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Determine the Validity of the Gail model in Indian Women

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Abstract:
Introduction:
Due to increased incidence of breast cancer in India, it is vital to detect high-risk breast cancer cases early and timely. Western countries widely used GM for predicting the absolute risk of invasive breast cancer. Here we studied Gail's model applicability for breast cancer in the Indian Population.
Methodology:
The study was a prospective observational study Involving 600 patients and enrolled in two study groups based on Tissue Diagnosis Trucut Biopsy /Excision Biopsy comprising 300 patients in each. According to Gail score, they separated into High Risk and Low Risk. All women have undergone a triple assessment test for a definitive diagnosis. After establishing a definitive diagnosis, we were correlated Gail Model Score with Final Diagnosis. SPSS version 20 used for statistical analysis.
Result:
GAIL Score calculated after analysis of all patient, and its shown a 5-year risk of developing breast cancer in an individual of the same age and risk factors. The mean GAIL score was 0.28 in group 1 and 0.62 in Group 2. Although there was a significant difference in GAIL Score, a low GAIL score in study group 2 compares to the threshold of 1.67, which is considered substantial and affected screening follow-up and chemoprevention strategy for the patient. The average risk of developing breast cancer in a lifetime in study group 1 was 3.49, while group 2 was 4.53. P-Value of Gail is < 0.001, i.e. the difference in both Group is statistically significant. So low Gail score accurately predicts the low risk of breast cancer in the Indian Population.
Keywords: *Benign breast disease; Breast carcinoma; Gail score*

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I. Introduction

In all major parts of the world, breast cancer is the commonest, second most typical cancer in women [1]. Indian Medical Research Council (ICMR) has estimated that India's breast cancer burden will grow from 80,000 in 2005 through 122,000 new cases in 2011 and attain 141,000 cases in 2016 [2]. India faces a potential threat of breast cancer in the next decade due to women assuming Western lifestyles by marrying and bearing children later in life. There is required to adopt early detection strategies, including screening mammography aggressively. A 2005 study performed by the International Association of Cancer Research, based in Lyon, France, projected that 250 000 cases of breast cancer in India by 2015, a 3% increase per year. At present, India reports approximately 100000 new cases annually. There are also significant local variations in incidence rates; the overall rate estimated at 80 new cases per 100 000 per year. However, in Delhi, that rate is fixed at 146 per 100 000. By difference, the national rate was 23.5 in 1990 [3]. Breast cancer is increasing in India at such a pace that we may face a severe disease burden in the coming years. Due to ordinary people's lifestyle changes and the lack of a system to suitably enable mass-awareness, and an early diagnosis and treatment facility in various regions, breast cancer incidence is increasing in India [4].

The need for a Risk Model:

Considering the above facts and lack of medical infrastructure and people living in remote areas with no reach to the healthcare system, we require a Breast cancer risk assessment model validated for the Indian population. A good Risk Model should accurately predict the number of breast cancers that will develop in a cohort of women overall and women with specific risk factor combinations. There is a need to evaluate India's Gail model applicability and be extrapolated to diagnose/isolate Breast Cancer in Breast Lump cases.

II. Material And Method

This was a prospective observational study, including 600 patients diagnosed with malignant and benign breast disease between 35 to 65 Yrs of Age group and conducted at a tertiary care teaching hospital. The study period was for a period of 18 months from Oct 2013 to March 2015. All patients who fulfilled the eligibility criteria were included after ethical clearance from the institute's ethical committee. Patient details documented as per the preformed questionnaire. All women were coming to OPD with the palpable identifiable disease assessed for their Gail score, and it recorded in the Performa available with us. We were separate them accordingly as High Risk and Low Risk, according to Gail score. We were also calculated and define a modified mean score for Indian women. All women with palpable identifiable mass underwent a standard triple assessment test (Clinical Examination + Mammography + Histopathology), and a Definitive diagnosis was made. Investigations for tissue diagnosis- FNAC/True cut biopsy/ Excision biopsy was done. After establishing a definitive diagnosis, we were correlated Gail Model Score with Final Diagnosis. We also calculated Positive predictive value, negative predictive value and sensitivity and specificity of the Gail Model. A *p-value* of <0.05 was considered statistically significant in univariate analysis (Figure: 1). SPSS version 20.0. was used for statistical analysis.

