

Theory of Mind, Breast Cancer and Depression: Is Cancer Taking Over Your Social Cognition? A Comparative Study From Eastern India

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Abstract

Objectives

Theory of Mind (ToM) is the ability to attribute mental states to oneself, to others. Studies have established ToM deficits in patients with depression, autism, schizophrenia. But, no study so far has investigated the status of ToM in breast cancer patients who often suffer from depression. Hence we proposed a study to compare ToM deficits between women with breast cancer, with pure psychiatric depression (PPD) and healthy controls.

Methods

The study was conducted at a tertiary cancer hospital in Kolkata, India. We compared the ToM performance of patients with breast cancer without depression (group I; n=39), breast cancer with depression (group II; n=63), women with PPD (group III; n=53) and an age and sex matched healthy control group (group IV; n=50) using the widely used ToM task, Reading the Mind in the Eyes test.

Results

Mean age of women in all study groups ranged from 44-47 years. Prevalence of ToM deficit is seen in different study groups as: 65.11% vs 78.76% vs 59% vs 12%. All three study groups showed significant impairment in ToM when compared to healthy controls (Mean±SD =20.42±2.1 vs 12.9±4.32 vs 26.1±2.55 vs 32.3±3.25). However, ToM deficit was seen significantly higher in women with cancer when compared with their PPD counterparts (p value= 0.003 vs 0.21).

Conclusion

Women with breast cancer were found to significant deficits in “reading” social interactions when compared with depressed counterparts. This affects their ability to shore up for social support. This needs to be addressed urgently to ensure better quality of life.

Introduction

Breast cancer has one of the highest five years' survival rates among female cancers in India [1]. Depression is often underestimated in patients with breast cancer, with a reported prevalence between 10% to 25% [2,3]. Various studies have established theory of mind deficits (ToM) in patients with depression, autism, schizophrenia [4,5]. As a result, depressed individuals have dysfunctional interaction patterns [5] and problems in interpreting interpersonal information like emotions and their expressions [6]. Deficit in social interactions of depressed patients has a major role in the onset and maintenance of depression [5,7], thus setting up a vicious cycle.

In recent years, the social cognitive impairment caused by depression and its potential cognitive neuropsychological mechanisms have become a research hotspot. However, there is a dearth of literature on the social cognitive abilities of cancer patients who frequently suffer from depression. Very few studies that have actually looked into ToM deficits in patients with cancer and comorbid depression have reported significant impairment compared to healthy controls [4,8]. Cancer patients often suffer social isolation in the context of both family and community, particularly in developing countries like India where the disease is still associated with significant stigma and discrimination [9]. Additional risk factors involve financial issues, limited access to treatment, and for women, fear of disfigurement and subsequent spousal rejection [10]. The burden of social isolation increases when the cancer sufferer is unable to negotiate her social interactions efficiently, on account of depression related ToM deficits.

It is reported that the occurrence of breast cancer combined with depression is closely related with cognition in disease (J. Cara Pendergrass *et al.* 2018). Whether the cognitive biases include ToM deficits or not is not clear. In this study, the ToM deficits in patients with breast cancer combined with depression were investigated. In addition, the analysis included and the difference between ToM deficits between women with breast cancer, with diagnosed depressed patients and healthy controls.

Materials and Methods

Study Design

It was a cross-sectional comparative study using validated tools and structured face to face interview.

Sample Selection

This study was conducted at a tertiary cancer hospital in Kolkata, situated in eastern India, between April 2018 to August 2018. Early non metastatic breast cancer female participants between age group of 30-60 years, who had at least eight years of formal education were included, after applying specific inclusion and exclusion criteria. The Mini International Neuropsychiatric Interview (M.I.N.I.) [9,11,12] was administered by an experienced psychiatrist to assess the presence of depression.

