



# Impact of COVID-19 on the Diagnosis and Surgical Care of Patients with Breast Cancer—A Retrospective Observational Cohort Study from Kerala, South India

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## Abstract

The COVID-19 pandemic has strained the healthcare system worldwide. Our study aimed to evaluate the impact of the COVID-19 pandemic on the diagnosis and surgical care of patients with breast cancer in Amrita Institute of Medical Sciences, Kochi. This is a single-centre retrospective observational cohort study conducted in a tertiary care institution intended to analyse the management of patients with breast cancer before and after the pandemic outbreak. The number of mammograms dropped from 3689 in the pre-pandemic phase to 1901 in the post-pandemic phase, whilst the number of core biopsies remained almost the same (391 before the pandemic and 367 after the pandemic). The number of new patients decreased by 57.7% (from 614 to 354). However, the number of breast cancer surgeries has remained almost the same (318 before the pandemic and 287 after the pandemic). The number of breast conservation surgeries dropped from 127 in 2019 to 93 in 2020 ( $p$ -value = 0.01). Conversely, 24 patients underwent neoadjuvant chemotherapy in 2019, and this number increased to 37 in 2020, representing a statistically significant increase ( $p$  = 0.04). Even during a pandemic, cancer care is possible with proper resource allocation and by adopting a multidisciplinary approach.

**Keywords** Breast cancer surgery · COVID-19 · Perioperative outcomes · Low-middle-income countries

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**Synopsis** In this study, we have looked into the impact of COVID-19 on breast cancer patients. It shows that there was no significant difference in the surgical care for patients with breast cancer before and after COVID-19. With proper clinical triaging and universal screening, continuation of cancer care is possible even during this pandemic.

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## Introduction

COVID-19 outbreak was declared a pandemic by WHO on March 11, 2020. This pandemic affected the national health systems worldwide. The pandemic came to the lime-light when the first case was reported in Kerala, India, on January 30, 2020 [1]. On March 21, 2020, a lockdown was implemented throughout the country. Several hospitals in the public sector were designated as COVID-19 centres. The otherwise well-organised healthcare system in the state was disrupted following the rapid spurt of COVID-19 cases. Since the onset of the pandemic, breast cancer patients have been facing challenges during their treatment. Prioritisation of care has utmost importance amongst breast cancer patients to minimise the risk of COVID-19 infection. Surgery along with radiation and systemic therapy is the standard treatment offered for patients with breast cancer. The pandemic has challenged not only the area of treatment but also the field of diagnosis. Even under normal circumstances, cancer evokes anxiety and feeling of uncertainty amongst people. Recent changes to the healthcare system

would have worsened the inner fear amongst patients. There is a paucity of data on the management of breast cancer from lower-middle-income countries during this pandemic. The main aim of our study was to evaluate the effect of the COVID-19 pandemic on diagnosis and surgical care for patients with breast cancer in our institution.

## Materials and Methods

This single-centre retrospective study was conducted at Amrita Institute Of Medical Sciences, Kochi, to evaluate the effect of COVID-19 on the diagnosis and surgical care of patients with breast cancer before and after the pandemic. After IRB approval (ECASM-AIMS-2021–041), data were retrieved from the hospital's electronic medical records from March to December 2020 (after the pandemic). These data were compared with data from the pre-pandemic period (i.e. from March to December 2019). The mean treatment duration was calculated from pathological diagnosis to the date of initiation of the treatment (either surgery or systemic therapy).

We compared the pre- and post-pandemic numbers of mammograms and core biopsies, new patients, total breast surgeries and breast conservation surgeries. We also looked into tumour characteristics, including the size at presentation, the number of patients who underwent neoadjuvant treatment, the duration of symptoms, time between diagnosis and treatment, duration of hospital stays and postoperative infection rate.

All patients who arrived at our outpatient department were screened for any symptoms of COVID-19 during workup and admission. All patients with respiratory symptoms or fever were referred to the general medicine department. Examinations were done in well-ventilated rooms, and all practitioners wore N95 masks and gloves whilst adhering to social distancing guidelines. All procedures were performed only after a negative SARS-CoV-2 antigen report was obtained. Overcrowding in front of outpatient departments and theatres was strictly avoided. In those patients with breast cancer diagnosed with COVID-19, surgery was delayed except in cases of emergency. Separate theatres and equipment were used for high-risk patients. Personal protection equipment, including disposable gowns, gloves, N95 masks, face shields and hand antiseptic solutions, was provided for all health care workers in the theatre.