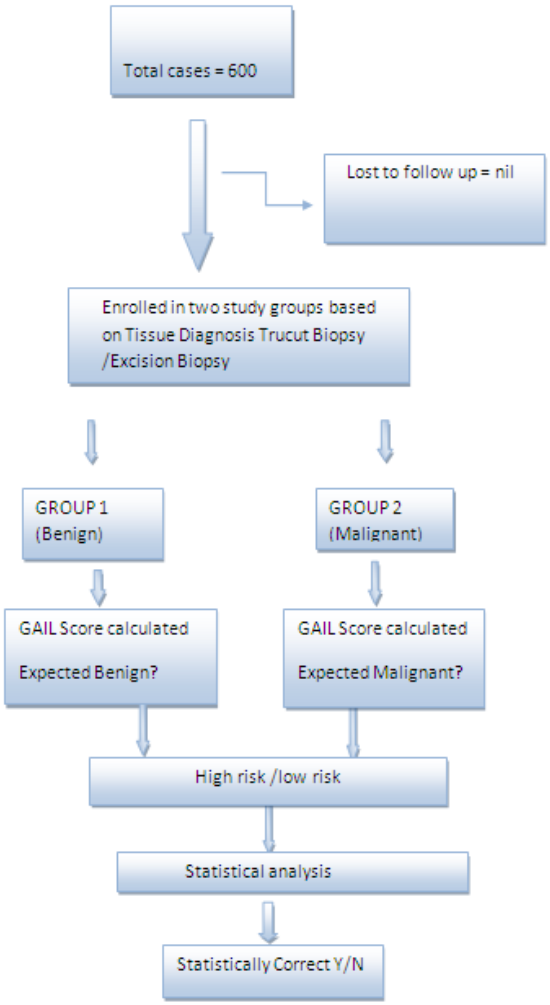

Figure: 1 Study outline

III. Observation and Results

This prospective study was conducted at a tertiary care hospital. It included all those patients reporting to this hospital with breast lump patients' complaints having tissue diagnosis proven benign breast tumour in 300 cases and 300 cases of malignant breast tumour cases. Based on history, examination and tissue diagnosis, the GAIL Risk score calculated, and the patient annotated as high risk or low risk for developing breast cancer. Further, we have correlated the Gail Model Score with Final Diagnosis. We have also calculated Positive predictive value, negative predictive value and sensitivity and specificity of the Gail Model. A *p-value* of <0.05 has been considered statistically significant in univariate analysis.

Observations in the two groups are depicted below:

1. The pattern of involvement of right/left or bilateral disease, age distribution, age at menarche, mean age and age of first childbirth in both groups are shown in table - 1, 2, 3, 4 & 5. *p-value* of <0.05 has been considered statistically significant.

		Group		Total	Pearson Chi-Square	p-value
		Group 1	Group 2			
site	B/L BREAST	4	2	2	9.53	0.049
	LT Breast	148	165	313		
	RT Breast	148	133	279		
Total		300	300	600		

Table: 1 Shows a comparison of which breast is affected in both groups.

		Group		Total	Pearson Chi-Square	p-value
		Group 1	Group 2			
Age	35-45 Yrs.	242	105	347	131.9	<0.001
	45-55 Yrs.	38	95	133		
	55-65 Yrs.	20	100	120		
Total		300	300	600		

Table:Age Distribution of Women

		Group		Total	Pearson Chi-Square	p-value
		Group 1	Group 2			
Age of menarche(in years)	<=11Yrs	0	5	5	5.5	0.064
	12-13 Yrs.	121	111	232		
	>13 Yrs.	179	184	363		
Total		300	300	600		

Table: 3 Distribution of age of menarche in both age groups.

Mean age in years	GROUP 1	GROUP 2
Current age	41.95	50.44
Age of menarche	13.83	14.05
Age of first live birth	20.45	20.61

Table: 4 Mean age trend in both groups

		Group		Total	Pearson Chi-Square	p-value
		Group 1	Group2			
Age of First Live Birth	<20 Yrs.	107	95	202	12.71	0.002
	20-24 Yrs.	193	193	386		
	25-29 Yrs.	0	12	12		
Total		300	300	600		

Table: 5 Distribution of Age of first Live Birth in two study Group

6. Number of first degree relatives with Breast Cancer:

There is no significant association found between a number of first degree relatives with breast cancer and the occurrence of breast cancer.GAIL model does not consider the number of second-degree relatives with breast cancer, which may be considered a drawback of the GAIL Model (Table: 6).

		Group		Total	Pearson Chi-Square	p-value
		Group 1	Group 2			
Number of first degree relatives with breast cancer	0	293	290	583	2.08	0.353
	1	7	8	15		
	2	0	2	2		
Total		300	300	600		

Table: 6 Distribution of Number of First-degree relatives with Breast Cancer

7. Number of previous breast biopsy:

Previous breast biopsy indicates suspicious pathology in the same patient earlier. In our study, 98 patients had a single previous breast biopsy, and one patient had twice a previous breast biopsy. Five patients had previous biopsy thrice in study group 2. Study group 1 had 15 patients with a single previous breast biopsy, and three patients had double previous breast biopsy (Table: 7).

