Leveraging AI to optimize breast cancer screening in the era of COVID-19

By Axel Gräwingholt, MD

COVID-19 AND ITS IMPACT ON BREAST CANCER SCREENING

Many breast cancer screening programs were halted worldwide during the height of the COVID-19 pandemic. Now that a number of countries in Europe have lifted confinement restrictions, breast cancer screening has begun to resume, yet patients may still be hesitant to come into the clinic for breast cancer screening out of fear – not just of breast cancer, but also due to fear of the novel coronavirus.

In 2018, breast cancer accounted for 26.4 percent of all new cancer cases in European women [1], indicating that regardless of the COVID-19 pandemic, cancer remains a major health concern. Although initially the hold on routine screening was intended to protect patients' health and safety, in general, the long-term effect of deferring breast cancer screening could have negative consequences in the years ahead – for patients and clinicians alike.

For patients, delaying screening could mean the difference between life and death, which is why it is so important for screenings to continue now that the threat of COVID-19 has begun to subside. And for clinicians, new challenges are emerging, as compressing 12 months of routine screening appointments into ten months or less presents a number of workload issues. This is compounded by the radiologist shortage in Europe, which made it difficult for clinicians to maintain medical standards, even prior to the pandemic [2]. But the latest in AI technology can empower clinicians to combat these issues, while also offering a number of benefits to women, during the era of COVID-19 and beyond.

A NOVEL SOLUTION FOR EMERGING DEMANDS

As screening and diagnostic mammography programs resume, clinicians may encounter a set of new challenges, including: workflow difficulties, as radiologists address a backlog of patients who need screening; reading accuracy may suffer due to longer work days and higher volumes of patients; and in the rush to view more mammographic images, clinicians may find complex cases to be increasingly difficult to evaluate.

A new artificial intelligence (AI) solution can help clinicians address these emerging challenges. iCAD's ProFound AI is a high-performing workflow solution available for 2D and 3D mammography, or digital breast tomosynthesis (DBT). Trained with the latest in AI and pattern recognition technology, this solution rapidly and accurately analyzes mammography and tomosynthesis images to identify potentially malignant lesions and provides radiologists with crucial information, such as Certainty of Finding lesion and Case Scores, which assists in clinical decision-making and improving reading efficiency. ProFound AI for 2D Mammography is CE Marked and ProFound AI for DBT is CE Marked, FDA-cleared and Health Canada licensed.

This leading-edge technology not only improves radiologist confidence, even while reading complicated datasets, such as those with dense breasts, but also it offers increased sensitivity and specificity, which helps physicians find more cancers, while reducing recall rates for non-cancer cases. As clinicians struggle with the aftermath of COVID-19, this technology is uniquely positioned to help address newfound challenges they are beginning to encounter.

A GROWING BODY OF SUPPORTIVE CLINICAL EVIDENCE

Positive clinical data from a large reader study was recently published in *Radiology: Artificial Intelligence* [3]. The research involved 24 radiologists who read 260 tomosynthesis cases, both with and without iCAD's ProFound AI solution. According to study findings, ProFound AI for DBT improved cancer detection rates by 8 percent, reduced unnecessary patient recall rates by 7.2 percent, and slashed reading time for radiologists by 52.7 percent. Additionally, ProFound AI for DBT cut reading time by up to 57.4 percent for radiologists reading cases with dense breasts [4]. This research suggests that ProFound AI for DBT offers unparalleled time-savings benefits to clinicians reading complex tomosynthesis datasets, with a considerable improvement in reader sensitivity.

The efficacy of ProFound AI for 2D Mammography was also validated in another recent study presented at the European Congress of Radiology (ECR) virtual meeting this year [5]. Professor Sylvia H. Heywang-Köbrunner, a radiologist and researcher based in Munich, Germany, examined 18,002 consecutive screening mammograms acquired between January and November 2018, which were anonymized and processed using ProFound AI for 2D Mammography. The AI technology's results were compared to that of two radiologists, who read the same cases. Researchers found ProFound AI for 2D Mammography achieved a sensitivity of 91.5 percent and a specificity of 80.2 percent for 32 ductal carcinoma in situ (DCIS) and 85 invasive cancers. This

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was compared to the first reader's results, which were 84.6 percent for sensitivity and 91.6 percent for specificity, as well as the second reader's results, which were 89.7 percent and 91.5 percent, respectively. ProFound AI's ability to find cancers outperformed both readers in the study, as well as the standards that were found in a review by ECIBC in Europe [6]. The findings of this study suggest that AI can perform at similar levels as experienced radiologists and can be confidently used as a valuable tool in the screening process.

