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Evaluation of breast cytology by applying modified Masood's scoring system

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ABSTRACT

Background: The occurrence of breast cancer is increasing worldwide with peak incidence occurring above the age of 50 years in developed countries, whereas in india, it is above the age of 40. Fine-needle aspiration cytology (FNAC) is a quick, easy, and cost-effective diagnostic tool for breast disease, and also helpful to differentiate between various benign and malignant lesions of breast. **Aims and Objectives:** (1) to assess the usefulness of Modified Masood's Scoring Index (MMSI) in breast cytology. (2) To study cytohistopathological correlation in breast lesions. After the FNAC of breast lesion, classify the breast lesion based on MMSI and histopathology. **Materials and Methods:** A hospital-based prospective study was conducted between March 2021 and September 2022 on 183 patients who were referred for FNAC from the surgery department to the cytology section of the Pathology Department at Netaji Subhash Chandra Bose Medical College Hospital in Jabalpur, Madhya Pradesh. **Results:** In our study, the largest group of cases (45.90%) was in the 20–39 age range, with a mean age of 37 ± 14.65. The majority of cases (60.6%) belonged to category II (proliferative breast disease [PBD] without atypia) with a mean MMSI score of 11.35 ± 5.55. The cytological findings showed a correlation of 98.20% with MMSI in category II and 88.68% in category IV, while the histopathological findings showed a correlation of 89.52% with MMSI category II and 98.15% with MMSI category IV. Fibroadenoma (FA) was the most common finding on histopathological examination, accounting for 120 cases (65.6%). **Conclusion:** The MMSI is an effective tool to complement cytomorphological diagnosis in breast lesions, including PBD with or without atypia and carcinomas. It is particularly valuable in the early management and prognosis of patients, as treatment options can vary based on the MMSI score.

Key words: Fine-needle aspiration cytology; Modified Masood's Scoring Index; Breast lesion

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INTRODUCTION

Breast cancer is now one of the leading causes of cancer in Indian women, being second only to cervical cancer.[1-3] It is one of the leading causes of mortality with nearly 80,000 new cases being diagnosed annually.[4]

The occurrence of breast cancer is increasing worldwide with peak incidence occurring above the age of 50 years in developed countries, whereas in india, it is above the age of 40.[5]

Increase in cases of carcinoma breast is due to late marriage, the birth of the child in a late age, shorter period of breastfeeding, and nulliparity or low parity.

Most of cancer patients are diagnosed lately, due to lack of education toward female health in most parts of India and insufficiency of breast cancer screening programs including diagnostic facilities.

Simply by clinical examination, it is difficult to determine whether a suspicious lump is benign or malignant. Therefore, a definitive and diagnostic procedure which can separate these breast lumps at the outpatient clinic is needed. This procedure must be accurate, easy to perform, and reproducible.[6]

Fine-needle aspiration cytology (FNAC) is a quick, easy, and cost-effective diagnostic tool for breast disease,

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and also helpful to differentiate between various benign and malignant lesions of breast. FNAC is an outpatient procedure, since it requires no special equipment, causes minimal morbidity, and has high patient acceptance.

FNAC of breast lumps is an accepted and established method for determine the nature of breast lumps with a high degree of accuracy and it may play an important role when it is difficult to determine the nature of breast lumps by clinical examination.[7]

The application of FNAC for the diagnosis of palpable breast masses was first introduced by Martin and Ellis in 1930 and since then, it has been established as an important tool in the evaluation of breast lesions.[8]

FNAC is a highly sensitive and specific modality for distinguishing benign and malignant lesions of breast. It has been shown that FNAC can reduce the number of open breast biopsies. A single morphological feature cannot be relied upon to distinguish malignant cells from benign at any site.[9] Hence, Masood introduced a cytological grading system to categorize palpable breast lump aspirates based on cellular arrangement, cellular pleomorphism, anisonucleosis, the presence of myoepithelial cells, nucleoli, and chromatin pattern into different groups such as category I, II, III, and IV.[10,11]

FNAC has been found to have a sensitivity ranging from 81% to 97.5% and specificity of more than 99%.[12-14]

Nandini et al., found that modification in the original Masood's Scoring Index (MSI) by advocating rearrangement score of categories I and II to improve the diagnostic accuracy of both categories. The modified scoring system is named as Modified MSI (MMSI).[15]

Aims and objectives

- To assess the usefulness of MMSI in breast cytology
- To study cytohistopathological correlation in breast lesions.

