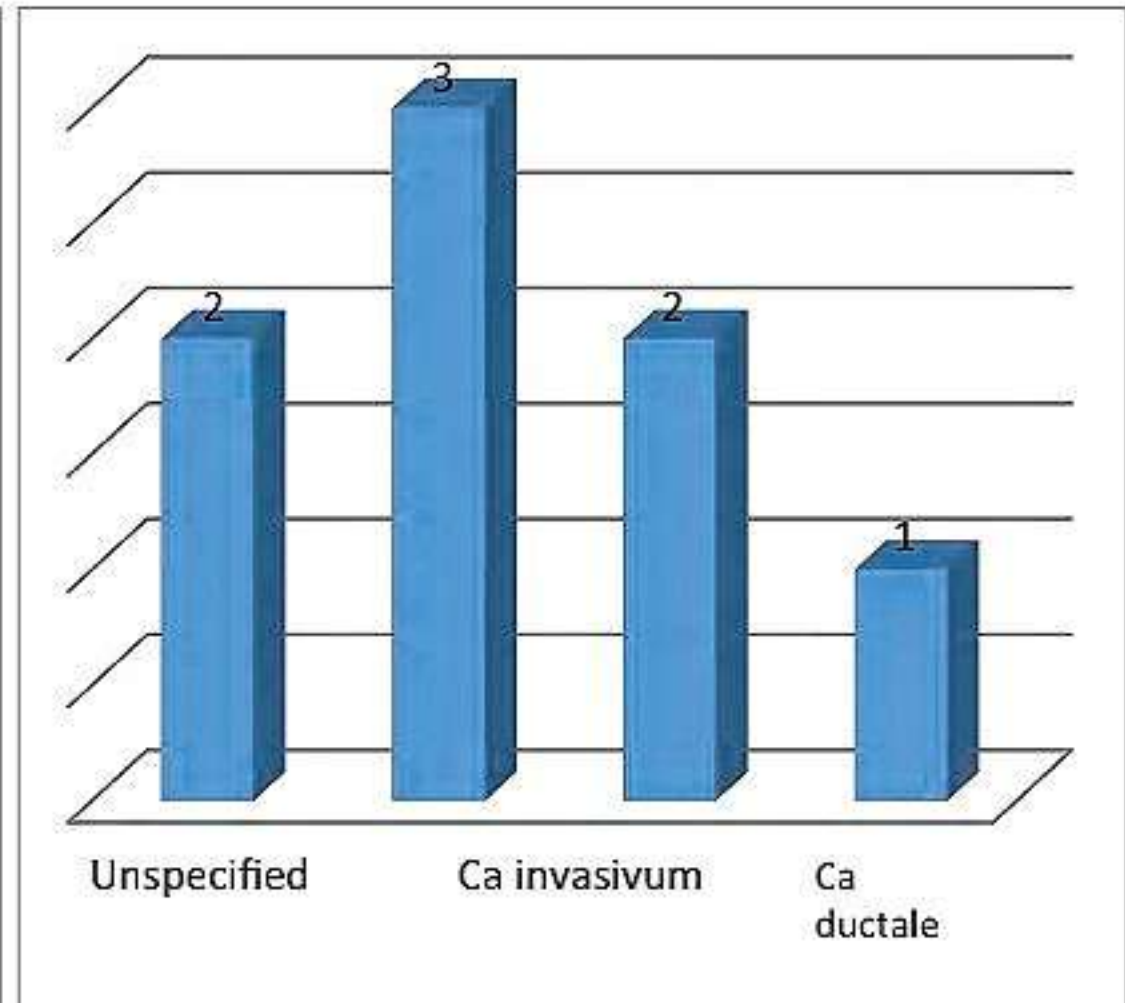after stereotactic biopsy

Figure 2 Histopathological findings of malignant
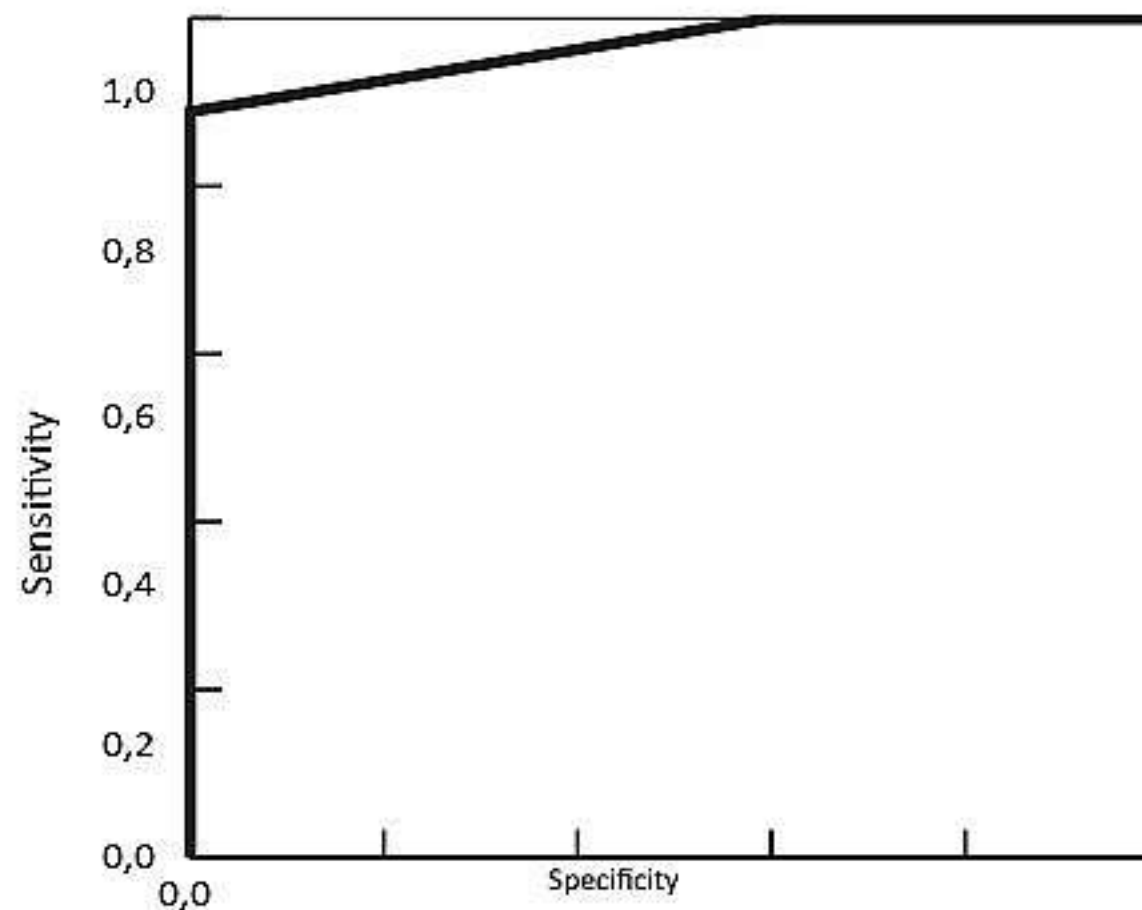lesions after stereotactic biopsy

The results of the evaluation of the degree of malignancy between the histopathological findings after stereotactic biopsy and after surgical surgery are shown in Table 1. There are significant correlations between the two variables (Spearman ρ test, p< 0.001)

Table 1 Number (n) and frequency (%) of benign, suspicious and malignant histopathological findings after stereotactic biopsy and after surgical procedure. The correlation between the identified degrees of malignancy is significant (Spearman's ρ test, p < 0.001).

		Histopathological findings after surgery					
		Benign		Suspicious		Malignant	
		n	%	n	%	n	%
Histopathological findings after stereotaxis	Benign	2	50.0%	0	0.0%	0	0.0%
	Suspicious	2	50.0%	0	0.0%	1	11.1%
	Malignant	0	0.0%	0	0.0%	8	88.9%

Figure 3 shows the ROC curve that can quantify the accuracy of the diagnostic method, that is, the accuracy of the histopathological findings after stereotaxis compared to the histopathological findings after surgery, which was used as the "gold standard". The area under the curve (AUC) was selected as a statistical parameter with a value of 0.967.

Figure 3 The ROC curve shows the relationship between the rate of false positive (FPR) and the rate of true positive (TPR) histopathological findings after stereotaxis compared to the findings after surgery. The area under the curve (AUC) has a value of 0.967.


