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BREAST

Editorial comment: cone-beam and phase contrast CT: new horizons in breast imaging?

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Abstract
This Editorial Comment refers to the articles "Contrast-enhanced cone-beam breast-CT (CBBCT): clinical performance compared to mammography and MRI" by Wienbeck S et al, Eur Radiol. 2018 Mar 28. doi: 10.1007/s00330-018-5376-4 and "Diagnosis of breast cancer based on microcalcifications using grating-based phase contrast CT" by Li X et al, Eur Radiol. 2018 Jan 26. doi: 10.1007/s00330-017-5158-4

With an incidence of 12.3%, breast cancer constitutes the most frequent cancer in the normal female population [1]. In Europe, 216,000 cases of breast cancer are newly diagnosed each year, with breast cancer being the second most common cause of death by cancer [2]. The most important breast imaging technique is mammography, which has been shown to reduce relative mortality in the order of 30–35%. However, conventional mammography is hampered by several shortcomings: (i) the relatively low sensitivity in patients with dense breast tissue, and (ii) the relatively low positive predictive value of microcalcifications resulting in a vast number of unnecessary biopsies.

A promising new technique is cone-beam computer-tomography of the breast (CBBCT) offering truly isotropic 3D images of the breast at high spatial resolution, which overcomes the short-coming of conventional mammography with the potential superimposition of breast cancer by dense breast tissue. Recently, Wienbeck et al [3] applied a CBBCT in a prospective study in 41 patients assessing 100 BIRADS 4 and 5 lesions. All included patients exhibited dense breast tissue (ACR type c or d). The authors compared contrast-enhanced CBBCT after the injection of iodinated contrast-agent (CE-CBBCT) with non-enhanced CBBCT (NC-CBBCT), conventional mammography and breast-MRI. The authors found a significantly higher diagnostic accuracy of CE-CBBCT compared to NC-CBBCT and conventional mammography almost reaching the accuracy of breast-MRI. Sensitivity of CE-CBBCT was 37–39% higher compared to conventional mammography. A limitation of the presented study is the lack of a comparison with digital breast tomosynthesis, which is a pseudo-3D technique reducing the overlap with dense breast tissue. Another limitation of the current CE-CBBCT imaging technique is the fact that only one breast may be imaged at once, which is not an issue in breast-MRI. As the device can only depict one breast within one scan, and contrast-agent can only be administered once during an examination, only one side can be depicted during one session, and examination of both breasts requires a second appointment.

Regarding the relatively low specificity of microcalcifications for prediction of breast cancer, one new promising technique is the phase-contrast measurement in X-ray breast examinations. In a study by Wang et al [4], the application of phase-contrast X-ray mammography for the classification of microcalcifications was proposed. In phase-contrast the complementary nature of absorption and small-angle scattering signals are used to obtain a more comprehensive characterization of microcalcifications. Technically, an X-ray grating interferometer is applied on a conventional X-ray tube. In a recent study by Li et al [5], a CT-based method was applied for phase-contrast imaging of microcalcifications. In a Talbot-Lau interferometer setup, 21 specimens from 20 patients were examined, with 11 specimens from benign breast diseases and 10 specimens from invasive-ductal carcinoma or ductal carcinoma in situ. Li et al report a significantly higher

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accuracy of phase-contrast imaging for the classification microcalcifications compared to projection images.

Altogether, there are several interesting new techniques on the horizon, which will provide a notable improvement of sensitivity and specificity in breast imaging using X-ray techniques, thereby allowing for significantly shorter examination times as compared to the current gold standard of breast MRI. CBBCT is already a commercially available technique, whereas phase-contrast mammography is still at the stage of development.

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