MATERIALS AND METHODS

The present study was conducted in patients with clinically palpable breast lumps, referred for FNAC from the surgery department to the cytology section of the Pathology Department, Netaji Subhash Chandra Bose Medical College Hospital, Jabalpur (M.P).

This hospital-based prospective cross-sectional study was performed to study the various cytomorphological pattern and frequency of breast lesions/lumps in our NSCB Medical College, Jabalpur (M.P.), and these lesions are also evaluated by applying MMSI and to access its usefulness

Grading system for interpretation of FNAC (Masood scoring index)

Cellular arrangement	Cellular pleomorphism	Myoepithelial cells	Anisonucleosis	Nucleoli	Chromatin clumping	Score
Monolayer	Absent	Many	Absent	Absent	Absent	1
Nuclear overlapping	Mild	Moderate	Mild	Micronucleoli	Rare	2
Clustering	Moderate	Few	Moderate	Micronucleoli and/or rare macronucleoli	Occasional	3
Loss of cohesion	Conspicuous	Absent	Conspicuous	Pre-dominantly macronucleoli	Frequent	4

Total score
Category-I- Non-proliferative breast disease 6–10
Category-II- Proliferative breast disease without atypia 11–14
Category-III- Proliferative breast disease with atypia 15–18
Category- IV- Carcinoma *in situ*/Carcinoma 19–24

Modified Masood's Scoring Index

Cellular arrangement	Cellular pleomorphism	Myoepithelial cells	Anisonucleosis	Nucleoli	Chromatin clumping	Score
Monolayer	Absent	Many	Absent	Absent	Absent	1
Nuclear overlapping	Mild	Moderate	Mild	Micronucleoli	Rare	2
Clustering	Moderate	Few	Moderate	Micronucleoli and/or rare macronucleoli	Occasional	3
Loss of cohesion	Conspicuous	Absent	Conspicuous	Pre-dominantly macronucleoli	Frequent	4

Total Score
Category-I- Non-proliferative breast disease 6–8
Category-II- Proliferative breast disease without atypia 9–14
Category-III- Proliferative breast disease with atypia 15–18
Category-IV- Carcinoma *in situ*/Carcinoma 19–24

in breast cytology also correlate with histopathological wherever possible.

Duration of study

The duration of the study was from March 2021 to September 2022.

Sample size

The sample size was 183.

Inclusion criteria

(1) Female with palpable lump in breast >1 cm clinically, (2) Age group 12–90 years, and (3) Patients giving consent for the study.

Exclusion criteria

(1) Clinically not palpable lump in breast, (2) Males are not included, and (3) Patients not giving consent for the study.

Tools to be used

(1) Gloves, (2) Spirit swab, (3) 2–5 mL disposable plastic syringe, (4) 22–23G needle, (5) Cotton, (6) Fixative (isopropanol alcohol), (7) Clean glass slides, (8) Coverslip, (9) Hematoxylin and eosin stain, (10) Dibutylphthalate polystyrene xylene, and (11) Microscope.

Ethical issues

This study will be conducted after getting informed consent from the patient. This is an observational study and the techniques going to be used are minimally invasive, thus no such ethical issues are being created.

Statistical analysis

The data of the present study will be recorded/fed into the computers and after its proper validation, check for error; coding and decoding will be compiled and analyzed with the help of SPSS 20 software for Windows. Appropriate univariate and bivariate analysis and descriptive statistics will be carried out other statistical tests such as the student's t-test for continuous data and Fisher's exact test or X^2 test for categorical data will also be applied if the necessity felt to support the hypothesis.

