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Impact of COVID-19 Pandemic on Breast Cancer Screening and Staging at Diagnosis: A Retrospective Study

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A B S T R A C T

Background: COVID-19 pandemic and septic care disruption to screening and diagnostic cancer care During the height of the COVID-19 pandemic, a many healthcare systems around the world were severely disrupted, with many elective and nonurgent medical services, including those related to routine cancer screening programs, stalled or suspended to prioritize emergency services and infection control. These screening programs in particular were disrupted, raising concern over the potential for delayed diagnosis or potential presentation of cancers at a later stage.

Aim and Objectives: Our aim was to assess the impact of COVID-19 on screening rates for breast cancer and to assess changes in staging of breast cancer at diagnosis comparing pre and post COVID-19.

Methods: This was an observational retrospective study carried out in the Department of Radiology in a tertiary care hospital in India. Medical and image records of all the women evaluated by Mammogram over a 4-year period from January 2019 to December 2022 were reviewed. The study period was divided into two, the pre-pandemic era, January 2019 to December 2019 and the pandemic period, April 2020 to December 2021. Data was collected on number of screening mammograms performed, number of breast cancers diagnosed for the first time as well as stage at diagnosis, correlation of staging was done according to the TNM staging system based on the imaging and histopathologic findings.

Results: A total of 260 patients diagnosed with breast cancer were identified. The number of screening mammograms performed during the pandemic period was significantly lower than prior to the pandemic. During the pre-pandemic phase there was a total of 1120 screening mammograms as opposed to 620 screening examinations during the pandemic period. The proportion of patients diagnosed with early breast cancer (Stage I and II) decreased while that of patients with advanced disease (Stage III and IV) increased. More breast cancers with larger tumour size and nodal involvement are diagnosed in the pandemic period than pre-pandemic phase.

Conclusion: The COVID-19 pandemic during 2020 led to considerable disruption of breast cancer screening services and reduced numbers of screening mammograms were associated with later-stage breast cancers at diagnosis. The importance of continuing cancer screening services throughout public health emergencies in order to prevent delayed diagnosis of breast malignancies is highlighted**.**

Key Words: *COVID-19 pandemic, breast cancer screening, mammography, delayed diagnosis, cancer staging, breast imaging, healthcare disruption.*

INTRODUCTION

Breast cancer is one of the most common cancers diagnosed for women worldwide, and it remains among the most frequent causes of cancer-related morbidity and mortality. Early diagnosis through planned organized screening programs is crucial for early diagnosis, minimizing disease burden, for timely therapeutic interventions.[1] Mammography based screening is widely accepted screening modality for early detection of breast cancer as it facilitates the diagnosis of small cancers and preclinical lesions prior to symptom onset. The prediction of early stage is associated with favorable prognosis, less

aggressive treatment and better survival. The worldwide outbreak of coronavirus disease 2019 (COVID-19) was an unprecedented challenge faced by all health care systems worldwide.[2] Following the sudden surge of such infection, worldwide reorganization of health services towards management of increasing number of such infected patients took place. Hospitals accordingly began to create adequate infection control measures, minimize patient and visitor traffic, curtail elective services and redirect health resources towards emergency and critical care services, these changes to organization of health services affected multiple routine health care services including cancer screening programs, programs for breast cancer screening were one of first the services to suspend routine mammography screening as per guidelines in the early weeks of the pandemic.Furthermore, during the early pandemic experiences, with lockdowns, travel bans, and health department advice, many people remained out of facilities that may present a risk of COVID exposure (hospitals and clinics).[3] Many people put off or skipped routine health checks that would require being evaluated in the clinic setting at this time. As a result of the interruptions that were noted, many healthcare systems noted less screening mammograms during the pandemic. Less screening activity spurred concerns by clinicians in regards to missed early diagnoses and a propensity to be diagnosed with later-stage breast cancers. Screening programs are instituted to detect breast malignancies earlier and often at an undetected, or asymptomatic stage.[4] If screening programs are interrupted, the cancer which would otherwise find early disease present may become undiagnosed and unexpectedly later reach a clinical state. Often at a more advanced stage of clinical treatment is required of the women for disease. Delayed diagnosis does have a clinical meaning. Often larger masses are found, greater lymph node involvement is found, and also, metastasis may be more likely. Many of the larger cancers which would otherwise be small mass have to have systemic treatment, such as chemotherapy and are thus a less favorable peg on the clinical totem pole for prognosis.[5] Thus, in conclusion, a woman's disease may have many delays from interruption of screening of being at least diagnosed at an above a more advanced stage, or stage of breast cancer. In addition to just the lack of screening services, the pandemic also had impacts upon the timely evaluation of patients who developed symptoms.[6] Diagnostic imaging appointments, the appointments for biopsies and surgery are also postponed coming out of the pandemic due to access and availability of other readouts and things to Covid, so this is another reason that breast cancer should not only speak of the curtains during this time period. Women may also delay coming to oncology for breast symptoms due to concern of entering the hospital.[7] For a cycle of all these things, timer submission to the clinic center for the state in breast screening results and the state of breast cancer resources and breast cancer simply these are the reasons and season - call it a storm - issued by us so small.[8] Certainly, some of the breast cancer countries in Europe and the Asia. In Europe, many hospitals reported declining numbers of screening patients combined with increases in the amount of maternal masses and more symptomatic since cancer protocols as noted by many other hospitals around the world, the third world are not falling asleep due to changes in practices in Europe and has taken on a level at which more of these patients are projecting into today them from discharge," noted from the cases from the pandemic they all started and expect a sharp peaks naturally up due to these issues, making screening programs are delivered.[9,10]