		Group		Total	Pearson Chi-Square	p-value
		Group 1	Group 2			
Number of previous breast biopsy	0	282	196	478	82.44	<0.001
	1	15	98	113		
	2	3	1	4		
	3	0	5	5		
Total		300	300	600		

Table: 7 Distribution of Number of previous breast biopsy

8. The Previous biopsy has showing atypia:

In our study, 63 patients had Atypia (Atypical ductal hyperplasia ADH or Atypical lobular hyperplasia ALH) in previous breast biopsy, and they all belong to Study group 2 that have malignant cases. P-value is < 0.001, i.e. statistically significant, indicating breast biopsy Atypia to be strongly correlated with cancer (Table: 8).

		Group		Total	Pearson Chi-Square	p-value
		Group 1	Group 2			
whether the previous biopsy has shown atypia	No	300	237	537	70.39	<0.001
	Yes	0	63	63		
Total		300	300	600		

Table: 8 Distribution of Previous Breast biopsies showing Atypia

9. Mammography results:

There were 164 patients with BIRADS I in Group 1 and 1 patient with BIRAD 1 in Group 2, while there was no patient with BIRADS Score of IV, V and VI in Group 1whereas 84,102 and 68 patients respectively with BIRADS Score IV, V and VI. P VALUE< 0.001 indicating a significant difference in the BIRADS Score of mammography in both groups (Table: 9).

		Group		Total	Pearson Chi-Square	p-value
		Group 1	Group 2			
MMG	BIRADS I	164	1	165	507.1	<0.001
	BIRADS II	131	21	152		
	BIRADS III	5	24	29		

	BIRADS IV	0	84	84		
	BIRADS V	0	102	102		
	BIRADS VI	0	68	68		
Total		300	300	600		

Table: 9 showing the mammography pattern in both groups.

10. GAIL Score:

After analysis of all the patients, GAIL Score was calculated. It gives a 5-year risk of developing breast cancer in an individual of the same age and risk factors. The mean GAIL score in group 1 was 0.28, and Group 2 was 0.62. Although there was a significant difference in GAIL Score, in study group 2 is lower than the threshold of 1.67, which was considered significant and affected screening follow-up and chemoprevention strategy for the patient. Average lifetime risk of developing breast cancer in our study group 1 was 3.49, while in group 2, i. e. 4.53.

P-Value of Gail is < 0.001, i.e. the difference in both groups were statistically significant. So low Gail score accurately predicts the low risk of breast cancer in the Indian Population(Table: 10).

	Group 1	Group 2
GAIL SCORE of patients	0.28	0.62
5 yr risk of developing breast cancer in women of the same age	0.42	0.62
a lifetime risk score of patients	3.49	4.53
the lifetime risk of breast cancer in women of the same age	5.12	4.31

Table: 10 Distribution of GAIL Score results

11. Low /High Risk:

According to Gail Model, 12 patients (2 %) of cases were found to have high risk. According to the GAIL model, 12 patients are at high risk for developing breast cancer in the next five years, all of which belong to group 2.588 Patients (98 %) had a low risk of developing breast cancer in the next five years (Table: 11).

		Group		Total	Pearson Chi-Square	p-value
		Group 2	Group 1			
LOW/HIGH	High	12	0	12		
	Low	288	300	588	12.24	<0.001
Total		300	300	600		

Table: 11 Distribution of Low /High Risk

12. Sensitivity, Specificity PPV and NPV AS PER GAIL'S Score:

As per our study, at a Gail score of 0.62(of malignant cases i.e.group 2), the Gail model's sensitivity was 4%, specificity was 100%, Positive predictive value was100%, and the negative predictive value was 51%.

13. Area under the curve (ROC):

Receiver operating characteristics (ROC) curves plotting true positive (sensitivity) versus false-positive fraction (specificity). ROC Curve suggests that the maximum area under the curve is for GAIL Score (Percentage of 5-year risk of developing breast cancer in a patient of the same age group and risk factors), so it is a most significant Gail value score (Figure: 2 and Table: 12).