All means are expressed as mean ± standard deviation and proportion as in percentage (%). The critical value for the significance of the results will be considered ≤0.05 level.

RESULTS

In this study, the maximum number of cases (84) were of 20–39 years age group (45.90%), followed by 52 cases (28.42%) in the 40–59 years age group. The mean age of the study population was 37±14.65 (Table 1).

In the present study, around 13 cases (7.1%) of category I (Figure 1) of MMSI (score 6–8), majority of cases belong to category II (Figure 2) of MMSI proliferative breast disease without atypia MMSI (score: 9–14) accounting for 111 cases (60.6%), only 6 cases (3.3%) were found Category III (Figure 3a and b) of MMSI (score: 15–18), followed by category IV (Figure 4a and b) carcinoma *in situ*/carcinoma MMSI (score: 19–24) were 53 cases (28.9%). The MMSI score mean was 11.35±5.55 (Table 2).

Table 1: Age-wise distribution of cases

Age (years)	Frequency, n (%)
<20	34 (18.58)
20–39	84 (45.90)
40–59	52 (28.42)
≥60	13 (7.10)
Total	183 (100.00)

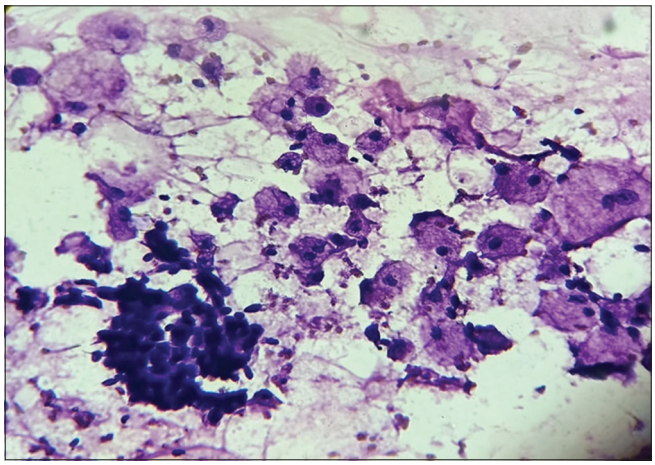

Figure 1: Hematoxylin and Eosin stain stained smear showing cohesive small one cluster ductal epithelial cells with plenty of foamy macrophages against a proteinaceous background s/o Fibrocystic disease of breast

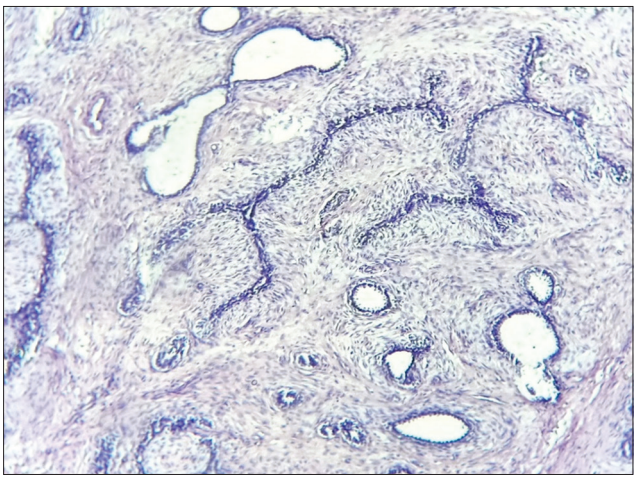

Figure 2: Hematoxylin and Eosin stain section show both intra-canaliculi and para-canaliculi patterns. Stroma compresses and distorts slit-like space. (Fibroadenoma)

In this study, the correlation between cytological findings (FNAC) and MMSI was studied. The cytological findings show that 98.20% correlate with MMSI in Category-II findings and 88.68% with Category IV. On applying the Chi-square test, it is found to be significantly associated (P<0.001%) (Table 3).