Group 1 and 2 (Cancer and Cancer & Depression)

The researchers had approached 436 non metastatic breast cancer patients undergoing chemotherapy; 286 (65.56%) agreed to participate in the study. Among them, women who had previous history suggestive of psychiatric disorders (N=28), recurrence of cancer (N=85), or who were unable to give information and/or could not understand/read Bengali, the language spoken by the majority in this part of India (N=71) were excluded from the study, resulting in a total of 102 study participants.

These patients were screened using the Mini International Neuropsychiatric Interview (M.I.N.I) and those with diagnosis of first episode depression as per International Classification of Diseases - 10th Edition (ICD 10) [13] criteria, as confirmed by an experienced psychiatrist and clinical psychologist were included in Group 2 (N=63). The rest were included in Group 1 (breast cancer patients without depression; N=39). Those patients who received a diagnosis other than depression (N=11) were excluded from the study. All patients were given the Reading Mind in the Eyes test, a well-known ToM task [14-16].

Following were the inclusion and exclusion criteria

Inclusion Criteria

- Age between 30 to 60 years
- Diagnosed patients with non-metastatic breast cancer
- Patients undergoing neo adjuvant chemotherapy

- Willing to participate in the study
- Minimum eight years of formal education

Exclusion Criteria

- History of past mental illness
- Inability to understand/read Bengali language

Group-3 (Depression Without Medical Morbidity)

Following the patients' medical records, 53 age and education matched women attending psychiatric outpatient department were assessed for inclusion criteria and enrolled in the study. They performed "Reading Mind in the Eyes test".

Inclusion Criteria

- Diagnosed as having first episode of Depressive Disorder (per International Classification of Diseases - 10th Edition (ICD 10)).
- Duration of illness not more than 1 year

Exclusion Criteria

- Presence of any comorbid psychiatric illness or substance use disorder
- Presence of intellectual disability
- Inability to understand or read Bengali language

Group-4 (Healthy Group)

Healthy age and education matched women were chosen from the local community. 68 women were approached, of whom 54 agreed to participate in the study. Four were excluded on account of their inability to understand Bengali language. Presence of psychiatric morbidity was ruled out using the General Health Questionnaire (GHQ-12) Reading mind in the eyes test was also applied to them.

Inclusion Criteria

- Age between 30 to 60 years
- No history of past or present major medical illness or psychiatric disorder
- No associated intellectual disability

Exclusion Criteria

- Unwilling to participate
- Unable to read or understand Bengali language

Informed consent was obtained using the standard informed consent form laid down by Indian Council of Medical Research (ICMR)(Council & Medical, n.d.), the apex body governing biomedical research in India.

Data Collection

Demographic data were collected from all the groups of the study population, followed by administration of tests in a single interview.

Instruments

Semi Structured Proforma A semi structured proforma was developed to assess the sociodemographic and clinical details of the study subjects.

M.I.N.I. The Mini-International Neuropsychiatric Interview (M.I.N.I.) is a short structured diagnostic interview, developed jointly by psychiatrists and clinicians in the United States and Europe, for DSM-IV and ICD-10 psychiatric disorders. With an administration time of approximately 15 minutes, it is easy to administer. It is validated in multiple Indian languages, including Bengali, the language most spoken in this part of the country.

Reading Mind in the Eyes Test: This test, which is meant to evaluate mind-reading ability, was developed by Baron-Cohen, *et al.* in 2001 [15]. The revised form of this test includes photographs from eye region (from eyebrows to halfway down the bridge of the nose) of actors in 36 different forms. For each photograph, four words describing mental states with similar emotional capacity are presented. Respondents are asked to pick the word that best describes the mental state of the person in the photograph. The maximum score achievable for choosing the right words in the test is 36 and the minimum is zero. In the scoring stage, each correct answer is worth one point and overall scores range from zero to 36. Overall scores between 22 and 30 demonstrate a medium theory of mind; scores lower than 22 shows a low theory of mind; and scores higher than 30 indicate a high theory of mind [17-20].

GHQ The General Health Questionnaire (GHQ) is a measure of current mental health. Since its development by Goldberg in the 1970s [21] it has been extensively used in different settings and cultures as a screening tool to determine whether an individual is at risk of developing a psychiatric disorder. The GHQ comes in four versions.