During the 24–48 h before surgery, a pre-surgical evaluation and screening for SARS-CoV-2 with RT-PCR were done to rule out the possibility of asymptomatic infection. Patients who tested negative were advised to self-isolate and avoid visitors until the day of surgery. A SARS-CoV-2 antigen test was also made mandatory for all their caretakers. Statistical analysis was done using SPSS 20 Version (SPSS

Inc, Chicago, USA). Statistical significance was calculated using the independent *t*-test and chi-square test.

## Results

A total of 614 new patients with breast cancer were seen during the pre-pandemic period (March to December 2019), and 354 were seen during the post-pandemic period (March to December 2020). The mean ages of patients were  $54.96 \pm 13.06$  (pre-pandemic phase) and  $53.20 \pm 11.94$  (post-pandemic phase). The number of diagnostic and screening mammograms decreased from 3689 in the pre-pandemic phase to 1901 in the post-pandemic phase (Table 1.) Out of 1901 mammograms in the post-pandemic phase, 503 had a unilateral mammogram; 167 bilateral mammograms were performed as part of comprehensive health checkup. And the remaining bilateral mammograms included new diagnostic cases, surveillance after BCS and average risk screening. The number of core biopsies remained almost the same. A maximum decrease in mammograms and core biopsies was noted in April 2021 (immediately following the lockdown). Even though the number of new patients was 354, 391 core biopsies were conducted before pandemic, and 367 after the pandemic. The number of core biopsies was enumerated on basis of site of biopsy in patient and not the patient number. Amongst 367 core biopsies conducted during pandemic period, 343 core biopsies were from breast and 24 from axillary lymph node. Eighty-eight of 343 breast biopsies were benign and 3 were lymphoma according to final histopathology report.

During this month, the number of mammograms decreased from 364 to 44, and the number of core biopsies decreased from 37 to 12. The number of new patients decreased by 57.7% (from 614 to 354) after the pandemic. However, the number of breast cancer surgeries remained almost the same (318 before the pandemic and 287 after the pandemic). Again, the month of April contained the highest decreases in the number of new patients (from 37 to 18) and in the number of breast cancer surgeries (from 21 to 14). Out of the total number of breast cancer surgeries, 127 breast conservation surgeries were done in 2019. This number dropped to 93 in 2020 ( $p=0.015$ ) (Table 1).

The mean duration of symptoms, mean treatment duration, average tumour size at presentation and mean duration of hospital stay were not significantly different between the two groups. Significantly more patients underwent NACT in the pandemic period, and post-op infections decreased, though not to a statistically significant extent. The mean duration of symptoms before the pandemic was  $20 \pm 56.38$  weeks; after the pandemic, this value was  $15 \pm 24.3$  weeks ( $p=0.188$ ). The mean treatment duration was  $25.05 \pm 52.12$  days before the pandemic

**Table 1** Clinical profile of the patients

	2019	2020	<i>p</i> value
Mean age	54.96 +/– 13.06	53.20 +/– 11.94	0.26
Total mammograms	3689	1901	
Total core biopsy	391	367	
New patients	614	354	
Total number of surgeries	318	287	
Total no of BCS	127	93	0.01 (statistically significant)
Duration of symptoms (weeks)	20 +/– 56.38	15 +/– 24.3	0.18
Time taken for treatment (days)	25.05 +/– 52.12	31.52 +/– 44.44	0.30
Average tumour size	2.92 +/– 1.65 cm	2.91 +/– 1.31 cm	0.96
Advanced stage			
*size > 5 cm	23	25	0.76
*NACT	24	37	0.04 (statistically significant)
Duration of hospital stay	3.84 +/– 1.48 days	3.97 +/– 1.53 days	0.30
Total patients with complications	113	83	
No of patients with post op infection	39	25	0.18

and 31.52 +/– 44.44 days after the pandemic ( $p=0.306$ ) (Table 1). The average tumour size was 2.92 +/– 1.65 cm before the pandemic and 2.91 +/– 1.31 cm after the pandemic ( $p=0.963$ ) (Table 1).

