

Imaging breast with implants – a Swedish perspective

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Abstract

Background: Today, the most common cancer among women in Sweden is breast cancer. To detect and treat cancer at an early stage, women between 40-74 years are offered mammographic screening. However, it is becoming more common with women having breast implants, which causes some difficulties in meeting the image criteria in mammographic screening. Therefore, Eklund's technique is preferred to optimize the detection of breast cancer for women with breast implants.

Purpose: The purpose of this study was to report and describe the screening protocol of several mammography clinics for imaging breasts with implants.

Method: A survey with four open questions was distributed, and then interpreted and reported in a quantitative manner. Out of 28 contacted mammography clinics, 24 responded.

Result: The results of the study show that most of the participating clinics were using Eklund's pushback technique without knowing it. There were significant differences in the selection of projection and compression pressure for the mammographic screening.

Conclusion: The results of the study indicate that guidelines are recommended to ensure that every clinic in Sweden is working evidence-based and that women can be offered equal care.

Bakgrund: Bröstcancer är den vanligaste cancerformen som drabbar kvinnor i Sverige. För att upptäcka och bota bröstcancer i tidigt stadium erbjuds kvinnor mellan 40–74 år mammografiscreening. Det är vanligt att kvinnor väljer att operera in bröstimplantat som medför en del svårigheter att uppfylla bildkriterierna vid screeningundersökningarna.

Eklunds teknik är därför att föredra för att optimera upptäckten av bröstcancer hos kvinnor med bröstimplantat.

Syfte: Syftet med studien var att redovisa och beskriva ett flertal mammografiklinikers screeningprotokoll vid bildtagning av bröst med implantat.

Metod: En enkätundersökning med fyra öppna frågor mejlades ut där svaren sedan tolkades och redovisades. 28 kliniker tillfrågades.

Resultat: Majoriteten bland de tillfrågade klinikerna använder Eklunds pushback teknik, men utan att veta om det. Det fanns signifikanta skillnader i val av projektion och tryck på kompression vid screeningundersökningarna.

Slutsats: Studiens resultat tyder på att riktlinjer är att rekommendera för att säkerställa att varje klinik i Sverige arbetar kunskapsbaserat och att kvinnor kan erbjudas likvärdig vård.

Introduction

Mammography is a radiological examination of women's and men's breasts. The method is inexpensive, fast and reliable for diagnosing breast cancer (Aspelin & Pettersson, 2008). The sensitivity for discovering breast cancer using mammography is as high as 85%, and even very small, non-palpable lumps can be discovered in mammography (Lisle, 2012).

Information from Cancerfonden (2015) also shows that screening has aided in discovering half of all breast cancer in Sweden. This indicates that screening saves lives. Two studies made in 2002 and 2007 showed that screening was, and is, necessary as a health examination, since women can be diagnosed at an early stage and run less risk of fatality (Duffy et al., 2002; The Swedish Organised Service Screening Evaluation Group, 2007).

Two projections per breast are performed during a normal screening examination: craniocaudal (CC) and medio-lateral oblique (MLO). The CC-projection is performed in a craniocaudal (head-to-foot) radiation alignment, while the breast is compressed by a plate towards the detector. MLO is performed with a mediolateral oblique (angled-side view) radiation alignment from the chest alongside the breast. MLO is the projection that best visualizes the lateral side of the breast, where most pathological changes are statistically found (Mohamed, Luo, Peng, Jankowitz & Wu, 2017). Criteria for the CC-projection is that both breasts, in two separate images, must be radiographed symmetrically: and, if possible, also the breast muscle (m. pectoralis). The medial part of the breast must be visible, and as much as possible of the lateral portion of the breast. For MLO-projections, the total breast tissue must be visual. The breast muscle must include the mammary plane and the skin fold between the breast and abdominal wall, shown without any overlapping of tissue. The mammary must always, regardless of projection, be shown in profile (Eklund, Cardenosa & Parsons, 1994; Perry, 2006).

It is becoming more common for women, for different reasons, to have breast implant surgery (Figure 1). Breast implants are primarily used to enhance the breasts by changing the form or size of the breast or in addition to reconstruct and create a new breast after a mastectomy. In the USA, breast implants are the most common type of plastic surgery being conducted (Johnson, 2013). According to BRIMP - Bröstimplantatsregistret (breast implant register), there is a continuing yearly increase in the number of registered patients with breast implants in Sweden. Latest annual report from the breast implant register from 2016, estimated that approximately 5,906 women have breast implants; which should be noted as an approximate value, as there certainly are surgeries performed at clinics that have not reported in. (BRIMP, 2016).

