E15. New imaging techniques: the role of digital mammography

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Imaging technology for breast cancer detection and diagnosis has changed rapidly over the last 30 years. Among the newer imaging techniques, digital mammography is expected to have a major impact on the quality and organisation of breast diagnostic and screening units.

Market data indicate that, worldwide, there are approximately over 30 000 film-screen mammography systems installed, but the estimate of the conversion to digital mammography systems (DMS) is still uncertain.

The principal theoretical advantage of DMS comes from decoupling the image display from the image receptor. This permits the digital image to be captured, stored electronically, and then manipulated, analysed, and displayed allowing each step to be optimised. Many physical measurements have shown that when comparing the use of standard X-ray techniques, as in conventional film-screening mammography, with DMS that the latter performs better in the visualisation of very low contrast details and at least equally well for high contrast details, even when details smaller then the pixel size are presented [1].

These results have to be validated in clinical trials because each step from receptor to display plays a fundamental role in enabling a correct diagnosis to be made.

A large amount of clinical research has to be developed using new advanced applications of DMS as Computer-Aided Detection (CAD), Contrast Enhanced Imaging, 3D Reconstruction, but also to validate the clinical use of currently available DMS.

Two major trials have been carried out, mainly in screening populations, in the USA – University of Colorado and of Massachusetts [2] – and in Europe – the Oslo Trial 1 [3] – with the aim of evaluating the performance of Full Field Digital Mammography (FFDM) with soft copy reading compared with conventional screen-film mammography (SFM).

These trials showed that FFDM compared with SFM have comparable detection rates, although in both studies the absolute number of cancers detected by FFDM was slightly lower. The first study [2] has also shown that FFDM has a lower recall rate, whilst the Oslo trial has shown that FFDM has a higher rate of cases selected for the consensus meeting. The differences in the two trials may be due to the different selected populations (higher prevalence of cancer in the USA trial) and diagnostic procedures adopted. It is clear, however, that for soft copy reading a learning period is necessary and the development of a dedicated soft-copy reading system is needed, especially for using FFDM in the screening setting [4].

In our opinion, digital mammography will have a great future in screening for breast cancer where CAD [5] and teleconsulting could compensate for the lack of skilled radiologists and the high costs of DMS can be balanced by savings in the number of staff and radiographical material costs.

Our experience is that the performance of radiologists currently involved in mammography reporting is far from optimal when measured with proficiency tests (6). In order to evaluate the potential benefit of CAD in screening, we have tested a system developed and presently commercialised by CADx Medical Systems Inc. with the national proficiency test used in Italy. The series studied consisted of 150 cases, including 17 screen-detected cancers. CAD indicated 767 sites for second review (average 5.1 per case or 1.2 per film, 93 microcalcifications, 674 opacities). CAD identified cancer, at least in one view, in 16 of the 17 cases, with a sensitivity of 94.1%. Overall, CAD reading resulted in increased, unchanged or decreased sensitivity for 6, 3 or 1 readers, respectively. All but one reader reported an increased recall rate at CAD reading. Considering all 10 readings, on average cancer was identified in 85.8 vs. 90.0% of cases (chi square 0.99, degrees of freedom, df = 1, P = 0.31) and the recall rate was 7.9 vs. 11.4 % (chi square 8.69, df = 1, P = 0.003) at conventional or CAD readings, respectively. Only the difference in the recall rates reached statistical significance.

Comparing the reading of a single radiologist with CAD with simulated conventional double readings by the four radiologists of our Institute (CSPO), on average, CAD reading (four readings) was slightly more sensitive (sensitivity 97.0 vs. 96.0%, non-significant (N.S.)) and almost as specific (recall rate 10.7 vs. 10.6%, N.S.) compared with double reading.

In conclusion, CAD single reading was as effective as conventional double reading and its current use in screening with a dedicated digital system could compensate for the lack of skilled radiologists.

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