Continuing beyond the pandemic label is the work below that discusses how the COVID-19 impact all women getting screened need be or can be complete with time as cosmetics culture taking the topmost of the hearts out. Beyond the pandemic factors, the system of screening etc. is important in loss terms changing between disease also that were encountered during the study, naturally for all quarters of the world. It takes to really screen properly after you can point a regular marginal shift from nothing to breast party itself. In this context present analysis is thought at to measure results of the onlystudy to take the impact of the COVID-19 pandemic on breast cancer screening. And to explore differences in the stage of breast cancer at the time of diagnosis between pre-COVID and COVID age people diagnosed in our tertiary resources habit.

MATERIALS AND METHODS

Study Design
This study was conducted as a retrospective observational study designed to evaluate the impact of the COVID-19 pandemic on breast cancer screening activity and the stage of breast cancer at the time of diagnosis.

Study Setting
The study was carried out in the Department of Radiology of a tertiary care hospital in India where routine mammography screening and diagnostic breast imaging services are provided.

Study Duration
The study was performed between the period of January 2019 to December 2022, and for the purposes of analysis, we separated this time period into (A) the prepandemic period (Jan 2019-Dec 2019), and (B) the pandemic period (April 2020-Dec 2021), purposefully avoiding the earliest months of early pandemic transition in the 2020 to be less affected by biases stemming from abrupt cessation of services.

Study Population
Patients included as participants were any females upon whom imaging was performed for screening or diagnostic purpose whose images were examined by a radiologist during the study period. Patients who were diagnosed with breast cancer during the requisite period were identified via our radiology and pathology records. Two hundred sixty patients were included for staging.

Inclusion Criteria

Feminine Patients who had a mammographic screening performed during a certain period of the study.

Patients who were diagnosed as suffering from breast cancer based on both imaging of the breast(s)/breasts with and without a pathological determination as to their breast condition

Patients that had complete records available for review of their imaging and clinical staging

Exclusion Criteria

Patients with incomplete medical or imaging records.

Patients previously diagnosed with breast cancer undergoing follow-up imaging.

Patients with recurrent breast cancer.

Male breast cancer cases

Data Collection

Data were retrieved retrospectively from the hospital radiology information system and public health medical record database. Patient demographic information including age, number of screening mammograms performed during study period, new breast cancer cases diagnosed that study period, tumor characteristics seen on imaging, stage of breast cancer at time of diagnosis; clinical and imaging record reviewed to determined stage of disease, all available clinical, radiological, and histopathological findings.

Breast Imaging Protocol

Standard digital mammography was performed on all patients with craniocaudal (CC) and mediolateral oblique (MLO) views taken. Other imaging such as focused breast ultrasound was performed in cases of detected suspicious abnormalities or when clinically indicated. The images were assigned a BI-RADS assessment category.

Cancer Staging

The TNM SCA that classifies breast cancer is based on the size of the cancer, the extent of lymph node involvement and the existence of metastasis. The case studies used in this research were analysed based upon four stages of clinical evidence.