DISCUSSION

Technological advances and modernization of radiology have led to earlier detection of small breast lesions during routine mammography. The digital stereotactic biopsy is used to obtain a sample for histopathological analysis of these small lesions that are not visible on ultrasound. The results of the stereotactic biopsy largely matched the postoperative results in patients who underwent surgery, specifically in 11 patients. The accuracy of the method is illustrated by the ROC curve, which is used to show the relationship between the false positive rate (FPR) and the true positive rate (TPR) of the findings. The calculated AUC value is 0.967, which is very close to the ideal value of 1. If the AUC is between 0.5 and 1, this means that the model is better than random selection, and a higher AUC value indicates better performance of the diagnostic method. Given the very high AUC value, the results of the stereotactic analysis and the findings obtained from the surgical sample do not differ significantly. Only in two cases did the results deviate: in the case of a patient with a lesion suspected of malignancy through stereotactic biopsy, which postoperatively turned out to be usual ductal hyperplasia, and in another case where a B3 lesion of a borderline malignant potential was postoperatively confirmed as ductal carcinoma in situ. However, this was also a borderline B finding that certainly required further diagnostic processing. Our results confirmed the exceptional significance of stereotactic breast biopsy in the diagnostic process, which aligns with reports from other authors, such as Bruening et al., who concluded, based on a meta-analysis of 33 studies, that stereotactic and ultrasound-guided biopsies are almost as accurate as open biopsies, with a lower complication rate[6].

A correlation analysis was conducted between the assessed grade of malignancy from the histopathological findings after stereotactic biopsy and after the surgical procedure. The Spearman's ρ test demonstrated a significant correlation between the two methods ($p < 0.001$). In other words, stereotactic breast biopsy in our study proved to be a reliable method for biopsy sampling in the diagnostic procedure of breast changes. Like any method,
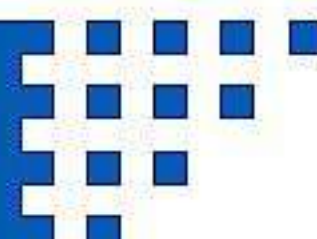
stereotactic breast biopsy has its advantages and disadvantages. The advantage is primarily the lower invasiveness of this procedure compared to surgical biopsy methods. A small scar may remain post-procedure, or in some cases, no scarring may occur at all. According to a study conducted by Yazici and Sever[7] of 210 patients who underwent 11-G needle stereotactic biopsy, only 4.3% of them had scar tissue on the control mammogram.

This method is suitable for obtaining samples from lesions with microcalcifications that are non-palpable and not visible on ultrasound. The study conducted by Liberman and Gougoutas[8] on a sample of 139 patients with microcalcifications in the breast suspected of malignancy showed that stereotactic biopsy significantly reduced the number of surgeries compared to open biopsy (patients who underwent stereotactic biopsy averaged 1.2 surgeries, while patients who underwent open biopsy averaged 1.6 surgeries), thereby reducing the stress experienced by the patients as well as the cost of the diagnostic and therapeutic procedure.

The reduced need for reoperation arises from the fact that after a stereotactic biopsy, the surgeon has enough information to predict whether a wider excision, mastectomy, or histopathological examination of the axilla is necessary.[9] All lesions for which a biopsy is indicated can be performed stereotactically; however, lesions that are close to the thoracic wall or axilla, as well as in cases where the patient has small breasts, can sometimes be difficult to access, depending on the equipment and apparatus available at the clinic. For lesions located directly behind the nipple, other methods are also preferred, as the stereotactic approach is more challenging. A complicating factor in stereotactic biopsy is that the mammogram may sometimes show only an ambiguous change in tissue density without a clearly defined mass, and at times, that change may be too subtle to be recognized during the biopsy. Diffuse deposits of microcalcifications in the breast can be challenging to target, and in such situations, this method is also limited. Sometimes, the histopathological diagnosis resulting from a stereotactic biopsy cannot exclude the presence of cancer. Thus, for example, the diagnosis of ductal atypia, due to its histological heterogeneity, requires surgical excision to rule out cancer. If the obtained sample is inadequate, ductal carcinoma in situ cannot exclude the presence of an invasive component that may later be confirmed after surgical intervention. In our study, two patients had a histopathological diagnosis of ductal carcinoma in situ after stereotactic biopsy, and after surgical excision, the presence of an invasive component was not confirmed. Additionally, sometimes a small sample size makes it impossible to make a definitive diagnosis, most commonly in the differentiation of phyllodes tumors and fibroadenomas.[10] To reduce the frequency of false-negative results, it is crucial to technically execute the biopsy procedure correctly and then compare the radiological and histopathological findings. In cases where the results are inconsistent, further diagnostic steps need to be determined. Often, in cases with significant radiological findings where a benign result is obtained through stereotactic biopsy, further diagnostic procedures are recommended, including open biopsy. The method of digital stereotactic biopsy significantly reduces the number of surgical procedures for benign changes, while in the case of malignant changes, it assists in planning an adequate surgical intervention.
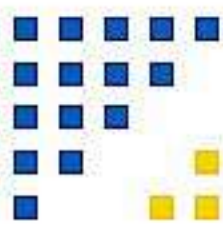
CONCLUSION

The accuracy of the diagnostic method was confirmed by analyzing the ROC curve. The AUC value is 0.967, which shows very little deviation from the ideal performance of the "gold standard," namely postoperative histopathological diagnosis. The results obtained from digital stereotactic breast biopsy are in correlation with the postoperative histopathological findings. (Spearman's ρ test, $p< 0.001$) Breast stereotactic biopsy in our study proved to be a reliable method of biopsy sampling for breast changes.