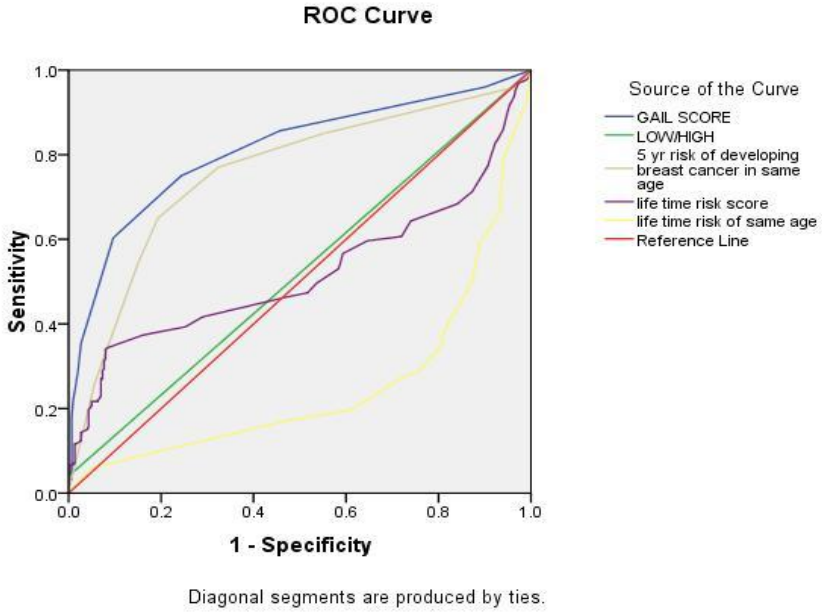

Figure: 2 Receiver operating characteristics (ROC) curve

Test Result Variable(s)	Area
GAIL SCORE	0.81
LOW/HIGH	0.52
5 yr risk of developing breast cancer in the same age	0.756
lifetime risk score	0.519
the lifetime risk of the same age	0.251
The test result variable(s): GAIL Score, Low/High risk, the 5-year risk of developing breast cancer in the same age, lifetime risk score, the lifetime risk of the same age has at least one tie between the positive actual state group and the negative actual.	

Table: 12 Receiver operating characteristics (ROC) curve

14. Multivariable regression analysis:–

Calculated R Square has a value of 77.9 %, which means most of the variability of data around its mean. It also tells us that model is adequately fit to our data (Table: 14).

Model Summary									
					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. The error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.883[a]	0.779	0.777	0.17601	0.779	419.349	5	594	0

Table: 14 Multivariable regression analysis

15. Paired t-test:

The paired t-test was done for all the variables of the Gail model. The mean GAIL Score of Benign Group 1 was 0.28 with a Standard deviation of 0.18 with a t value, while for malignant Group 2, it was 0.62 with a standard deviation of 0.44. The t value is 12.363 with a p-value of,0.001 which is significant. Means Low GAIL score confirms the diagnosis of Benign Breast disease affirmatively. Lifetime risk of developing breast cancer in the patients of study Group 1 in 3.49 %, with a standard deviation of 1.35. Lifetime risk of developing breast cancer in the patients of study Group 2 is 4.53 % with a standard deviation of 4.32, so there is a considerable variation in risk of developing Breast cancer in study group 2.Mean 5 yr. Risk of developing breast

cancer in Individual of the same age as group 1 is 0.42 with an SD of 0.16. The mean 5 yr risk of developing breast cancer in Individual of the same age as group 2 is 0.62, with an SD of 0.41(Table:15).

	Group	N	Mean	Std. Deviation	t-value	p-value
GAIL SCORE	Group 1	300	0.28	0.18	12.363	<0.001
	Group 2	300	0.62	0.44		
5 yr risk of developing breast cancer in the same age	Group 1	300	0.42	0.16	7.828	<0.001
	Group 2	300	0.62	0.41		
lifetime risk score	Group 1	300	3.49	1.35	3.968	<0.001
	Group 2	300	4.53	4.32		
the lifetime risk of the same age	Group 1	300	5.12	1.18	7.244	<0.001
	Group 2	300	4.31	1.53		
Current age	Group 1	300	41.95	7.32	12.332	<0.001
	Group 2	300	50.44	9.41		
Age of menarche	Group 1	300	13.83	1.09	2.182	0.03
	Group 2	300	14.05	1.43		
Age of first live birth	Group 1	300	20.45	1.75	1.064	0.288
	Group 2	300	20.61	2.07		
Number of first degree relatives with breast cancer	Group 1	300	0.02	0.15	1.056	0.292
	Group 2	300	0.04	0.23		
Number of previous breast biopsy	Group 1	300	0.07	0.29	8.28	<0.001
	Group 2	300	0.38	0.59		

Table: 15 t-Test Result

16. Interpretation regression analysis:

When we keep Gail score as the dependent variable –Current age, age of first live birth, number of first degree relatives with breast cancer and number of previous breast biopsy values came as significant in the GAIL model.