In the present study, the histopathological findings show that 89.52% correlate with MMSI Category II and MMSI Categories-IV showed 98.15% correlation. On applying the Chi-square test, it is found to be highly significantly associated (P<0.001) (Table 4).

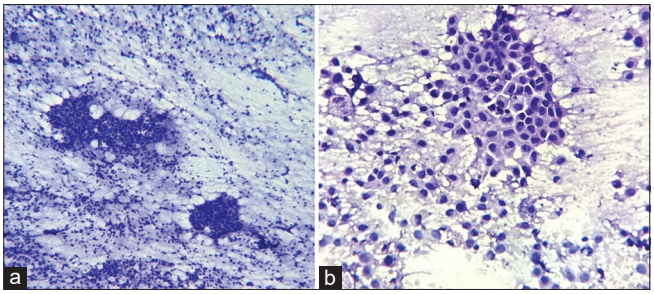

Figure 3: (a and b) Hematoxylin and Eosin stain stained smear showing loose cluster of ductal epithelial cells having round to oval, mild to moderate pleomorphic, hyperchromatic nuclei. Suggestive of proliferative breast disease with atypia

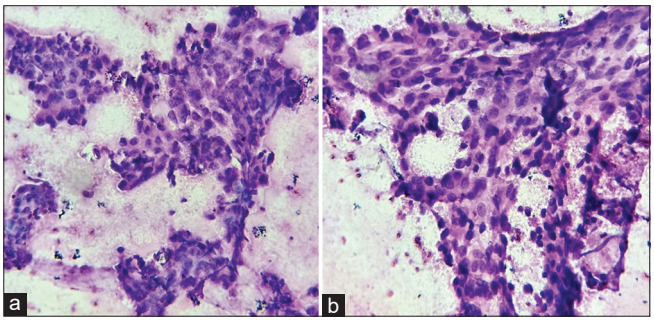

Figure 4: (a and b) Hematoxylin and Eosin stain stained smear showing large cluster and small clumps neoplastic ductal epithelial cells having enlarge, mild to moderate cellular pleomorphism, fine to coarse granular chromatin and prominent nucleoli suggestive of ductal carcinoma breast

Table 2: Modified Masood's Scoring Index

Grade	Category	MMSI score	Frequency (%)
I	NPBD	6–8	13 (7.1)
II	PBD without atypia	9–14	111 (60.6)
III	PBD with atypia	15–18	6 (3.3)
IV	Carcinoma *in situ*/carcinoma	19–24	53 (28.9)

PBD: Proliferative breast disease, MMSI: Modified Masood's Scoring Index, NPBD: Non-PBD

In the present study, fibroadenoma was the most common breast lesion. The cytological findings were in 87.5% concordance with histopathological findings and ductal carcinoma breast was in 87.04% concordance with histopathological findings. On applying the Chi-square test, it is found to be highly significantly associated (P<0.001*) (Table 5).

DISCUSSION

In the present study, 183 patients were included, all of which were females between the age of 14–78 years. Majority of the cases 136 (74.35%) were between 20 and 59 years. In our study, most of the patients belonged to the active reproductive age (20–39 years) and youngest patient was 14 years of age, and the oldest was 78 years old. The common age group (20–39 year) were affected with benign disease of breast. The mean age was 37±14.6% years (Table 1). Cherath and Chithrabhanu[16] observed that 65.11% of cases were in the age range of 26–55 years (mean age - 46.1 years). Panjvani et al.,[8] found that the maximum number of cases belonged to the age group 21–40 years (50.45%). Agrawal et al.,[17] observed that the maximum number of cases was in the range of 41–70 years.