This study confirmed that the results of the histopathological analysis of samples obtained through the stereotactic biopsy method largely align with the postoperative histopathological diagnosis in patients who underwent surgical treatment. The discrepancy between the histopathological findings obtained from digital stereotactic biopsy and open biopsy occurred rarely, specifically in cases where the stereotactic biopsy confirmed a lesion of borderline malignant potential. Lesions that were suspicious on radiological examination but confirmed as benign through biopsy need to be closely monitored due to the often increased risk of malignancy in these patients.

Digital stereotactic breast biopsy is a relatively inexpensive, safe, and painless method used in the diagnostic process for breast lesions of uncertain etiology. It carries certain risks, such as the risk of bleeding and infection; however, these complications occur very rarely, especially when all preventive measures are taken, including proper preparation, cessation of anticoagulant therapy, and ensuring adequate sterile equipment. This method often reduces the number of surgeries required in cancer patients, as it allows the surgeon to better plan adequate surgical treatment.

REFERENCES

1. Prasad SN, Houserkova D. The role of various modalities in breast imaging. Biomedical Papers. 2007;151(2):209–18. Available at : https://pubmed.ncbi.nlm.nih.gov/18345253/ Pristupljeno: 26. Apr 2023

2. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, Bray F. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. CA Cancer J Clin. 2021 May;71(3):209-249. Available at: https://pubmed.ncbi.nlm.nih.gov/33538338/ Acessed: 26 Apr 2023.

3. Vinay K, Abul KA, Jon CA, Nelson F. Robbins and Cotran Pathologic Basis of Disease. Eight ed. Elsevier; Lyon, France: 2010. Accessed: 02 May 2023

4. Chakrabarti I. FNAC Versus CNB: Who Wins the Match in Breast Lesions? J Cytol. 2018;35(3):176-8. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6060573/

5. Radiological Society of North America (RSNA) and American College of Radiology (ACR). Stereotactic Breast Biopsy [Internet]. Available at: https://www.acr.org/-/media/ACRAccreditation/Documents/Stereotactic/1999-ACR-SBBAP-QC-Manual.pdf Pristupljeno: 09. May 2023

6. Bruening W, Fontanarosa J, Tipton K, Treadwell JR, Launders J, Schoelles K. Systematic review: comparative effectiveness of core-needle and open surgical biopsy to diagnose breast lesions. Ann Intern Med. 2010;152(4):238-246. Available at: https://pubmed.ncbi.nlm.nih.gov/20008742/ Acessed on: 16 May 2023
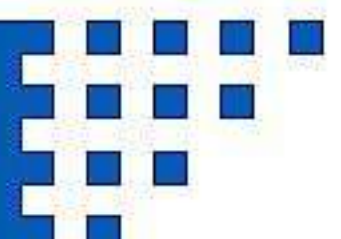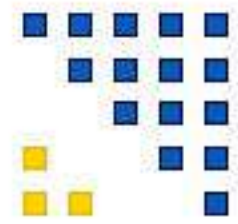
7. Yazici B, Sever AR, Mills P, Fish D, Jones SE, Jones PA. Scar formation after stereotactic vacuum-assisted core biopsy of benign breast lesions. Clin Radiol. 2006;61(7):619- 24. Available at: https://pubmed.ncbi.nlm.nih.gov/16784949/ Acessed on: 16 June 2023

8. Liberman L, Gougoutas CA, Zakowski MF, LaTrenta LR, Abramson AF, Morris EA, et al. Calcifications highly suggestive of malignancy. American Journal of Roentgenology. 2001;177(1):165–72. Available at: https://pubmed.ncbi.nlm.nih.gov/11418420/

9. Liberman L, LaTrenta LR, Dershaw DD, Abramson AF, Morris EA, Cohen MA, et al. Impact of core biopsy on the surgical management of impalpable breast cancer. American Journal of Roentgenology. 1997;168(2):495–9. Available at: https://pubmed.ncbi.nlm.nih.gov/9016234/ Acessed on: 16 June 2023

10. Dershaw DD, Liberman L. Stereotactic breast biopsy: indications and results. Oncology (Williston Park). 1998;12(6):907-922. Available at: https://pubmed.ncbi.nlm.nih.gov/9644688/ Acessed on: 26 June 2023