Factor analysis was applied to explore factor structure of GHQ-12. The adequacy of the correlation matrix of the GHQ-12 item was checked, and it was observed that there was a strong and statistically significant correlation between the variables (0.3-0.6). The principle component extraction method was adopted as it is suggested in establishing preliminary solutions in exploratory factor analysis (Min Qin, Athina Vlachantoni *et al.* 2018).

Consent Form: Informed consent was obtained from all participants in writing according to the format laid down by the Indian Council for Medical Research (ICMR), the apex body governing research in India (Indian Council of Medical Research, 2000).

Procedure

Written informed consent was obtained from all participants. Study protocol was approved by Ethical Committee of the institute. Demographic data were collected via interview using the semi-structured proforma. After assessing psychiatric state using MINI by psychiatrist and clinical psychologist, they were given the Reading Mind in the Eyes test. Presence of psychiatric disorder in the control group was ruled out using the GHQ₁₂.

Statistical Analysis

SPSS program version 24 was used for compilation and analysis of data. Descriptive statistics were calculated as the mean \pm standard deviation of age and frequency of demographic factors was tabulated according to relationship status, residence, education, occupation and per capita family income to determine comparability according to four groups. The Chi-square test was used to compare categorical variables (depression vs Healthy) and (cancer vs healthy). Two way ANOVA test was also used to determine the effect of two predictor variables Cancer (with and without) and depression (with and without) on a continuous outcome variable (RMT score). Statistical significance was defined at $p < 0.05$.

Results

Demographic Information

Table 1 shows the demographic details of participants in each group. The mean age of Group 1 was 46.83 ± 0.18 years, while it was 44.12 ± 0.21 in Group 2, and 45.12 ± 0.01 in the control group. All groups were comparable in terms of sociodemographic variables.

Table 1: Descriptive data: Evaluation of the Groups According to Demographic Characteristic

Demographic Character	Breast cancer Without depression (Gr I)	Breast cancer with depression (Gr II)	Depression without medical comorbidity (PDD) (Gr III)	Healthy Control (Gr IV)	p value
Age	46.83 \pm 0.18	44.12 \pm 0.21	47.05 \pm 0.26	45.12 \pm 0.01	0.67
Religion					
Hindu	71.2	69.8	67.9	79.4	0.62
Muslim	29.2	30.2	32.1	20.6	
Relationship Status					
Living with spouse	87.1	94.3	90.6	73.5	0.44
Living alone	12.9	5.7	9.4	26.4	
Residence					
Rural	60	60.4	69.8	61.8	0.51
Urban	40	39.6	30.2	38.2	

Education					
Primary education	41.9	49.1	45.3	55.9	0.052
High School	37.1	32.1	34	14.7	
Graduate	21.0	18.9	20.8	29.4	
Family income					
≤500	20.1	62.3	32.1	41.2	0.75
500-1000	38	26.4	41.5	17.6	
1001-3000	24.2	9.4	13.2	32.4	
>3000	17.7	1.9	13.2	8.8	
Occupation					
Home maker	87.1	71.8	83	73.5	0.76
Engaged with type of work	12.9	28.3	17	26.5	

*p=<0.05

In Group 1 (breast cancer without depression), 87% were living with their spouse and 60% were coming from rural areas. 41.9% received less than 10 years of formal education and 87.1% women were homemakers. Majority belonged to low socioeconomic status (500 to 1000 Indian rupees per capita per month).

In case of Group 2 (breast cancer with depression) majority were living with spouse (94.3%) and most of them hailed from rural areas (60.4%). 49.1% received less than 10 years of formal education and most of them were homemakers (71.8%). Here also a large majority of women belonged to a low socioeconomic status.

In Group 3 (depressed patients without any medical comorbidity), 90.6% were living with spouse and most of them were coming from rural area (69.8%). 45.3% received less than 10 years of education and 17% of patients were involved in work other than homemaking.