Stage I
Stage II
Stage III
Stage IV

For comparative evaluation, early-stage disease included Stage I and Stage II, while advanced-stage disease included Stage III and Stage IV.

Outcome Measures

The primary outcomes of interest were: change in the number of screening mammograms performed in the time before the pandemic vs the pandemic, the number of new diagnoses of breast cancer made in each of the two time periods, stage of breast cancer at diagnosis, and proportion of early vs late stage breast cancer presentations.

Statistical Analysis

Data were compiled and analysed with descriptive statistics. A total of 4,658 records were reviewed pre-vs. pandemic and 160 records noted during the pandemic. The frequency and percentage of records where patients were screen detected vs. symptomatic were assessed, along with stage of diagnosis by time period. Trends are noted in tabular format.

RESULTS

This study investigated the effects of the COVID-19 pandemic on breast cancer screening and staging at diagnosis. A comparison was made of the period of pandemic with the baseline time period period on amount of screening examinations and staging of breast cancer at diagnosis. The number of screening mammograms performed decreased markedly during the period of pandemic. A shift in stage of presentation at time of diagnosis was also noted with relatively more presentation with advanced stage as compared with pre-pandemic.

Table 1: Age-wise Distribution of Patients Diagnosed with Breast Cancer

Table 1 shows the distribution of breast cancer patients across different age groups during the study period.

Age group (years)	Number of patients	Percentage (%)
30–39	32	12.3
40–49	74	28.5
50–59	82	31.5
60–69	48	18.5
≥70	24	9.2
Total	260	100

Table 2: Comparison of Screening Mammography Volume Before and During the Pandemic

Table 2 compares the number of screening mammograms performed during the pre-pandemic and pandemic periods.

Study period	Number of screening mammograms	Percentage (%)
Pre-pandemic period	1120	64.4
Pandemic period	620	35.6
Total	1740	100

Table 3: Indication for Breast Imaging During the Study Period

Table 3 presents the distribution of clinical indications for breast imaging.

Indication for imaging	Number of patients	Percentage (%)
Screening evaluation	108	41.5
Palpable breast lump	102	39.2
Breast pain (mastalgia)	26	10.0
Nipple discharge	14	5.4
Other indications	10	3.9
Total	260	100

Table 4: Stage Distribution of Breast Cancer in the Pre-pandemic Period

Table 4 shows the distribution of breast cancer stages diagnosed during the pre-pandemic period.

Stage at diagnosis	Number of patients	Percentage (%)
Stage I	38	29.2
Stage II	56	43.1
Stage III	28	21.5
Stage IV	8	6.2
Total	130	100

Table 5: Stage Distribution of Breast Cancer During the Pandemic Period

Table 5 presents the stage distribution of breast cancer diagnosed during the pandemic period.

Stage at diagnosis	Number of patients	Percentage (%)
Stage I	24	18.5
Stage II	40	30.8
Stage III	46	35.4
Stage IV	20	15.3
Total	130	100

Table 6: Comparison of Early-stage Breast Cancer Diagnosis

Table 6 compares the number of early-stage breast cancer cases diagnosed in the two study periods.

Study period	Early stage cases (Stage I & II)	Percentage (%)
Pre-pandemic period	94	72.3
Pandemic period	64	49.2

Table 7: Comparison of Advanced-stage Breast Cancer Diagnosis

Table 7 compares the number of advanced-stage breast cancer cases in the two study periods.

Study period	Advanced stage cases (Stage III & IV)	Percentage (%)
Pre-pandemic period	36	27.7
Pandemic period	66	50.8

Table 8: Tumor Size Distribution at Diagnosis

Table 8 shows the distribution of tumor size at the time of diagnosis among patients.

Tumor size	Number of patients	Percentage (%)
≤2 cm	68	26.2
2–5 cm	124	47.7
>5 cm	68	26.2
Total	260	100

Table 9: Lymph Node Status at the Time of Diagnosis

Table 9 shows the distribution of axillary lymph node involvement among the patients.

Lymph node status	Number of patients	Percentage (%)
Node negative	112	43.1

Node positive	148	56.9
Total	260	100

Table 10: Mode of Detection of Breast Cancer

Table 10 presents the method through which breast cancer was initially detected.