The number of patients with a tumour size exceeding 5 cm was 23 before the pandemic and 25 after the pandemic ( $p=0.762$ ). Twenty-four patients underwent neoadjuvant chemotherapy in 2019, and this number increased to 37 in 2020 ( $p=0.04$ ) (Table 1). The mean duration of hospital stay was 3.84 +/– 1.48 days before the pandemic and 3.97 +/– 1.53 days after the pandemic ( $p=0.306$ ) (Table 1). Culture-positive postoperative infection was seen in 39 patients before the pandemic and in 25 patients after the pandemic ( $p=0.186$ ) (Table 1).

During pre-surgical evaluations, three patients tested positive for SARS-CoV-2. These patients were kept in quarantine for the period advised by the state government. Subsequently, these patients underwent surgery after they tested negative for SARS-CoV-2. None of these patients experienced any complications during surgery or the postoperative period. None of their caregivers or health care workers developed SARS-CoV-2 from these index cases.

## Discussion

The pandemic has challenged our healthcare systems in terms of diagnosis and treatment. Health care protocols had to be reorganised and rescheduled so that the general public was not affected. We took a multidisciplinary approach to provide care to our oncology patients. There was a significant decrease in the number of new patients (614 before the pandemic and 354 after the pandemic). In India, a

multicentric study by the National Cancer Grid showed 54% reduction in the number of new patients [2]. Another study from King George Medical College Lucknow also showed that outpatient services dropped by 62% [3]. This was possibly due to fear of the pandemic, difficulty to travel due to lockdown restrictions, a lack of awareness of treatments and financial constraints. In other parts of the world, the situation was similar. According to a registry-based study by the University of Split, Croatia, the number of newly diagnosed cases reduced by 24% from April to June 2020 compared to the year before. This was not observed during the second lockdown, possibly due to better preparedness [4]. The department of Oncology and Hemat–Oncology, University of Milan, Italy, noted an 87% reduction in breast surgery outpatient activity, an 84% reduction in extra-regional patients and a 42% reduction in patients from Lombardy (the region in Italy affected the most by COVID-19 based on a comparison between 2019 and 2020 data) [5].

In our study, the number of routine mammograms decreased drastically from 3689 to 1901. Despite this decrease, the number of core biopsies for suspicious breast lumps remained almost the same (391 before the pandemic and 367 after the pandemic). A significant drop was only noted in the lockdown month of April 2020—in all other months, the numbers of these cases were either the same or greater than before the pandemic. This shows that even though there was a decrease in routine breast cases, patients with suspicious breast lumps requiring biopsy still managed to come for evaluation.

Even though the number of new patients has decreased, the number of breast cancer surgeries has not significantly reduced (318 before the pandemic and 287 after the pandemic). This contrasts with the data from many other centres

that have reported reduced numbers of surgeries during the pandemic. In a study similar to ours, Nibril et al. [6] showed a decrease in surgical activity by 30%. In the Netherlands, Filipe et al. also reported a decrease in the number of patients undergoing surgery for breast cancer during the pandemic [7]. According to a retrospective multi-centric study, the number of surgical procedures has drastically reduced in Hubei, China, from 16.4% in December 2019 to 2.6% in February 2020. The researchers also mentioned that only 2% of patients were newly diagnosed in February 2020 compared with 19.3% in December 2019 [8].

Meanwhile, a multi-centric retrospective cohort study conducted in the Netherlands showed an overall decrease in the number of breast surgeries from March to May 2020. The number of referrals from general practitioners and screening programmes also declined. However, the postoperative complications remained stable during this period [7]. An observational study from Spain showed that out of 93 patients diagnosed during the pandemic, 72 underwent surgery and 21 received primary systemic therapy. The surgical activity was reduced by 30% without having a notable impact on postoperative complications [6]. In our study, there was a statistically significant reduction in breast conservation surgeries (from 127 in 2019 to 93 in 2020) ( $p=0.15$ ). Patients undergoing breast conservation required adjuvant radiation, thus requiring daily hospital visits even after surgery, which would have reduced this number.