In Group 4 which comprises healthy controls, 73.5% were living with their spouses, 61.8% came from rural areas and majority (55.9%) had received less than 10 years of formal education.

Reading Mind in the Eyes (RMT) Score

The RMT scores for each group are shown in figure 1. All groups performed poorly compared to normal healthy controls (32.1 ± 0.27). RMT scores for study groups I, II and III were observed as (20.92 ± 0.61) vs (17.89 ± 0.14) vs (21.61 ± 0.22).

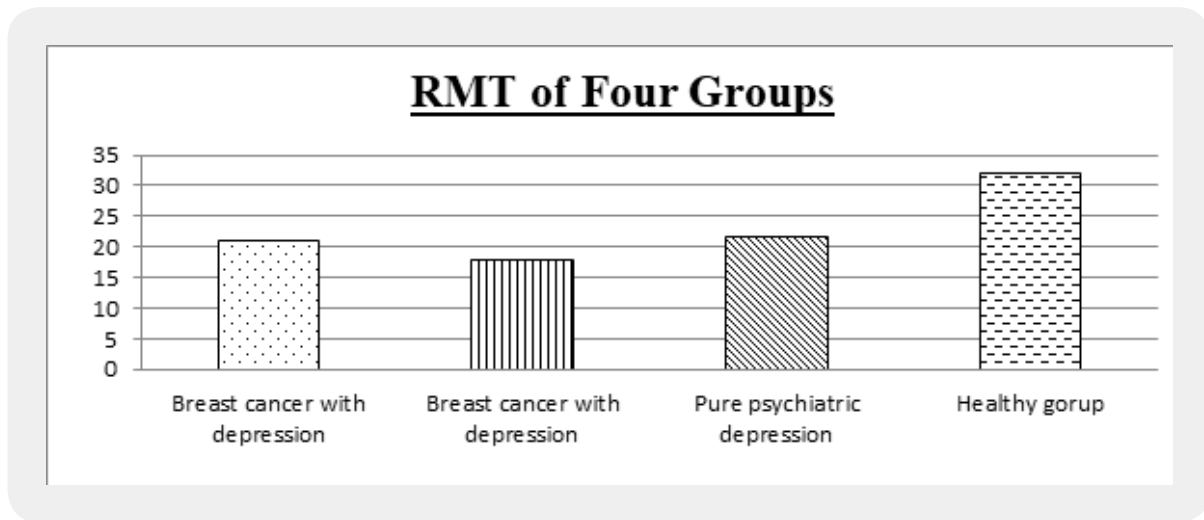


Figure 1: Distribution of RMT score

All 4 groups (pooled together) with age, religion, relationship, residence, education, family income and occupation revealed the following outcomes (Table 2).

Table 2: Distribution of RMT score according to sociodemographic variables among participants

Sociodemographic Factors	Group-1 RMT score	Group-2 RMT score	Group-3 RMT score	Group-4 RMT score	p-value
Age					
30-40	19.1±0.67	16.1±0.5	24.1±0.5	27.85±0.87	
40-50	14.09±0.32	11.9±0.23	27.2±0.61	28.62±1.56	0.001*
50-60	20.1±12	17.6±0.1	25.2±0.21	27.8±1.31	
Marital status					
Living with spouse	17.33±0.22	11.21±0.33	21.23±0.22	28.35±0.79	
Living without spouse	15.42±0.3	11.09±0.12	21.8±0.3	26.25±0.92	0.4
Residence					
Rural	10.8±0.43	7.01±0.41	16.3±0.42	27.09±0.72	
Urban	14.1±0.25	11.2±0.7	17.1±0.31	29.08±1.21	0.23
Religion					
Hindu	21.4±0.9	17.81±0.92	18.11±0.7	27.89±0.77	
Muslim	19.72±1.32	18.08±1.03	21.64±0.85	27.71±1.15	0.63
Education					
Primary school	16.2±0.31	7.07±0.25	23.3±0.11	27.08±1.05	
High school	23.6±0.29	14.1±0.13	26.9±0.19	29±1.63	0.002*
Graduate	28.1±0.25	17.77±0.21	30.1±0.27	29.7±1.26	