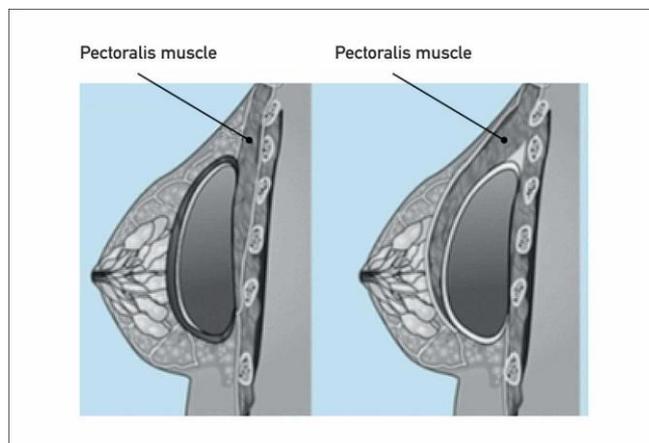


Figure 1: Positioning of breast implants, over or under the pectoralis muscle, may result in several difficulties during screening examinations in order to fulfil those image criteria required to discover breast cancer. (Johnson, 2013).

Breast implants may result in several difficulties during screening examinations in order to fulfil those image criteria required to discover breast cancer (Figure 2). The ultimate result, during a screening, is to project an image of a breast with high image quality and as much breast tissue in the image as possible (Kopans, 2007).

When doing standard projections, the breast tissue is not visible as it lies above or under the implant due to the implants high attenuation. This leads to information, from the breast tissue, being hidden by as much as 83%, between 23% -83% in the image (Johnson, 2013).

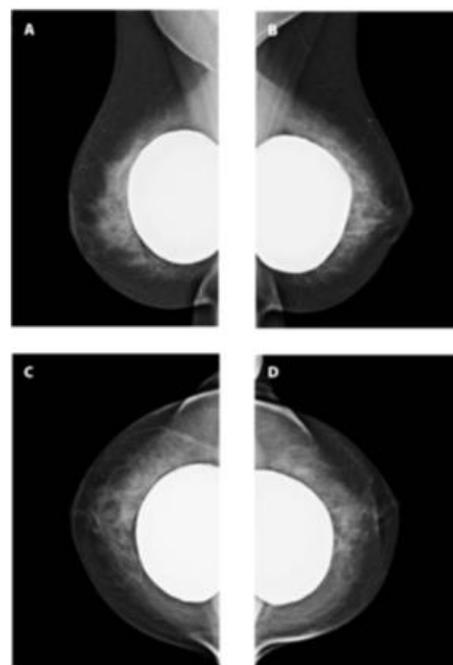


Figure 2: Mammography of breasts, containing implants (Johnson, 2013).

Eklund's technique

According to Public Health England (2017), there is an internationally known method for optimizing the discovery of breast cancer in women with breast implants. This method is called Eklund's technique, and the images performed are named pushbacks (Figure 3). The method was developed and introduced by a radiologist GW Eklund at the end of the 1980's to achieve suitable compression and image quality when taking pictures. The breast implant is moved posterior to the wall of the breast, so that any breast tissue behind it will be visible in front of the breast implant in the image (Eklund, Busby, Miller & Job, 1988). During a screening examination, in addition to the usual standard projection, women with breast implants must have at least four extra projections performed during the screening, when Eklund's technique is used. The images must include pushback images of craniocaudal and mediolateral oblique projections for each breast. A fifth projection may also be carried out at a 90° lateral position, depending on the issue at hand (Johnson, 2013).

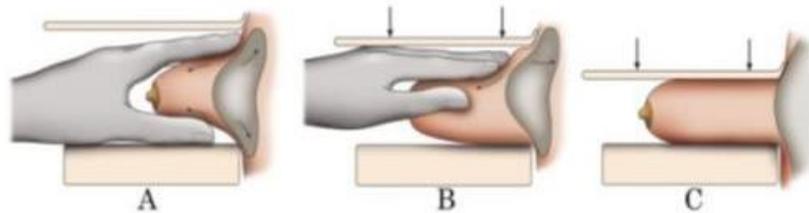


Figure 3: Eklund's technique use pushback techniques to help the amount of breast tissue considerably improved for mammography.

