

Thoracic and Cardiac Imaging / Imagerie cardiaque et imagerie thoracique

Occurrence and Positive Predictive Value of Additional Nonmass Findings for Risk Stratification of Breast Microcalcifications in Mammography

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Abstract

Purpose: To assess the occurrence and positive predictive value of additional nonmass findings to stratify the risk of breast microcalcifications.

Methods: This retrospective evaluation included 278 lesions with vacuum- or image-guided hook-wire biopsy for suspicious microcalcifications. The lesions were categorized into exclusive microcalcifications and microcalcifications with focal asymmetry, tubular density or architectural distortion (ie, nonmass findings). To evaluate the utility of additional nonmass findings for risk stratification, outcome variables were positive predictive values and odds ratios for malignancy and invasive carcinoma.

Results: Forty-five of 278 microcalcification lesions (16%) were associated with nonmass findings: 28 focal asymmetries, 2 tubular densities, and 15 focal asymmetries in conjunction with tubular densities. Architectural distortion was observed in 28 of these cases. The odds ratio for additional nonmass findings relative to exclusive microcalcifications was 5.9 and was statistically significant ($P < .00001$). Architectural distortion was the most specific indicator for malignancy and invasiveness, with odds ratios of 6.5 ($P = .0072$) and 5.6 ($P = .0214$), respectively.

Conclusions: Microcalcifications with nonmass findings were less frequent than exclusive microcalcifications but were more predictive for malignancy. Architectural distortion demonstrated the highest risk of malignancy and invasiveness. Assessment of additional nonmass findings might be useful for further risk stratification of microcalcifications, indications for additional imaging, and pretreatment considerations.

Résumé

Objet : Évaluer la fréquence et la valeur prédictive positive des résultats supplémentaires de rehaussement sans masse afin de stratifier les risques de microcalcifications mammaires.

Méthodes : L'évaluation rétrospective englobait 278 lésions ayant fait l'objet d'une biopsie pour des microcalcifications suspectes, soit par aspiration, soit suite à la mise en place d'un harpon stéréoguidé. Les lésions ont été classifiées en microcalcifications isolées et en microcalcifications avec asymétrie focale, densité tubulaire ou distorsion architecturale (c.-à-d. rehaussement sans masse). Dans le but de mesurer l'utilité des résultats supplémentaires de rehaussement sans masse à des fins de stratification des risques, les résultats ont été établis comme valeurs prédictives positives et comme rapports de cotes de la malignité et du carcinome invasif.

Résultats : Parmi les 278 lésions présentant des microcalcifications, 45 (16%) étaient associées à un rehaussement sans masse, dont 28 cas d'asymétrie focale, 2 cas de densité tubulaire et 15 cas d'asymétrie focale assortie de densité tubulaire. Une distorsion architecturale a été observée dans 28 de ces cas. Le rapport de cotes pour les résultats supplémentaires de rehaussement sans masse par rapport aux microcalcifications isolées était de 5,9 et était statistiquement significatif ($P < 0,00001$). La distorsion architecturale s'est avérée l'indicateur de malignité ou de cancer invasif le plus précis, présentant un rapport de cote de 6,5 ($P = 0,0072$) et de 5,6 ($P = 0,0214$), respectivement.

Conclusions : Les microcalcifications présentant un rehaussement sans masse étaient moins fréquentes que les microcalcifications isolées, mais détenaient une valeur prédictive plus élevée au chapitre de la malignité. La distorsion architecturale a par ailleurs démontré le risque de malignité ou de cancer invasif le plus élevé. L'évaluation des résultats supplémentaires de rehaussement sans masse pourrait servir à stratifier

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les risques des microcalcifications de manière plus exhaustive, à indiquer le besoin d'examens supplémentaires et à analyser les diverses considérations entourant le prétraitement.

