BREAST CANCER

APBI is an alternative to WBI

To reduce the risk of disease recurrence after breast-conserving surgery, women with early stage breast cancer typically receive whole-breast irradiation (WBI) daily for 3–5 weeks. Accelerated partial irradiation (APBI), delivered only to the tumour-bearing region over 5 treatment days, has been proposed as a more convenient option. Now, data from two randomized controlled trials reveal similar recurrence rates for both modalities.

In the NSABP B-39/RTOG 0413 and RAPID trials, women with ductal carcinoma in situ or stage I/II invasive ductal carcinoma were randomly assigned to receive either WBI ($n=2,109$ patients and 1,065 patients, respectively) or APBI ($n=2,107$ patients and 1,070 patients). The median follow-up durations were 10.2 years and 8.6 years, respectively.

In NSABP B-39/RTOG 0413, the 10-year cumulative rates of ipsilateral breast-tumour recurrence (IBTR) were 4.6% and 3.9% with APBI and WBI, respectively. With a hazard ratio (HR) of 1.22 (90% CI 0.94–1.58), the study did not meet the pre-specified limits for equivalence (HR range 0.667–1.5), favouring WBI. In RAPID, the 5-year cumulative rates of IBTR were 2.3% and 1.7% with APBI and WBI, and the 8-year cumulative rates were 3.0% and 2.8%, respectively. The HR was 1.27 (90% CI 0.84–1.91) and did not exceed the pre-specified upper margin for non-inferiority (2.02). In both studies, no statistically significant differences in overall survival were observed between treatment groups.

In NSABP B-39/RTOG 0413, 10% of patients reported grade 3 toxicities with APBI versus 7% with WBI, and <1% of patients reported grade 4–5 toxicities in both arms. In RAPID, the incidence of grade 3 acute toxicity was similar with both treatments (1.8% and 1.7%) but grade 3 late radiation toxicities were more common with APBI than with WBI (4.5% versus 1.0%; $P<0.0001$). "The difference in late toxicity is important because it resulted in 16% more patients reporting adverse cosmesis with APBI than with WBI," explains Tim Whelan, an investigator involved in the RAPID trial.

> "The difference in late toxicity is important ..."

Modifications in the delivery of APBI are underway: the RAPID investigators are evaluating the toxicity of daily APBI, whereas the NSABP B-39/RTOG 0413 investigators aim to reduce the number of treatments below five. "As with all treatment approaches, APBI has limitations that patients should review with their doctor," concludes Frank Vicini, an investigator involved in NSABP B-39/RTOG 0413.

Diana Romero

ORIGINAL ARTICLES Vicini, F. A. et al. *Lancet Oncol.* **394**, 2155–2164 (2019) | Whelan, T. J. et al. *Lancet Oncol.* **394**, 2165–2172 (2019)

BREAST CANCER

AI outperforms radiologists in mammographic screening

Mammographic screening is widely used for the detection of breast cancers, but has its flaws. For example, false-positive findings can lead to unnecessary medical interventions and patient anxiety, whereas false-negative results delay diagnosis and potentially preclude cure. Now, collaboration between Google Health and physician scientists has resulted in an artificial intelligence (AI) approach with the potential to enhance the efficiency of breast cancer diagnosis.

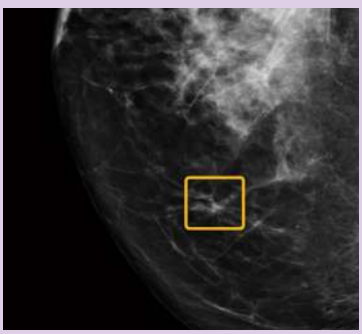
A deep learning-based AI system was trained using mammograms from ~76,000 women in the UK and >15,000 in the USA, and was then retrospectively applied to UK and US test sets comprising 25,856 and 3,097 women, respectively. The AI system resulted in absolute reductions of 1.2% and 2.7% in the rates of false-positive and false-negative detection of biopsy-confirmed breast cancers, respectively, in the UK test set and 5.7% and 9.4% in the US dataset, relative to the judgement of the first or sole radiologists.

> "...we addressed a common concern that machine learning results fail to generalise to new populations..."

"In our study, we addressed a common concern that machine learning results fail to generalise to new populations by re-training the algorithm using UK data only and then testing it on US data," adds Google Health employee Shravya Shetty. "Despite a small drop in performance, the AI system continued to demonstrate a reduction in false-positive and false-negative rates [3.5% and 8.1%, respectively]."

When used to provide a rapid second opinion as part of the double-reading process used in the UK, the accuracy of the AI system was non-inferior to serial reading by two radiologists, and the simulated workload of the second reader was reduced by 88%. Thus, AI has the potential to alleviate pressures on services in the context of a worldwide shortage of radiologists.

The survival benefits of mammographic screening, per se, continue to be debated and overdiagnosis is a key concern. Notably, the fundamental principles of AI in discerning patterns and associations that are often imperceptible to humans might, in the future, provide the capacity to distinguish clinically relevant and irrelevant cancers. "Further clinical studies are required to understand how software systems inspired by this research could improve patient care," Shetty emphasizes, concluding that "the goal is to increase the accuracy, efficacy and efficiency of screening, as well as reduce patient wait times and stress."



Reproduced from McKinney, S. M. et al. *Nature* **577**, 89–94 (2020).

David Killock

ORIGINAL ARTICLE McKinney, S. M. et al. International evaluation of an AI system for breast cancer screening. *Nature* **577**, 89–94 (2020)