According to Eklund, Busby, Miller and Job (1988), the image quality and the amount of breast tissue shown in the images are considerably improved when Eklund's technique is used on women with breast implants. Eklund's technique currently appears to be the only scientific-based method carried out at mammography clinics throughout the world. The method is also referred to in many new scientific articles published within the last 5 years, which means the Eklund's technique is still a current, applicable method when imaging breast implants (Johnson, 2013; Shah & Jankharia, 2016; Smetherman, 2013).

Purpose

Today, the most common type of cancer among women in Sweden is breast cancer, and due to mammographic screening, breast cancer is discovered in good time, with the majority of those affected by cancer being cured. A few women have breast implants that hide important information during imaging. Breast implants, that are not correctly projected, may lead to incorrect diagnostics. By examining several Swedish mammography clinics' screening protocols of breast with implants, we may gain insight on today's methods of imaging.

Methods

The research survey project was designed to provide systematic information; using a quantitative descriptive research design. The survey questions were standardized and had no variation. However, the questions were open and therefore non-structured (Trost & Hultåker, 2016). The selected clinics received the same questions and under similar conditions, all were contacted via e-mail. The purpose of the study was the basis of the questions designed and the respondents were measured as they were intended to be measured. The questions asked were; 1) How do you find out if the patient has breast implants or not during screening examinations? 2) Do you take extra images in addition to the standard CC and MLO-projections when screening patients with implants? If yes – indicate which. 3) Why do you take these images? 4) Do your clinic document guidelines for compression of the breast with implants and which pressure do you then use?

The authors Bell and Waters (2016) speak in favor of a pilot study being initiated in order to evaluate the survey's content, and, as a result, a smaller pilot study shortly prior to the work's start was initiated, where test persons evaluated the survey. This proved to be useful, and the questions on the survey were redesigned based on the points of view that arose. The collection of data began after sending out e-mails with information letters and survey questions to in total 28 clinics across Sweden, for a wide range of respondents. To increase the chances of answering frequency, reminders were also sent out per e-mail to those clinics that had not answered within the first two weeks. The participating clinics answered the survey questions by e-mail.

A convenience selection of only mammography clinics throughout Sweden were chosen to give insight to the mammography clinics' protocols. One responsible and certified radiographer was contacted via e-mail to delegate the task to a suitable mammographer that was to answer the survey questions. 24 of 28 contacted clinics participated in the study with a drop-out of four.

Results

The result of the study is based on the four survey questions sent to mammography clinics in Sweden to assess the different clinics' screening protocol. A total of 24 clinics answered among the 28 asked (85% participation), which gave a drop-out of four clinics (15%). The answers have been freely interpreted and compiled in descriptive statistics to present results of the data collection.

Finding out if the patient has breast implants; results from survey question 1: "How do you find out if the patient has breast implants or not during a screening examination?". The results were unanimous, all 24 clinics responded that they always ask the patient if she has implants prior to a screening examination; through an oral standard questionnaire, or via a summons sent home to the women. If the patient had breast implant surgery, then follow-up questions are asked, such as what type of surgery, whereby the information on breast

implants is reported and noted in the clinic’s work system, and the staff is informed for future examinations. Even if information about implants is documented, the question is always asked prior to examination, so the staff could avoid mistakes.

Breast implant imaging

The clinics’ responses to survey question 2, "Do you take extra images in addition to the standard CC and MLO-projections during screening examinations of patients with breast implants?" showed that 18 of the 24 clinics (75%) took some form of extra images in addition to the standard projections, as illustrated in table 1. The latter six (25%), did not take extra images; they only took standard images during screening examinations. As a result of the answers given by the clinics, as to whether they choose to take extra images during screening examinations of breast implants, a supplementary question was asked, where the clinics were requested to indicate those extra images performed in addition to the standard projections performed. Five of 24 clinics only took four standard images with no extra images. One clinic took, in addition to the four standard images, only two extra ML-images of breast implants at a 90-degree angle. One clinic took six images, where the pushback technique was used only in CC-alignment of each breast in addition to the standard projections. Four of 24 clinics only took two standard images in MLO and four pushback images in CC and MLO. The majority answered that extra pushback images, in addition to standard projections, were performed on each breast in CC and MLO, which totals 8 images,

<i>Clinics</i>	<i>No.images performed</i>	<i>Descriptions of projections per breast</i>
1	6	CC image with implants. MLO-image with implants. ML-image with implants
1	6	CC-image with implants. MLO-image with implants. CC-image pushbacks
4	6	MLO-image with implants. CC-image pushbacks. MLO-pushbacks
12	8	CC-image with implants. MLO-image with implants. CC-pushbacks. MLO-pushbacks

Table 1. Eighteen clinics in all performed extra images during screening examinations. The number images per screening visit performed, and the projection names, are listed

Respondents comments

The survey was open; and respondents were invited for freely comments. Two clinics indicated that “they could only perform pushback images when the implants were placed

behind the breast muscle and could be pushed aside, otherwise the staff could not take any extra images”.