In this present study, the majority of cases classified based on MMSI score belonged to Category II (proliferative breast disease [PBD] without atypia) and the second most common involved Category IV (carcinoma *in situ*/carcinoma) - 53 cases (28.9%). The remaining 13 cases (7.1%) belong to Category I (NPBD) and only 6 cases (3.3%) were found in Category III (BPD with atypia) (Table 2). Shah and Code[18] found that the maximum number of cases belonged to Category II (42%), followed by Category IV (34%). Agrawal et al.,[17] found that the maximum number of cases belonged to Category IV (47.8%).

In the present study, cytology and MMSI concordance in Category I is 72.22% (Table 3), histopathological and MMSI concordance was 23.07% (Table 4), because we received minimum number of biopsy reports in this

Table 3: Correlation of cytology finding with Modified Masood's Scoring Index

Categories	FNAC findings	MMSI number of cases	Concordance (%)	Non-concordance (%)
NPBD (Category-I)	18	13	72.22	27.78
PBD without atypia (Category-II)	109	111	98.20	1.80
PBD with atypia (Category-III)	9	6	66.67	33.33
Carcinoma *in situ*/carcinoma (Category-IV)	47	53	88.68	11.32

PBD: Proliferative breast disease, MMSI: Modified Masood's Scoring Index, NPBD: Non-PBD, FNAC: Fine-needle aspiration cytology

Table 4: Correlation of histopathological findings with Modified Masood's Scoring Index

Category	MMSI No. of cases	HPR findings	Concordance (%)	Non-concordance (%)
NPBD (Category-I)	13	3	23.07	76.93
PBD without atypia (Category-II)	111	124	89.52	10.48
PBD with atypia (Category-III)	6	2	33.33	66.67
Carcinoma *in situ*/carcinoma (Category-IV)	53	54	98.15	1.85

PBD: Proliferative breast disease, MMSI: Modified Masood's Scoring Index, NPBD: Non-PBD

Table 5: Correlation of cytological findings with histopathological findings

FNAC findings	Number of cases	HPR findings	Concordance (%)	Non-concordance (%)
BBL	18	3	16.67	83.33
FA	105	120	87.5	12.5
ADH	9	2	22.22	77.78
Phyllodes	4	4	100.0	0.00
DCB	47	54	87.04	12.96

FNAC: Fine-needle aspiration cytology, BBL: Benign breast lesion, FA: Fibroadenoma, ADH: Atypical ductal hyperplasia, DCB: Ductal carcinoma breast

Category as compared to various studies by William et al.,[19] found that the concordance between MMSI and histopathology is 66.6% Cherath and Chithrabhanu[16] found that the concordance between MMSI and histopathology is 92.68%.

In the present study, cytology and MMSI concordance in Category II was 98.20% (Table 3) and histopathological finding and MMSI concordance was 89.52% (Table 4). Shah and Code[18] found that the concordance between MMSI and histopathology is 95.45%. William et al.,[19] found that the concordance between MMSI and histopathology is 100%.

In the present study, maximum discordance of 33.33% was found between cytology and MMSI in category III (Table 3), and 76.93% between histopathological findings and MMSI in category I (Table 4). Shah and Code[18] found that the discordance between MMSI and histopathology was maximum for category I (9.1%). William et al.,[19] found that the concordance between MMSI and histopathology is 33.3%.

In the present study, cytology and MMSI concordance in category IV was 88.68% (Table 3) and histopathological findings and MMSI concordance was 98.15% (Table 4). Cherath and Chithrabhanu[16] found that the concordance between MMSI and histopathology is 100%. William et al.,[19] found that the concordance between MMSI and histopathology is 88.8%.

In the present study, concordance between cytological and histopathological findings in fibroadenoma, ductal carcinoma breast, and phyllodes was 87.5%, 87.04%, and 100%, respectively (Table 5).