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	64.957	5	12.991	419.349	.000[a]
	Residual	18.402	594	0.031		
	Total	83.359	599			

a. Predictors: (Constant), Number of previous breast biopsy, Number of first degree relatives with breast cancer, age of first live birth, age of menarche, Current age

b. Dependent Variable: GAIL SCORE

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-0.931	0.116		-8.052	0
	Current age	0.018	0.001	0.445	22.582	0
	Age of menarche	0.001	0.006	0.004	0.185	0.853
	Age of first live birth	0.021	0.004	0.109	5.646	0
	Number of first	0.696	0.038	0.361	18.442	0

	degree relatives with breast cancer					
	Number of previous breast biopsy	0.425	0.015	0.556	28.452	0
a. Dependent Variable: GAIL SCORE						

IV. Discussion

Gail's model is commonly used in Western countries for estimation of absolute risk of invasive breast cancer. Many other prospective studies looking at the accuracy of the GM were previously performed. However, these studies were done predominantly in Western populations: New York [5], Canada [6], Edinburgh [7], Malmo [8,9], Kopparberg and Ostergotland [10], Stockholm [11], Gothenburg [9,12], and Turkey [13]. Enrollment of asian women into such trials conducted in Western populations has been rare and grim. Quite few publications have evaluated the GM in a population outside the US, and these were based primarily on case-control data, which are more appropriately used for assessment of relative rather than absolute risk [14,15], so by taking into consideration of the above facts, we studied of Gail's model applicability for breast cancer in Indian population.

In the present study, 300 women with benign breast disease were included in Group 1, and 300 women with malignant breast disease were included in Group 2 with age from 35 to 65 years. Group 1 has a mean age (41.95 yrs) lower than group 2(50.44 yrs). A maximum number of benign cases of Group 1 are in the younger age group, 242 cases in less 35-45 Years age group. Group 2 has an even age distribution with no prelidiction for the specific age group with 105 in 35-45 yrs age group and 95 cases in 45-55 and 100 cases in 55-65 years. In group 1, only 20 cases with an age group of 55 to 65 years, so malignancy tends to present in a higher age group. P-Value being < 0.001 shows the difference in the age group between the two study groups as significant.

In the study conducted by Reddy et al. [16] for assessment of the clinical utility of the Gail model in estimating the risk of breast cancer in women from the Indian population, there were 104 patients above 35 years with confirmed breast cancer (Group A), 100 patients above 35 years with confirmed benign breast disease (Group B) and 100 patients attendant above 35 years (Group C). The mean age was 48 year in Group A,42 years in Group B and 45 years in Group C.

In the Singapore Breast Cancer Screening Project (SBCSP), conducted by Wen Yee Chay et al. [17] for validation of the Gail model for predicting individual breast cancer risk in Singapore women, there were 28,104 women aged 50 to 64 in the study population who did not have breast cancer detected during screening. In the present study mean age of menarche is 13.83 Years in group 1, i.e. benign group and 14.05 years Group 2, i.e. Malignant group, which correlates with the study conducted by Reddy et al. [16], in which the mean age of menarche was 13 year in Group A(malignant disease),13 years in Group B (in patients with benign disease).

In the present study mean age of Patients at first live birth is 20.45 year in Group 1(benign disease) and 20.61 in Group 2 (malignant disease), so there is no significant difference in the two study groups which do correlate with the study conducted by Reddy et al. [16] mean age of first live birth was 20 years in Group A (malignant disease) and 21 years in Group B (in patients with benign disease).

The incidence of breast cancer is tremendously low earlier age 30 (incidence <25 cases per 100,000), after which it increases linearly till the age of 80, reaching a plateau of slightly less than 500 cases per 100,000 [18]. If all women less than 65 yrs of age were equated with women aged 65 yr or older age, the relative risk of breast cancer associated with increased age was 5.8 (Figure:3)

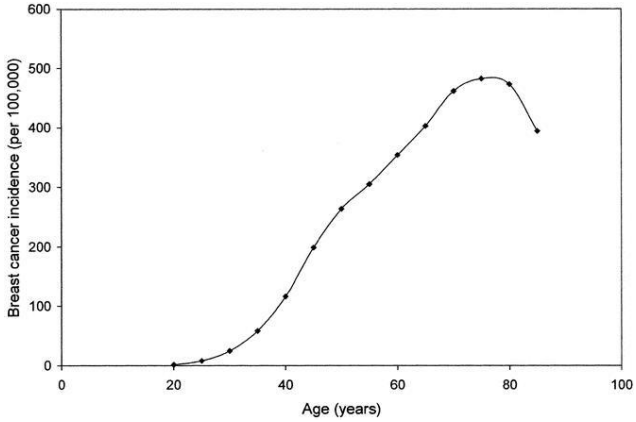

Figure: 13 Breast cancer incidence (per 100,000) as a function of age. (Data derived from SEER Cancer Statistics Review, 1973–1997[18]).