At my center in Germany, I am working on an ongoing retrospective study evaluating ProFound AI for 2D Mammography on interval cancers, or lesions that are detected between routing mammography screenings. This research involves a review of 37,367 women screened in 2011 and 2012.

In an organized population-based screening program, it is expected that the number of interval cancers found are comprised of about 50% true interval cancers that developed between screening rounds, and about 50% that are either missed cancers or minimal sign cancers that were not seen or misinterpreted in the previous screening.

According to the preliminary conclusion to this study, of the 50% that were missed or minimal sign cancers, ProFound AI identified 93.3 percent of these cancers. Thus, by using ProFound AI for 2D Mammography, we can have higher detection rates of cancer and fewer mislabeled interval cancers. In addition, we also ran ProFound AI on cancers detected during screenings and their prior images. In many cases, the algorithm found a lesion in the prior images, suggesting this cancer could have been detected earlier if the clinician had originally used ProFound AI.

As we recover from COVID-19, it is essential for breast cancer screening to resume, as a growing body of evidence suggests early cancer diagnosis leads to better outcomes [7,8,9]. It is currently a prime time for clinicians to leverage the latest technologies, such as ProFound AI, which can help us navigate emerging challenges following this pandemic.

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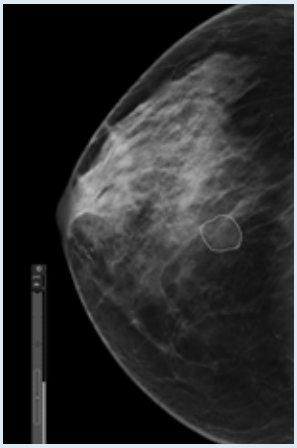
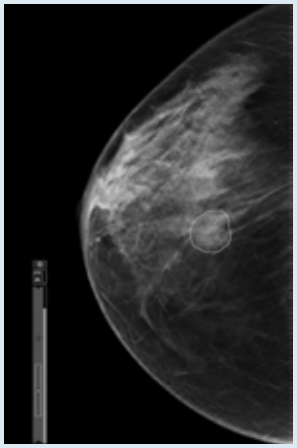
Case Report

Reading Tomosynthesis with ProFound AI can help to anticipate tumor diagnosis.

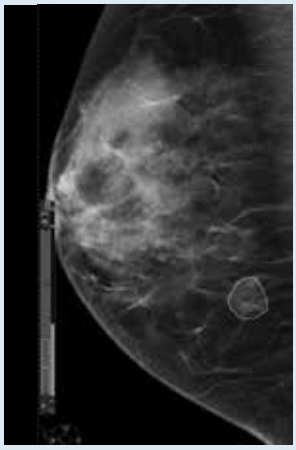
A 59 year old woman was referred by her gynecologist to the department of diagnostic mammography. The gynecologist who performed the ultrasound detected a lesion at 6 o´clock in the right breast. Tomosynthesis revealed an ill defined mass at 6 o'clock consistent with the ultrasound findings. The size was 1.63 cm, distance to the nipple was 5.2 cm.



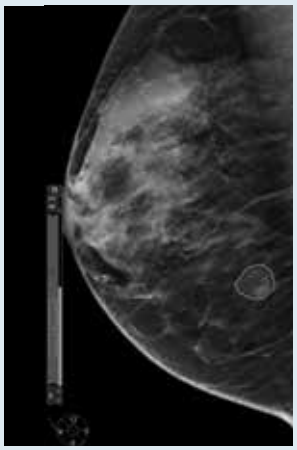
Tomosynthesis plane cc 2019
Lesion Score with ProFound AI 68%
Case Score with ProFound AI 93%



Prior
Tomosynthesis plane cc 2017
Lesion Score 35%
Case Score with ProFound AI 55%



Tomosynthesis plane obl 2019
Lesion Score with ProFound AI 81%



Prior
Tomosynthesis plane obl 2017
Lesion Score with ProFound AI 41%

CONCLUSION/HYPOTHESIS

If ProFound AI had been used for reading in the prior images from 2017, the lesion would have been identified by the radiologists. Although the gynecologist had not seen the lesion in the ultrasound, it is most likely that, knowing this lesion's localisation from tomosynthesis with ProFound AI, either the radiologist or the gynecologist would have found it. Therefore, it can be concluded that this cancer may have been detected two years before; possibly in a more favorable stage than at the time of actual diagnosis.