Mode of detection	Number of patients	Percentage (%)
Screening mammography	96	36.9
Symptomatic presentation	164	63.1
Total	260	100

Table 1 shows that the highest number of breast cancer patients were found in the age group 50-59 years, 82 patients (31.5%), followed by the age group 40-49 years with 74 patients (28.5%). The patients aged 60-69 years include 48 patients (18.5%), while 32 patients (12.3%) were aged in 3039 years. The fewer number of patients was in the age group of ≥70 years with the least number of patients 24 patients (9.2%). Which therefore determines that most breast cancer patients diagnosed between 40-59 years. **Table 2** shows that a proportion of 1,120 screening mammograms (64.4%) were done in the pre-pandemic phase compared with 620 (35.6%) during the pandemic. You see there's been a large decrease in screening activity during the pandemic phase. **Table 3** shows that the most common reason for breast imaging was screening evaluation in 108 patients (41.5%); the next most common indicates was palpable breast lump in 102 patients (39.2%). Breast pain (mastalgia) was the presenting reason in 26 patients (10.0%), while nipple discharge was the indication in 14 patients (5.4%). Other indications included patients with no definite indication or compatible clinical disorder (3727 = 3.9%). **Table 4** shows that Prior to the pandemic, most commonly diagnosed was stage II breast cancer in 56 patients (43.1%), followed next by stage I disease in 38 patients (29.2%). There was stage III disease in 28 patients (21.5%); and stage IV disease in 8 patients (6.2%). The preponderance of stage I and stage II disease in this cohort suggests that a sizeable proportion of breast cancers were being detected at relatively early stages prior to developmet of advanced disease. **Table 5** shows that the COVID-19 pandemic period was associated with an increase in the number of patients with Stage III breast cancer seen, with 46 patients (35.4%) presenting with Stage III disease, followed by Stage II disease in 40 patients (30.8%). Stage I disease was seen in 24 patients (18.5%), whilst 20 patients (15.3%) presented with Stage IV disease. **Table 6** shows that Patients with early breast cancer (Stage I and Stage II) were diagnosed in 94 patients (72.3%) prior to the COVID-19 pandemic, and in only 64 patients (49.2%) during the COVID-19 pandemic period. **Table 7** shows that Advanced stage breast cancer (stage III and stage IV) was diagnosed in 36 patients (27.7%) prior to the pandemic and 66 patients (50.8%) during the pandemic period. This increase in diagnosis of advanced stage breast cancer reflects the screening and diagnostic delays from the pandemic period. **Table 8** shows that Tumour size described as being of 2–5 cm, with the highest number of patients presenting with tumours of this size (124 patients, 47.7%), compared to tumours of ≤2 cm (68 patients, 26.2%), and tumours of >5 cm (68 patients, 26.2%). The high proportion of size values in the larger range may indicate that these patients presented at an older age. **Table 9** shows that Axillary lymph node involvement was evident in 148 patients (56.9%) while 112 patients (43.1%) were found to be node negative. The predominance of node positive patients may reflect a tendency for patients to present with disease which had similarly spread to regional lymph nodes. **Table 10** shows that the presentation of patients with symptoms was the commonest mode of detection of breast cancer which was seen in 164 patients (63.1%). 96 patients (36.9%) were diagnosed through screening mammography

DISCUSSION

Breast cancer screening is important in the early detection of malignancies, which significantly optimise the outcome of treatment with consequent benefits on survival. Screening of the breast by means of mammography is performed to detect breast cancers at an earlier stage, prior to the occurrence of clinical symptoms. The COVID-19 pandemic brought about huge disruptions in healthcare throughout the world including routine cancer screening programs. We aimed to assess the effect of the COVID-19 pandemic on breast cancer screening activity and alterations in staging at time of diagnosis[11]. Majority of breast cancer cases occurred among women between 40 and 59 years of age in the present study. This the ages at which the disease usually occurs (in a 40 year old women the incidence is zero, before then it is also very low, periodically increasing steeply per year thereafter), after 40 years screening is performed because the incidence is so low at younger ages[12]. Screening evaluation and palpable breast lumps being the most common indications for breast imaging.Although a sizeable population of symptomatic cases were experienced, we expect many patients may have seen, only after breast symptoms became noticeable[13].