Family income					
<500	16.43±0.11	12.3±22	22.1±0.25	27.36±1.21	
500-1000	12.33±0.4	11.4±0.5	23.1±0.2	29±1.63	0.11
1001-3000	19.3±0.23	15±0.27	21.09±0.17	29±1.22	
>3000	15.67±0.33	12.2±0.31	19.6±0.19	27.33±2.02	
Occupation					
House wife	15±0.21	10.9±0.41	20±0.37	27.64±0.76	
Engaged in any type of work	18±0.19	9.23±0.27	21.5±0.19	28.44±1.33	0.94

*p<0.05

There is a significant variation between RMT score and age (RMT* Age, Significant 0.001 level) and education (RMT* education, Significant 0.002) level.

When categorically tested to determine the difference of RMT score in pure psychiatric depressed people without any physical morbidity and healthy control group, there chi square value is 4.25 and p=0.034. That means, there was of difference between observed data (Pure psychiatric depressed and healthy group) and tested data (RMT score) (Table 3).

Table 3: Prevalence of RMT score according to diagnosis

Diagnosis	ToM Deficit		Value	Significant (Depression Vs Healthy *RMT)
	Yes (%)	No (%)		
Depression				
Pure Psychiatric Depression without any physical comorbidity (within deficit)	59	41	5.02	0.03*
Healthy control (Within deficit)	12	88		
Breast Cancer (Within deficit)				Significant (Breast Cancer Vs Healthy *RMT)
With depression	78.76	21.24	10.89	0.002*
Without depression	65.11	34.89		
Healthy Control	12	88		

*p<0.005

Depressed people who had also breast cancer showed significant higher level of deficit (Mean=12.9 and SD=4.32) than those who did not have depression along with presence of cancer (Mean=20.42 and SD=2.1). There was a main effect deficit of ToM, “cancer” word (F=31.57, sig=0.001) weighing more than “depression” word (F=11.52, sig=0.21). Finally, there was an interaction between cancer and depression, was also significant ((F=64.27, sig=0.001) (Table 4).

Table 4: Two way ANOVA to determine the effect of "Cancer" and Depression on RMT

<i>Depression</i>	<i>Cancer</i>	<i>Mean</i>	<i>SD</i>	<i>Sum of square</i>	<i>df</i>	<i>Mean square</i>	<i>F</i>	<i>p value</i>
With depression	With cancer	12.9	4.32					
	Without Cancer (Pure depression)	26.1	2.55					
Without depression	With cancer	20.4	2.1					
	Healthy	32.3	3.25					
Cancer	333.31			860.428	1	663.5	31.57	.003*
Depression	1			347.31	11.52	0.21		
Cancer* Depression	1601.529			1506.53	64.27	.001*		

*p=<0.005

Discussion

Theory of mind is the ability to understand others' mental states. It is an essential component of social cognition, considered extremely important in helping people maintain their social network and support [22]. Depression is known to adversely affect people's ToM, preventing them from activating social support which could have helped them cope with their own illness, thus setting up a vicious cycle [23]. In this background, the additional contribution of the present study was to assess ToM in a group of breast cancer patients, in order to know whether the diagnosis and subsequent stigma and isolation of cancer magnifies the impact of depression on one's theory of mind.

The results from the study shows that ToM deficits exists in majority of patients with cancer (cancer or not) as compared to a depressed group (with or not) (Table 3). This confirms our assumption that breast cancer patients' social cognition is an important area of deficit, which, if unaddressed, will make her lose her valuable social support and allow her to slip into depression with subsequent non adherence to proper treatment and other related adverse issues. The findings are in keeping with that of previous researchers who have proposed that social constraints inhibit cognitive processing of the cancer experience, leading to poorer adjustment and wellbeing [24-37].