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Key Words: Breast; Microcalcifications; Mammography; Breast neoplasm; Ductal carcinoma in situ

Type and distribution descriptors of microcalcifications are generally used for risk stratification of breast malignancy [1]. The use of focal asymmetry, tubular density, and architectural distortion in the context of microcalcifications for risk stratification has received less attention. Studies of proven ductal carcinoma in situ (DCIS) alone are reporting the occurrence of focal asymmetry and architectural distortion in conjunction with DCIS [2,3]. Stomper et al [3] found that the spectrum of soft-tissue abnormalities associated with clinically occult DCIS appears to have 2 major pathologic correlations: a direct manifestation of the tumour with tumour-filled ducts and the presence of periductal fibrosis or elastosis, which creates an irregular or spiculated mass. By using subgross histology and large-section histology, Tabár et al [4] explained tumour-forming DCIS by the induction of dense and disorganized duct-like structures. The presence of a basement membrane classifies these structures as an in situ process.

In a large study, Venkatesan et al [5] examined the positive predictive value of specific mammographic findings. Focal asymmetry exhibited the lowest predictive value for malignancy. Architectural distortion demonstrated a low prevalence but was highly predictive of invasive cancer. Calcifications were similarly predictive of invasive cancer and DCIS in their cohort. Combinations of mammographic findings were not analysed in this study. If associated with suspicious microcalcifications, then tubular structures were considered significant by the standards presented by the American College of Radiology Breast Imaging-Reporting and Data System (BI-RADS), 4th edition, [1]. We noticed a lack of studies that quantify the positive predictive value for malignancy of suspicious microcalcifications in conjunction with nonmass findings: focal asymmetry, tubular density, and architectural distortion. Therefore, we evaluated the occurrence and positive predictive value for malignancy and invasiveness of suspicious microcalcifications with and without additional nonmass findings.

Materials and Methods

Study Design

This retrospective study includes the results of 324 consecutive x-ray-guided biopsies (vacuum-assisted stereotactic biopsy or open surgery with hook-wire guidance) performed in 284 women because of nonpalpable suspicious microcalcifications on mammograms between January 2002 and December 2003 at an academic hospital before the introduction of an official and nationwide screening program, and

were part of a 7-year follow-up. The mammograms were retrospectively reevaluated by 2 subspecialty-trained breast imagers in accordance (E.V.S., M.B.R.). The readers were blinded for histopathology, medical record, and previous description of microcalcifications. The analysis of additional mammographic findings included focal asymmetry, tubular density (tubular structure), and architectural distortion [1]. The exclusion criteria for this retrospective analysis with special focus on microcalcifications with nonmass lesions were as follows: (a) microcalcifications were not identified in the histologic specimen (1 case of vacuum biopsy; all other 108 vacuum biopsies were technically successful), (b) 2 or more synchronous or asynchronous separate accumulations of microcalcifications in the same quadrant (1 case of asynchronous microcalcifications in the same quadrant), and (c) mammographic images that showed a combination of microcalcifications with spherical mass (44 cases; 9 complex lesions, and 35 cases selected for x-ray-guided biopsy because of small, invisible, or not clearly detectable spherical mass lesions on prior focused ultrasound). Thus, 278 mammographic lesions (either pure microcalcifications or microcalcifications with nonmass findings) were further analysed in regard to the positive predictive value for malignancy and invasiveness.

Patients

The institutional review board approved this study and waived the requirement for informed consent. The women were 25–83 years of age (mean age [SD], 54.5 ± 11.3 years). All included mammographic lesions were nonpalpable breast lesions. Twenty-six women with 31 included mammographic lesions were followed-up because of a history of breast cancer (prior histologic examination: 4 women with pure DCIS and 22 women with invasive carcinoma with or without a DCIS component). Fourteen women (14 lesions, 1 woman with a history of breast cancer) showed a suspicious palpation within a different quadrant, and 7 women (7 lesions; 2 women with a history of breast cancer) manifested with nipple discharge. Hence, 3 women had a history of breast cancer and were symptomatic women. Thus, 229 of 278 mammographic lesions were screen-like detected lesions in asymptomatic women (206 asymptomatic women without a history of breast cancer).

Mammograms and Readings

Examinations were made by using the dedicated screen-film technique. During the 2-year study period, a total of 7878 mammograms were evaluated. Craniocaudal, mediolateral

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