Our study showed no significant difference in the tumour size at presentation before and after the pandemic. Still, a significant increase was observed in the number of locally advanced diseases requiring neoadjuvant treatment (24 before the pandemic and 37 after the pandemic) ( $p=0.04$ ). This possibly reflects the advanced presentation caused by the pandemic. A prospective cohort study was conducted in west of Scotland, and the data were compared to the regional cancer registry data recorded before the pandemic. In total, 189 surgeries were carried out on 179 patients (multiple oncoplastic surgeries and postoperative hematoma). Forty-two patients were diagnosed during the lockdown. The number of patients presenting tumours of an advanced size was significantly higher during lockdown than before the lockdown (cT3-4 16.8% vs 7.4%). The breast conservation rate was low during the lockdown (58.6% vs 65%). Also, no reconstruction was offered during the lockdown [9].

There were no significant differences in terms of the duration of symptoms, time between diagnosis and treatment or duration of hospital stay when comparing the pre- and post-pandemic phases in our study. Also, the postoperative infection rate decreased from 39 in 2019 to 25 in 2020, which was not statistically significant. There could have been many contributing factors for the decreased infection rate, one amongst them is hand hygiene; using a proper hand washing technique and frequent use of

handsanitiser could explain this decline. Multiple studies from India have failed to show an increase in morbidity from major cancer surgery during the pandemic. Similarly, during the pandemic phase, the number of patients and bystanders in the hospital also was less; this could have contributed to the reduced postoperative infection. We are looking into causes of post-op infection in our patient population [3, 10–12].

The Nightingale Breast Centre, one of the largest such centres in Europe, continued to offer simple breast surgeries whilst avoiding oncoplastic/reconstructive surgeries, which require a prolonged hospital stay and long surgery hours [13]. Pelle et al. from NCI (in Italy) maintained the same volumes and extent of breast surgery during the pandemic as before the pandemic [14].

We had only three patients (< 1%) who tested positive for SARS-Cov-2, and they were all operated on successfully after a 3- to 4-week quarantine period. In a retrospective, an observational clinical study from Karachi, Pakistan, only 70.5% of patients (206 out of 292) underwent surgery for breast cancer. Ten patients (4.9%) tested positive for SAR COV-2 and were operated on later. The other 86 patients (29.5%) were given neoadjuvant treatment. Of these patients, four (4.6%) tested positive whilst receiving treatment. The researchers concluded that despite this being a global crisis, they could still give adequate care and timely treatment to breast cancer patients [15].

One of the strengths of this study is that it was conducted in a tertiary care university hospital where COVID-19 patients were also being treated. Comparisons are available for a similar number of patients treated in the same unit during the previous year. Also, data were collected from an outpatient radiology department and operation theatre, thus providing a complete picture of the results. However, a single-centre study performed at a non-government hospital where the COVID-19 burden would be much more severe and the chances of other departments being affected would be much greater might produce a different result. Also, we have looked only at breast cancer patients who underwent surgery.

## Conclusion

Even though the pandemic and lockdown affected people's daily lives, the healthcare system actively functioned in the state. This study shows no significant difference in the surgical care given to patients with breast cancer before and after COVID-19. With proper triaging and universal screening, the continuation of clinical cancer care is possible during the current pandemic, even in lower-middle-income countries.