In the present study, 18/183 cases were classified as NPBD on FNAC, by applying MMSI to FNAC aspirates, 13/183 cases fell under Category-I (NPBD). Because 7 cases had high MMSI scores between (9 and 14) these cases were placed in Category-II (PBD without atypia) and 1 case had high MMSI score between (15 and 18) which was placed in Category-III (PBD with atypia). We got MMSI correctly placed 3/183 cases in Category-I (NPBD) according to histopathology because 11 cases were shifted to Category-II and 1 case was shifted from Category-II. Our study compared with Shah and Code[18] found that 20/50 cases were classified as NPBD on cytology, by MMSI on FNAC aspirate, 11/50 cases fell under Category-I and they found histopathology report 10/50 cases, MMSI correctly place 10 cases under Category-I (NPBD) because FNAC of breast lesion began as a screening procedure to distinguish benign lesion from malignant lesions.

In the present study, the number of cases diagnosed on FNAC with PBD without atypia was 109/183, out of which the majority of cases were diagnosed with fibroadenoma. By applying MMSI on FNAC aspirate, 111/183 cases were placed under Category-II (PBD without atypia), because 7 cases shifted from Category-I (NPBD) to Category-II (PBD without Atypia) had high MMSI scores (9–14) and 2 cases shifted to Category-III MMSI score (15–18) from Category-II MMSI score (9–14) and 3 cases shifted to Category-I MMSI score (6–8). HPR confirmed 124/183 cases under Category-II because 1 case was shifted to Category-I and 11 cases shifted from Category-I and 3 cases shifted from Category-III. The result was found by Jayaram et al.,[20] where they diagnosed 144 cases in Category-II through histopathology, out of which 134 cases were diagnosed with cytology and 140 cases by MMSI. Another result was found by Shah and Code[18] where the number of cases diagnosed on cytology was 12/50. By MMSI categories, 21/50 cases were in this group. On HPR, 22/50 cases were confirmed.

In the present study, 09/183 cases were diagnosed as Category-III (PBD with atypia), most commonly atypical ductal hyperplasia on FNAC. By applying MMSI, only 6/183 cases in Category-III, because 6 cases were shifted to Category-IV and 1 case shifted from Category-I and 2 cases shifted from Category-II. 2/183 cases are placed in Category-III confirmed by HPR because 3 cases shifted to Category-II and 1 case was shifted to Category-IV. Similar results were found by Shah and Code[18] that 2 cases were diagnosed as FNAC. By applying the MMSI on FNAC, 1 case was found in Category III and confirmed by histopathology.

In this study, the number of cases diagnosed as ductal carcinoma breast on FNAC was 47/183. By applying MMSI, 53/183 cases were in Category-IV because 6 cases shifted from Category-III had high MMSI scores ranging from (15 to 18). 54/183 cases confirmed by histopathology report were diagnosed as infiltrating ductal carcinoma of breast because 1 case was shifted from Category-III. Similar results were found by Shah and Code[18] where they diagnosed 16/50 cases as Category-IV (carcinoma breast) on FNAC, MMSI categorized 17/50 cases to Category-IV, and one case was added from Category-III which had high MMSI score. The findings were correlated with histopathology and 17/50 cases were confirmed as carcinoma breast. Agrawal et al.,[17] diagnosed 33 cases in this category. All the cases were correlated with histopathology with similar concordance.

Limitations of the study

Our study had small sample size.

CONCLUSION

In the present study, we concluded that FNAC is simple rapid, minimally invasive cost-effective, reliable outpatient procedure highly sensitive in making early and accurate diagnosis.

MMSI is useful along with cytomorphological diagnosis in breast lesions, PBD with or without atypia, and carcinomas which is very useful in the early management and prognosis of patients, as the line of treatment varies.

In the present study, insignificant results were found in NPBD on cytology and MMSI because the risk of malignancy is very low, so in the maximum number of cases, biopsy was not found.

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Author's Contributions:
JY- Concept and design of the study, prepared first draft of manuscript; **PB-** Interpreted the results; reviewed the literature and manuscript preparation; **SDB**- Coordination, preparation and revision of manuscript, statistical analysis, and interpretation.

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