Previous breast biopsy indicates suspicious pathology in the same patient earlier. In our study, 98 patients had a single previous breast biopsy, and one patient had two previous breast biopsy, and five patients had three previous biopsies. All of these patients were in study group 2(with cancer patients). Study group 1(with benign disease) had 15 patients with a single previous breast biopsy, and three patients had a double previous breast biopsy.

In the study conducted by Reddy et al. [16], four patients underwent benign biopsy in Group A (malignant disease)and one in Group B (in patients with benign disease). Among the four patients in the group, A 3 had a biopsy for atypical ductal hyperplasia (ADH) and one for Atypical lobular hyperplasia. In group A, one had a previous biopsy for ADH. In our study, 63 patients had atypia (Atypical ductal hyperplasia ADH or Atypical lobular hyperplasia ALH) in previous breast biopsy, and they all belong to Study group 2 that have malignant cases. P-value is < 0.001, i.e. Statistically significant, indicating breast biopsy atypia to be strongly correlated with cancer.

In the present study, there is a history of breast cancer in one first degree relatives of 7 patients in Group 1(benign breast disease group). Of 8 patients in Group 2(i.e. Cancer group) and no history of the presence of second-degree relative with breast cancer in Group 1while presence of a history of a second-degree relative in 2 patients with Group 2.P-Value being 0.353(i.e.>0.05 is not significant).while in the study conducted by Reddy et al. [16], seven patients in Group A (malignant disease) and one patient in Group B (in patients with benign disease). A study documented in a 1985 study by Dupont et al. [19] re-evaluated breast biopsies from 1,925 patients with the proliferative disease (hyperplasia) and 1,378 patients nonproliferative benign breast disease who had been followed for a median duration of 17 years. In comparison to patients without hyperplasia, they found that the relative risk for invasive breast cancer was 1.9 in patients with early hyperplasia, 5.3 in patients with atypical hyperplasia, and 11 in patients with atypical hyperplasia with a positive family history (mother, sister, or daughter) with breast cancer.

Fabian et al. [20] performed random periareolar fine-needle aspiration cytology on 480 women designated as high risk based on a family history of breast cancer, prior precancerous biopsy, or prior invasive cancer. The estimated risk of future cancer development was calculated using the Gail model. Women were categorised as having a Gail risk above the median or a Gail risk below the median. Eight to ten aspirations were performed per breast, and the aspirates were pooled for analysis. Samples were classified as nonproliferative, proliferative, or proliferative with atypia. At a median follow-up time of 45 months, women with a Gail risk above the median and evidence of proliferation with atypia had a fivefold increased risk for the development of breast cancer compared with women having a Gail risk above the median but with no evidence of proliferation with atypia. Women with a Gail risk below the median and no evidence of proliferation with atypia had no breast cancer incidence in this time period.

The increase in cancer risk associated with atypical cell proliferation is quite similar for both histologic and cytologic approaches (four to fivefold). That positive family history has a similar effect in increasing that risk. This is supported by the results of King et al. [21], who reported a significant correlation between histologic and cytologic atypical hyperplasia in cases with an underlying malignancy.

An international collaborative study was done to correlate age at first birth and breast cancer risk [22]**.** An international collaborative study of breast cancer and reproductive experience have been carried out in seven region of the world. In all areas studied, a prominent relation between age at first birth and breast cancer risk was observed. It is projected that women having their first child when aged under 18 yrs have only about one third the breast cancer risk of those whose first birth is delayed till the age of 35 yrs or more. The births after the first, even if they occur at an early age, have no, or very little, protecting effect.

In a Systematic Population-Based Assessment of Cancer Risk in First-Degree Relatives of Cancer Probands, Utah population database resource was used to systematically study familial clustering of 28 distinct cancer site definitions amongst first-degree relatives (parents, siblings, and offspring) of cancer probands.

By estimating relative familial risks by identifying all cases of cancer in these first-degree relatives of cancer patients. These observed values were compared with those expected based on cohort-specific internal rates calculated from 399 786 relatives of all individuals in the Utah Population Database known to have died in Utah. Highly significant familial associations (one-sided; p<0l) were found among breast, colon, and prostate cancers and between breast and thyroid cancers [23]**.**

In the present study, as per **mammography** result, there were 164 patients with BIRADS I in Group 1 and 1 patient with BIRAD 1 in Group 2, while there was no patient with BIRADS Score of IV, V and VI in Group 1whereas there were 84,102 and 68 patients with BIRADS Score IV, V and VI.P VALUE< 0.001 indicating the significant difference in BIRADS Score of mammography in both group.