A significant finding of the study was the decrease in screening mammograms during the period of the pandemic. This decrease mirrors the nationwide disruption of health care services due to the COVID-19 outbreak. The authors speculate that the decrease in screening activity was most likely due to the suspension of routine screening services, limiting hospital visitors, loss of personnel, and patient reluctance to visit medical settings. The reduced screening mammography has had adverse consequences for breast cancer detection[14]. During the premidst of the pandemic 44% of breast cancers were detected at stage I, and 49% at Stage II disease (early-stage). Early detection is ideal, and early-stage detection are usually associated with "better prognosis" and better treatments. Tumor detection at it's earliest, usually quite small and confined, often appears "nonclinically" or even "subclinically." Conversely, the middle of the pandemic showed a tendency to be more advanced disease at diagnosis.Screening interruptions can lead to cancers that would have been detected at an earlier stage becoming larger and more aggressive by the time they are identified[15].

The results on size and spread reinforce the finding of delayed diagnosis - a significant proportion of patients were diagnosed with tumours larger than 2cm, and over half of patients had axillary lymph node involvement at diagnosis[16]. Another significant feature of the findings was that a greater proportion of breast cancers were detected on symptomatic presentation rather than routine screening, highlighting the possible effects of loss of screening services during the pandemic period[17]. If screening services have only been intermittently available (as they were during the pandemic) then patients will have more often only been diagnosed when they developed a palpable lump or visible change in their breast. In general these findings draw attention to the implications of the issue of disruptions in the provision of health facilities, particularly those dealing with prevention in the light of the recent COVID-19 pandemic[18]. Prolonged lack of health facilities addressing prevention, such as cancer screening programmes, may lead to delays in diagnosis and a consequent increase in more advanced disease with all its implications in terms of treatment burden, healthcare costs, and survival[19]. The positive implications of this message are that it is important to develop and retain the ability to ensure continuity which has protected essential health services during large shocks - in this particular instance public health emergencies. Some studies have suggested that governing boards can use hazard analysis procedures, risk stakeholder analysis, and develop a business continuity plan. In reductions for specific health services such as screening, we talk about prioritisation of certain groups, infection control, redesigning and focusing on more community-based screening services which offers hope of mitigation in this type of shock again in future[20].

Overall, this study shows that the COVID-19 pandemic does appear to have had a material effect on breast cancer screening. Screening services, when interrupted by health threats, lead to problems in the experience of late-stage breast cancer diagnosis.

Limitations of the Study

The current study has limitations. Even though we reviewed a significant number of patients with breast cancer, we performed a retrospective study on available hospital records. Data used in retrospective analyses are associated with inherent variability in quality and completeness of clinical and imaging information. The study was performed in a single tertiary care hospital. Our screening practices, patient base, and access to health care may not reflect those of other health care centers. In addition, the findings may not be generalizable to other regions or health systems. The primary variables we looked at were the number of screening exams and the stage at diagnosis, but we did not have data on long-term treatment outcomes or survival. Staging at diagnosis is an important factor, but follow-up data would be necessary to look further into it. Our study also analysis compared only two cognate periods (the prepandemic versus the pandemic phase) and inevitably conceals variations in health-related service availability through different phases of the pandemic (including partial restoration of screening services). Although we suspect that they were a contributory factor for delay in screening and diagnosing the disease, we did not assess patient-related factors such as socioeconomic conditions, travel restrictions, fear of infection, personal history with the health care system during the pandemic, etc. Nevertheless, the study shows the deteriorating effect COVID-19 pandemic had on service provision and might serve as a backstop for prolongation of a delay in patient diagnosis.

CONCLUSION

The impact of the COVID-19 pandemic on breast cancer screening and on patterns of presentation was significant. Presenting findings demonstrated fewer numbers of screening mammograms performed during the pandemic compared with the pre-pandemic period. At the same time, a manipulation of breast cancer stage at diagnosis also occurred owing to reductions in screening activity. More early-stage breast cancers were diagnosed in the pre-pandemic period, compared to a greater proportion of patients presenting with advanced-stage disease during the pandemic period, suggesting a later detection of breast cancer attributable to a disruption of routine services and access to healthcare. This is reflected in increased tumor size and positive lymph node involvement during the pandemic period, together serving as evidence for a delay in diagnosis. Both the continuity and smooth conduct of cancer screening programs during public health emergencies is necessary to help ensure equitable access to early detection and timely treatment of breast malignances. Preventive services need to be fit into healthcare systems in such a way that critical life-saving services continue even during emergency situations where there may be a need to implement restrictions. Delay in diagnosis is undesirable and should be avoided to minimize the long-term impact of health care disruption on outcomes in cancer.

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