## Declarations

**Conflict of Interest** The authors declare no competing interests.

## References

- Andrews MA, Areekal B, Rajesh KR, Krishnan J, Suryakala R, Krishnan B et al (2020) First confirmed case of COVID-19 infection in India: a case report. *Indian J Med Res* 151:490–492. [https://doi.org/10.4103/ijmr.IJMR\\_2131\\_20](https://doi.org/10.4103/ijmr.IJMR_2131_20)
- Ranganathan P, Sengar M, Chinnaswamy G, Agrawal G, Arumugham R, Bhatt R et al (2021) Impact of COVID-19 on cancer care in India: a cohort study. *Lancet Oncol* 22:970–976. [https://doi.org/10.1016/S1470-2045\(21\)00240-0](https://doi.org/10.1016/S1470-2045(21)00240-0)
- Akhtar N, Rajan S, Chakrabarti D, Kumar V, Gupta S, Misra S et al (2021) Continuing cancer surgery through the first six months of the COVID-19 pandemic at an academic university hospital in India: a lower-middle-income country experience. *J Surg Oncol* 123:1177–1187. <https://doi.org/10.1002/jso.26419>
- Vrdoljak E, Balja MP, Marušić Z, Avirović M, Blažičević V, Tomasović Č et al (2021) COVID-19 pandemic effects on breast cancer diagnosis in Croatia: a population- and registry-based study. *Oncologist* 26:e1156–e1160. <https://doi.org/10.1002/onco.13791>
- Veronesi P, Corso G (2020) Impact of COVID-19 pandemic on clinical and surgical breast cancer management. *EClinicalMedicine* 26:100523. <https://doi.org/10.1016/j.eclinm.2020.100523>
- Acea-Nebriil B, García-Novoa A, García-Jiménez L, Escribano-Posada C, Díaz-Carballada C, Bouzón-Alejandro A, et al. Impact of the COVID-19 pandemic on a breast cancer surgery program. Observational case-control study in a COVID-free hospital. *Breast J* 2020;26:2428–30. <https://doi.org/10.1111/tbj.14037>.
- Filipe MD, van Deukeren D, Kip M, Doeksen A, Pronk A, Verheijen PM et al (2020) Effect of the COVID-19 pandemic on surgical breast cancer care in the Netherlands: a multicenter retrospective cohort study. *Clin Breast Cancer* 20:454–461. <https://doi.org/10.1016/j.clbc.2020.08.002>
- Li J, Wang H, Geng C, Liu Z, Lin Y, Nie J et al (2020) Suboptimal declines and delays in early breast cancer treatment after COVID-19 quarantine restrictions in China: a national survey of 8397 patients in the first quarter of 2020. *EClinicalMedicine* 26:100503. <https://doi.org/10.1016/j.eclinm.2020.100503>
- Romics L, Doughty J, Stallard S, Mansell J, Blackhall V, Lannigan A et al (2021) A prospective cohort study of the safety of breast cancer surgery during COVID-19 pandemic in the west of Scotland. *Breast* 55:1–6. <https://doi.org/10.1016/j.breast.2020.11.015>
- Pai E, Chopra S, Mandloi D, Upadhyay AK, Prem A, Pandey D (2020) Continuing surgical care in cancer patients during the nationwide lockdown in the COVID-19 pandemic—perioperative outcomes from a tertiary care cancer center in India. *J Surg Oncol* 122:1031–1036. <https://doi.org/10.1002/jso.26134>
- Ramachandra C, Sugoora P, Karjol U, Arjunan R, Altaf S, Halkud R, et al. Outcomes of cancer surgery during the COVID-19 pandemic: preparedness to practising continuous cancer care. *Indian J Surg Oncol* 2020:1–5. <https://doi.org/10.1007/s13193-020-01250-z>.
- Shrikhande SV, Pai PS, Bhandare MS, Bakshi G, Chaukar DA, Chaturvedi P et al (2020) Outcomes of elective major cancer surgery during COVID 19 at Tata Memorial Centre: implications for cancer care policy. *Ann Surg* 272:e249–e252. <https://doi.org/10.1097/SLA.0000000000004116>
- Highton LR, Dave RV, Barnes NLP (2020) Breast cancer surgery during the COVID-19 pandemic. *Br J Surg* 107:e380. <https://doi.org/10.1002/bjs.11819>
- Pelle F, Cappelli S, Graziano F, Piarulli L, Cavicchi F, Magagnano D et al (2020) Breast cancer surgery during the COVID-19 pandemic: a monocentre experience from the Regina Elena National Cancer Institute of Rome. *J Exp Clin Cancer Res* 39:171. <https://doi.org/10.1186/s13046-020-01683-y>
- Vohra LM, Jabeen D, Asif N, Ahad A (2021) COVID-19 pandemic and breast cancer management: a retrospective observational clinical study from Pakistan. *Ann Med Surg* 63:102151. <https://doi.org/10.1016/j.amsu.2021.01.099>

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