ToM impairment in breast cancer patients cannot be explained by the presence of associated depression alone. Some other mechanism appears to be working here, which requires further probing in subsequent studies. The burden of a long, tiring journey from diagnosis to treatment of cancer, the stigma and isolation that a patient faces on her way, in addition to any other factor that we may have overlooked, seems to play a major role in affecting her social cognitive ability. This is not surprising, since studies that have explored environmental factors (age and education) affecting ToM have found that sociolinguistic and socioeconomic factors play a key role in its development and maintenance [10].

Since most of our patients belonged to poor socioeconomic status, poverty could have played an additional role in causing ToM impairment (Table 2). As per following previous study, persistent socioeconomic condition that exist depressive severity among cancer patients (Christopher Fagundes *et al.* 2014). in accordance with the studies of Inoue *et al* to ToM deficits are found in patients with depression in ToM tests (Inoue Y *et al.* 2004).

ToM was better, across all groups, in women who had higher levels of education (Table 2). Previous studies have explored the relationship between intelligence, education and ToM with varying results [38,39]. Some have found a positive association between ToM and intelligence level (IQ), even reading habits (reading literary fiction), the latter being a likely correlate of educational level [40].

Many studies have been proposed to explain the state related ToM deficit in depression (Hajnalka Berecz *et al.* 2014). Some presume that depression tends to turn the mind inward and direct attention towards self-rumination. This may result in lesser understanding or awareness of other people's states of mind [41-43].

This deprives them of some of the key positive resources to cope with life's crises - a strong social support, good family relationships and adaptive problem or conflict solving styles, all considered important in the overall quality of life of breast cancer patients [17-19,44].

The study has been carried out in Eastern India, and mostly addressed women belonging to a low socioeconomic status. The burden of cancer here is often plagued by an associated nihilism ("Death is knocking at your door"). It is almost a ritual here for streams of relatives to visit a patient diagnosed with cancer, not so much to offer support as to proffer pity. At the other end of the spectrum is the fear of death and even contamination (ulcerative lesions are often considered infectious) and rejection by other members in the patients' social circuit. One needs strong ToM skills and a consistent supportive confidante to negotiate all these challenging social circumstances. This is vital for the patients' prognosis, as studies have shown that social isolation results in 66% higher chance of death by all causes in breast cancer patients [45].

While discussing the negative impact that depression and a diagnosis of cancer can have on a woman's social abilities, we must also note that a significant number of breast cancer patients in our sample do not suffer from depression (61.8%). It is important to look into the possible protective factors that prevent the development of depression in this group. A number of recent researchers have turned their attention towards the positive psychological factors that mitigate emotional distress or depression in cancer patients and recently, resilience has been suggested as one of the key factors [20,46-51]. We would like to evaluate the effect of resilience and other positive psychological factors on our patients in subsequent studies [52].

Ethical Approve

The study was subject to approval by the Ethical Committee of our institute following guidelines given by the Indian Council of Medical Research (ICMR) (approval no: H15REA156).

Limitations of the Study

This study has its limitations. It was conducted on a relatively small sample size. Most patients belonged to lower socioeconomic strata and had lesser number of years in terms of formal education, hence it cannot be

said to be representative of all Indian women. No follow up was carried out except for a single sitting with breast cancer patients to look into their major concerns of life. Finally, we did not look into the possible protective factors against depression, and more specifically, impaired social cognition in cancer patients. We hope to address these issues in future studies.

Conclusion

A significant number of breast cancer patients (38.2%) suffer from depression. Breast cancer patients have compromised theory of mind compared to healthy controls. Presence of depression worsens the ToM of breast cancer patients, but breast cancer alone cannot fully explain their ToM deficits. Other factors, including social constraints and poverty need to be investigated in future studies. ToM skills are most affected in patients who come from rural background and lower socioeconomic status, have less formal education and are not engaged in any occupation. As social support is an important component of overall survival of breast cancer patients, and better ToM is likely to translate into better social adjustment and support, one needs to devise ways to improve depression and ToM in breast cancer patients as a priority. This report points out the importance of social support in cancer and provides recommendations for health care professionals.

Competing Interest

Authors have no conflict of interest.

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