The mammographic breast density is strongly related with breast cancer risk and responds to risk-modifying interventions. In a study of Melanie R. Palomares et al. [24] Mammographic Density Correlation with Gail Model Breast Cancer Risk Estimates [25] as calculated by the GM and to examine the relative association of each of the model co-variates to mammographic density. In this ninty nine members of the

National Surgical Breast and Bowel Project P-1 trial, ages 36 to 74 yrs, all of whom had a mammogram, and Gail model risk estimates done upon trial entry. Mammographic density was assessed using subjective and computer-assisted objective measures and correlated with risk calculated by the Gail model. The mammographic density was 2-fold higher in women with a more than 15% lifetime risk of breast cancer than those with less than 15% risk by all density assessment methods. This was equal to a 3% to 6% increase in density per 10% increase in risk. The Gail model co-variates that measured benign or premalignant breast tissue changes reported for the majority (41%) of the relationship with increased mammographic density. Seven per cent of density was not explained by risk factors included in the Gail model. It concluded that the Gail model does not fully account for the association between breast density and calculated breast cancer risk. Because mammographic density is a modifiable marker, developing a breast cancer risk assessment tool that includes mammographic density could be beneficial for evaluating individual risk.

Gail's Score gives a 5-year risk of developing breast cancer in an individual of the same age and risk factors. In our study, the mean GAIL score in group 1 is 0.28 and Group 2 is 0.62. However, there is a difference in GAIL Score. Still, the GAIL score in study group 2 is lower than the threshold of 1.67, which is considered significant and affected screening follow-up and chemoprevention strategy for the patient. The average lifetime risk of developing breast cancer in study group 1 was 3.49, while group 2 was 4.53.

P-Value of Gail is < 0.001, i.e. the difference in both groups is statistically significant, and so the Gail model accurately predicts the risk of breast cancer in the Indian population.

According to Gail Model, in the present study, as per Gail's Score, 12 patients (2 %) of cases were found to have high risk. Means 12 patients are at high risk of developing breast cancer in the next five years, which all belong to group 2.588 Patients (98 %) had a low risk of developing breast cancer in the next five years. As per our study, at a Gail score of 0.62(of malignant cases i.e.group 2), the Gail model's sensitivity is 4%, specificity is 100%, Positive predictive value is 100%, and Negative predictive value is 51%.

In the study conducted by Reddy et al. [16], for the lifetime risk of developing breast cancer of 7.5, the sensitivity and specificity of the Gail Model were 51.9% and 64%, respectively.

V. Conclusions

This study briefly evaluated the Gail model results and corroborated them with a confirmed diagnosis. Specificity and sensitivity of GAIL Score as tested in our study is 100 % and 4 %. PPV and NPV is 100 % and 51 %, respectively. Age is a Main risk factor for developing breast cancer.GAIL Model overestimates the lifetime risk of developing breast cancer in group 1 (Benign) in the Indian population.

References

[1]. Murthy N S ,Chaudhary K, Nadayil D ,Agarwal U K,Saxena S,Changing trends in incidence of breast cancer: Indian scenario.Indian J Cancer 2009:73-4.

[2]. CA CANCER J CLIN 2011;61:69–90 ;P-73 VOLUME 61 _ NUMBER 2 _ MARCH/APRIL 2011

[3]. CMAJ • JULY 1, 2008 • 179(1).

[4]. Garcia M et al. Global Cancer Facts & Figures. Atlanta, GA: American Cancer Society, 2007.

[5]. S, Strax P, Venet L. Evaluation of periodic breast cancer screening with mammography: methodology and early observations. 1966. CA Cancer J Clin. 1990;40:111–125. doi: 10.3322/canjclin.40.2.111.

[6]. Miller AB, To T, Baines CJ, Wall C. Canadian National Breast Screening Study-2: 13-year results of a randomised trial in women aged 50-59 years. J Natl Cancer Inst. 2000;92:1490–1499. doi: 10.1093/jnci/92.18.1490.

[7]. Alexander FE, Anderson TJ, Brown HK, Forrest AP, Hepburn W, Kirkpatrick AE, Muir BB, Prescott RJ, Smith A. 14 years of follow-up from the Edinburgh Shapiro randomised trial of breast-cancer screening. Lancet. 1999;353:1903–1908. doi: 10.1016/S0140-6736(98)07413-3.

[8]. Andersson I, Aspegren K, Janzon L, Landberg T, Lindholm K, Linell F, Ljungberg O, Ranstam J, Sigfusson B. Mammographic screening and mortality from breast cancer: the Malmo mammographic screening trial. BMJ. 1988;297:943–948. doi: 10.1136/bmj.297.6654.943.

