

Breast Imaging / Imagerie du sein

Clinical Image Quality and Sensitivity in an Organized Mammography Screening Program

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Abstract

Purpose: The study sought to examine the association between clinical image quality of mammograms and screening sensitivity.

Methods: Four radiologists evaluated the clinical image quality of 374 invasive screen-detected cancers and 356 invasive interval breast cancers for which quality evaluation of screening mammograms could be assessed from cancers diagnosed among participants in the Quebec Breast Cancer Screening Program in 2007. Quality evaluation was based on the Canadian Association of Radiologists accreditation criteria, which are similar to those of the American College of Radiology. The association between clinical quality and screening sensitivity was assessed by logistic regression. Adjusted sensitivity and adjusted sensitivity ratios were obtained through marginal standardization. No institutional review board approval was required.

Results: A proportion of 28% (206 of 730) of screening mammograms had lower overall quality for the majority of assessments. Positioning was the quality attribute that was the most frequently deficient. The 2-year screening sensitivity reached 68%. Sensitivity of screening was not statistically associated with the overall quality (ratio of 2-year sensitivity = 1.03; 95% confidence interval: 0.93-1.15) or with any quality attributes (positioning, exposure, compression, sharpness, artifacts, contrast). Results were similar for the 1-year sensitivity.

Conclusions: Although not all mammograms in the Quebec screening program met the optimum quality required by the Canadian Association of Radiologists or American College of Radiology accreditation, the screening mammograms produced in this population-based organized screening program reached a high enough level of quality so that the remaining variation in quality is too little to impair screening sensitivity.

Résumé

Objet : L'étude avait pour objectif d'examiner la relation entre la qualité clinique des clichés des mammographies et la sensibilité du dépistage du cancer du sein.

Méthodes : Quatre radiologistes ont évalué la qualité clinique des clichés de 374 cancers détectés infiltrants à l'examen de dépistage et de 356 cancers d'intervalle infiltrants pour lesquels il était possible de procéder à une évaluation de la qualité des mammographies de dépistage parmi les cancers diagnostiqués chez les participantes au Programme québécois de dépistage du cancer du sein en 2007. L'évaluation de la

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qualité reposait sur les critères d'agrément de l'Association canadienne des radiologues, lesquels sont semblables à ceux de l'American College of Radiology. La relation entre la qualité clinique et la sensibilité du dépistage a été évaluée par régression logistique. Les sensibilités ajustées et les rapports de sensibilités ajustés ont été obtenus par standardisation marginale. Il n'a pas été nécessaire d'obtenir une approbation du comité d'examen de l'établissement.

Résultats : Pour la majorité des évaluations, 28 % (206 sur 730) des mammographies de dépistage présentaient une qualité globale moindre. Le positionnement était la composante la plus fréquemment déficiente. La sensibilité du dépistage à 2 ans atteignait 68 %. La sensibilité du dépistage n'était pas associée sur le plan statistique à la qualité globale (ratio de sensibilité du dépistage à 2 ans = 1,03; intervalle de confiance de 95 %: 0,93-1,15), ni à aucune composante de la qualité (positionnement, exposition, compression, netteté, artefacts, contraste). Les résultats étaient semblables pour ce qui est de la sensibilité du dépistage à un an.

Conclusions : Bien que les clichés mammaires du programme québécois de dépistage ne respectent pas tous les critères optimaux de qualité exigés aux fins d'agrément par l'Association canadienne des radiologues ou l'American College of Radiology, les mammographies de dépistage pratiquées dans le cadre de ce programme organisé de dépistage populationnel présentent un niveau de qualité suffisamment élevé, si bien que la variation résiduelle ne nuit pas à la sensibilité du dépistage.

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Key Words: Breast cancer; Image quality; Mammography; Screening; Sensitivity

Quality assurance is a key element of most organized mammography screening programs [1,2] and many measures are implemented to ensure high mammography quality [3]. In the Quebec Breast Cancer Screening Program (Programme québécois de dépistage du cancer du sein [PQDCS]), participating facilities must, among other requirements, be accredited by the Canadian Association of Radiologists (CAR) [4,5]. Criteria used by the CAR for the evaluation of the clinical image quality are similar to those of the American College of Radiology (ACR) [6,7].

Despite the accreditation of all facilities of the PQDCS, a recent study demonstrated that a substantial proportion of a random sample of screening mammograms carried out in daily practice failed to meet the CAR quality standards [8]. Positioning was the quality attribute that was the most often deficient.

Clinical mammography quality is widely believed to influence sensitivity and specificity of breast cancer screening but few studies have examined these associations. One study suggested that lower overall clinical quality could be associated with an increase in the false-positive rate, with artifacts being associated with a 2-fold increase in the false-positive rate [9]. Only 1 study assessed the relation of screening mammogram quality to sensitivity and this study observed that lower quality of positioning was associated with a reduced screening sensitivity for women screened between 1988-1993 [10]. Other studies have suggested that poor mammography quality, including poor positioning, was associated with missed cancers [11] or being at more advanced stages at diagnosis [12]. A small proportion of missed cancers (0%-6%) was attributed to technical reasons or positioning in some studies [13–16], but this proportion was shown to reach 46% in 1 study [11].

The objective of this study was to evaluate the association between clinical quality of screening mammograms and screening sensitivity in the organized population-based PQDCS.

Methods

Setting

The PQDCS was launched in 1998. It actively invites women 50-69 years of age to receive biennial screening mammography in accredited facilities. Participating facilities must, among other requirements, be accredited by the CAR. The facility personnel must have specific qualifications, and both the technical and clinical image quality are evaluated every 3 years. Facilities must also be certified by the Laboratoire de Santé Publique du Québec. This certification includes yearly visits by a physicist who confirms that both the mammography unit and equipment used for image processing and viewing conditions are adequate. The physicists also verify that the participating facilities follow the strict quality control protocols specified by the program [4,5]. Screening mammograms are single read by radiologists who must read, in the years under study, a minimum of 500 mammograms per year.

At each screening examination, women characteristics, such as age, body mass index, and family history of breast cancer, are obtained from self-administrated questionnaires. Breast density is assessed by the radiologist who reads the screening mammogram. This information is pooled in the PQDCS information system that was used for this study. Characteristics of radiologists who interpreted the screening mammograms were obtained from the Quebec College of Physicians and from the PQDCS data. Type of screening facility (public or private) was also retrieved from PQDCS data. No institutional review board approval was required for this analysis because all women screened signed an informed consent allowing their data to be used for program evaluation.

Sample

This retrospective study is based on invasive screen-detected cancers and invasive interval breast cancers

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