Extra images

The reason for extra images when there are breast implants.

In addition to the mammography clinics’ answers about what extra images were performed on women with breast implants, survey question 3, “Why do you take these images?”, was put forward to study how the clinics feel they work and if they can refer to research or other literature as a basis to why extra images should be performed. Almost all participating clinics answered “that these extra pushback images were performed to push aside the implants in such a way that the breast tissue, gland structure and any changes would be visible”.

18 out of 24 participating clinics (not shown in figures) responded on “extra pushback images performed to push the implant out of the image to visualize the breasts’ own tissue as well as any changes”. Three out of the 18 even responded “... pushback images are performed because compression of the breast’s own tissues is much better when the implant is pushed aside. In this way, optimal image quality is achieved”.

Reason for not taking extra images when there are breast implants.

Since 6 of 24 participating clinics answered that they did not take any extra images when screening women with breast implants, they could not respond to the question “Why do you take these images?”

One of these six clinics answered “a decision was made by the medical advisor to not take extra images when screening. The images performed with implants shown in the images were considered to show optimal material for diagnosing images from the screening activities. Extra images were previously performed in the CC and MLO-projections”. Another answer from one clinic was “The doctor who assesses the images wants only images CC, MLO and ML on both breasts with the implant showing”. One clinic also responded that “they do not take extra images, but only within the responding clinic’s region”.

Compression of breast with implant.

Documented guidelines.

Survey question 4 “Does your clinic document guidelines for compression of breast with implants?” Six of 24 clinics answered “yes” and had guidelines or routines for the compression of breasts with implants, with a variation of 3 – 5 daN. 18 out of 24 clinics indicated that did not have any specific guidelines for compression of breasts with implants (figure 4), and that the compression pressure could vary between 3–10 daN, even if the compression pressure was adapted from patient to patient.

Compression pressure

In conjunction with the question “Does your clinic document guidelines for compression of breasts with implants?” (Figure 4), a supplementary question was included where every mammography clinic was asked “Which compression pressure do you use?”. Most of the clinics responded, “that they did not have any guidelines or routines regarding compression pressure for breasts with implants”. The staff’s experience, patient’s experience and the breast implant were interpreted as playing a large part in the examination and in the decision as to the compression pressure.

Six clinics responded, “that it was the size and the material of the breast implant that decided the pressure used in compression and that some implants are hard, which makes it difficult to compress the breast”. Two clinics indicated “that all implants are different and that an optimal pressure is not available; however, that depended on the nature and placement of the implant within the breast. This makes it therefore impossible to have guidelines for compression”.

Those two clinics that had guidelines for compression indicated “that the compression pressure is based on the thickness of the breast and that they have a special exposure list, with a specific mA”. Since no clinic was able to indicate clear and well-defined figures on how much pressure they used when compressing breasts with implants, this was difficult to account for in descriptive statistics.

Results

Screening of women with breast implants

Results of the study show that most clinics use the Eklund technique, however that there are lacking’s in the description as to why they use this technique. In answer to “Why do they choose to take extra images when there are breast implants”, it was obvious that the breast tissue was more clearly visible when the pushback-technique was used, however only one clinic mentioned “Eklund” in their response as to how those extra images were performed. The communication prior to every examination was considered well among those mammography clinics questioned, where all indicated that every woman was questioned as to if they undergone breast surgery, which led to the information as to whether the women had breast implants or not. One important prerequisite for safe care-giving is good communication between patients and mammographers in order to get a clear image of the situation, since insufficient communication is indicated as the most common cause for