[9]. Nystrom L, Rutqvist LE, Wall S, Lindgren A, Lindqvist M, Ryden S, Andersson I, Bjurstam N, Fagerberg G, Frisell J, Tabar L, Larson LG. Breast cancer screening with mammography: overview of Swedish randomised trials. Lancet. 1993;341:973–978. doi: 10.1016/0140-6736(93)91067.

[10]. Tabar L, Fagerberg G, Chen HH, Duffy SW, Smart CR, Gad A, Smith RA. Efficacy of breast cancer screening by age. New results from the Swedish Two-County Trial. Cancer. 1995;75:2507–2517. doi: 10.1002/1097-0142(19950515)75:10<2507::AID-CNCR2820751017>3.0.CO;2-H.

[11]. Frisell J, Lidbrink E, Hellstrom L, Rutqvist LE. Follow-up after 11 years--update of mortality results in the Stockholm mammographic screening trial. Breast Cancer Res Treat. 1997;45:263–270. doi: 10.1023/A:1005872617944.

[12]. Bjurstam N, Bjorneld L, Duffy SW, Smith TC, Cahlin E, Eriksson O, Hafstrom LO, Lingaas H, Mattsson J, Persson S, Rudenstam CM, Salander H, Save-Soderbergh J, Wahlin T. The Gothenburg breast screening trial: first results on mortality, incidence, and mode of detection for women ages 39-49 years at randomisation. Cancer. 1997;80:2091–2099. doi: 10.1002/(SICI)1097-0142(19971201)80:11<2091::AID-CNCR8>3.0.CO;2.

[13]. Ulusoy C, Kepenekci I, Kose K, Aydintug S, Cam R. Applicability of the Gail model for breast cancer risk assessment in Turkish female population and evaluation of breastfeeding as a risk factor. Breast Cancer Res Treat.

[14]. Boyle P, Mezzetti M, La Vecchia C, Franceschi S, Decarli A, Robertson C. Contribution of three components to individual cancer risk predicting breast cancer risk in Italy. Eur J Cancer Prev. 2004;13:183–191. doi: 10.1097/01.cej.0000130014.83901.53.

[15]. Amir E, Evans DG, Shenton A, Lalloo F, Moran A, Boggis C, Wilson M, Howell A. Evaluation of breast cancer risk assessment packages in the family history evaluation and screening programme. J Med Genet. 2003;40:807–814. doi: 10.1136/jmg.40.11.807.

[16]. Vasu Reddy Challa,Krishnmurty Swamyvelu and Naren Shetty.Assesment of the clinical utility of the Gail model in estimating the risk of breast cancer in women from Indian population. ecancer 2013, 7:363DOI:10.3332/ecancer.2013.363.
[17]. Wen Yee Chay, Whee Sze Ong, Puay Hoon Tan, Nicholas Qi Jie Leo, Gay Hui Ho, Chia Siong Wong,Kee Seng Chia, Khuan Yew Chow, MinHan Tan, Sr Validation of the Gail model for predicting individual breast cancer risk in a prospective nationwide study of 28,104 Singapore women Breast Cancer Res. 2012; 14(1): R19.
[18]. Ries LAG, Eisner MP, Kosary CL, et al. (eds). SEER Cancer Statistics Review, 1973–1997, *National Cancer Institute*. NIH Pub. No. 00–2789. Bethesda, MD, 2000.
[19]. Dupont WD, Park FF, Hartmann WH, et al. Breast cancer risk associated with proliferative breast disease and atypical hyperplasia. Cancer. 1993; 71: 1258–1265.
[20]. Fabian CJ, Kimler BF, Zalles CM, et al. Short-term breast cancer prediction by random periareolar fine-needle aspiration cytology and the Gail risk model. J Natl Cancer Inst. 2000; 92: 1217–1227.
[21]. King EB, Chew KL, Petrakis NL, et al. Nipple aspirate cytology for the study of breast cancer precursors. J Natl Cancer Inst. 1983; 71: 1115–1121.
[22]. MacMahon B et al Bull World Health Organ. 1970;43(2):209-2.
[23]. David. E. Goldgar et al [*JNCI J Natl Cancer Inst (1994) 86 (21): 1600-1608. doi: 10.1093/jnci/86.21.1600]*.
[24]. *Oza AM, Boyd NF. Mammographic parenchymal patterns: a marker of breast cancer risk. Epidemiol Rev 1993;15:196–208.*
[25]. Melanie R. Palomares et al , Cancer Epidemiol Biomarkers Prev 2006;15(7):1324–30.

Nayan Sharma, et. al. "Determine the Validity of the Gail model in Indian Women." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 21(01), 2022, pp. 55-65.