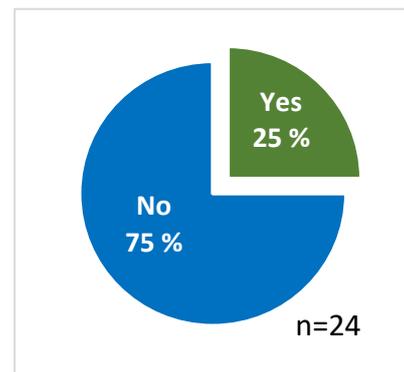


Figure 4: Documented guidelines for compression of breasts with implants, were confirmed by 18 mammography clinics, while the latter six reported they did not have such guidelines.

medical errors (Horch, 2017). This means that the correct type of image projection may be performed to ensure that every woman receive fair and patient-safe care, where the correct diagnosis may be given. This study shows results, that clear communication is carried out by all 24 clinics, as they all indicated that every patient, prior to imaging, is asked whether or not they have breast implants, which is then documented in the RIS-system.

Those clinics questioned, who chose to perform extra imaging, were requested to indicate which images were performed in addition to the standard projections. There were significant differences found here, both in the number and type of projections chosen per mammography clinic. A number of clinics chose e.g. only to take two extra images, where pushback images were only performed in either CC or MLO-projection. According to Mohamed et al. (2017), the MLO-projection result in the best visualization of the lateral side of the breast, and it should therefore be a priority that pushback images should be performed for best results among those women who have breast implants.

Another observation was that two clinics stated that they could only perform pushback images when the implant was placed behind the breast muscle and could be pushed aside. It was naturally qualified that Eklund technique could not be used after repeated failure at pushing the implant aside. On the other hand, pushback images should not be exempted without a few tries, regardless of the anatomic placement within the breast. According to Lanyi (2003), the breast tissue emerges more clearly when the implant is placed sub-glandular when the pushback image is used. Regardless of which breast implant that has been placed in the breast, Eklund's technique is still the most suitable method to use in all efforts to ensure correct image diagnosis.

In response to survey question 2, there were a few clinics that did not take extra images or choose to use the pushback technique and may therefore be interpreted as not working evidence-based. Imaging routines seem to be decided at a regional level and are the cause of the variation throughout Sweden. To ensure that every mammography clinic works according to evidence and research, national guidelines should be set up for clinics throughout Sweden, and also internationally, for the examination of breast implants.

The results of question 3, where the clinics responded as to why they take these extra images, show that the respondents are aware of the improvement in imaging and the diagnostics when performing a pushback. However, none of these clinics refer to research as a reason for performing the extra images. This may be interpreted as the clinics not working evidence-based, primarily when not connected to an active search for the best available research that is included in working evidence-based. Research within evidence-based radiography shows that mammographers today work evidence-based in a general way. However, according to Hafslund et al (2008), it is still not routine within radiography to actively search for research. This may be due to prerequisites such as time, money and

attitudes which affect mammographers' possibilities, but it may also be due to norms (Ahonen & Liikanen, 2010).

Pressure and guidelines for compression of breasts with implants.

Results of question four show that more than half of the participating clinics did not have routines or guidelines for compression of breasts with implants. The pressure was indicated at varying between 3–10 daN, but was adapted for each patient. In answer to how the pressure was adapted, the clinics questioned responded that it depended on the staff's experience, the patient's experience and the form and placement of the breast implants. According to Mercer et al. (2013), there are no real guidelines for compression, also covering breast with implants. The compression pressure is controlled by the mammographer, who in turn may affect the image quality, the radiation dose, and the patient's experience.

The study show that the compression pressure varies within the same clinic and between different clinics. The variation is reported being large, between 6-16 daN. There is a need for standardization of compression according to the wide variation indicated here (Branderhorst et al., 2015). By standardizing compression, the performance and results will be similar between patients, unnecessary pain and low compression that result in increased radiation doses and poor image quality can be avoided.

The study shows that norms and culture have a deciding effect on the compression pressure (Ahonen & Liikanen, 2010), but also social factors at a mammography clinic may decide the pressure instead of research results (Murphy, Nightingale, Hogg, Robinson, Seddon, & Mackay, 2014). Another important factor that may affect mammographers' choice of pressure, is the fear of having to redo the screening if the image quality is not up to standard. This is because good image quality increases the sensitivity for discovering breast cancer and reducing false positive diagnoses (Guertin et al. 2014).

Conclusion

Results of the study speak for the value of introducing guidelines for imaging projections and compression of breasts with implants when examining, to ensure that each mammography clinic works evidence-based throughout Sweden. This is to maintain good image quality and to be able to offer all women the same chances to equal care.

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