

RADIO-IMAGISTIC INVESTIGATIONS ALGORITHM IN BREAST CANCER

ROMEIA GLORIA CORINA CILOCA

County Clinical Emergency Hospital, Timișoara

Abstract: We define algorithm as a complex of rules and operations that have to be performed in a certain order to establish a precise/accurate diagnosis in a useful therapeutic time. Regarding the women under 30 years old, after the clinical examination, ultrasonography represents the first investigation which usually has to be made. We also recommend echography as a first investigation in pregnant women, in women after birth, in order to monitor the breast implants and, in general, regarding any kind of breast with high density. After the age of 30, breast examination is made by associating breast echography to mammography, especially in the cases with high density breasts or in the presence of unconvincing mammography. After menopause, we recommend the periodical examination (screening) of women, which should be performed first mammographically, and in the unclear cases, we recommend the use of other ultrasound investigations or investigations which should offer a correct diagnosis in 90-95% of the cases. Mammography still remains the first screening method, and it is uncertain that, in the near future, it will be replaced with the new techniques in the imagistic diagnosis of breast cancer. Bioptic puncture is the method which finally will certify the benignity or malignity of the lesion.

Keywords: imagistic investigations

Rezumat: Prin algoritm înțelegem un ansamblu de reguli și operațiuni ce trebuie efectuate într-o anumită ordine în vederea stabilirii unui diagnostic precis în timp util terapeutic. La femeile sub 30 de ani după examenul clinic ultrasonografia este investigația de primă intenție. De asemenea se recomandă ecografia ca investigație de primă intenție la gravide, lehuze, în monitorizarea implantelor mamare și în general la orice sân cu densitate mare. După vârsta de 30 de ani examinarea sânelor se face asociind ecografia mamografiei în special la cazurile cu sânii denși sau în prezența unei mamografii neconcludente. După instalarea menopauzei, se recomandă examinarea periodică a femeilor (screening) inițial mamografic iar în cazurile neclare, suspecte, asocierea cu investigații cu ultrasunete sau care în 90-95% din cazuri duc la un diagnostic corect. Mamografia rămâne în continuare principala metodă de screening, nefiind sigur că în viitorul apropiat să fie înlocuită cu noile tehnici în diagnosticul imagistic al cancerului

mamar. Puncția bioptică este cea care în final va certifica benignitatea sau malignitatea leziunii.

Cuvinte cheie: investigații imagistice

INTRODUCTION

Ultrasounds medical imagistics – Echoscropy

We define algorithm as a complex of rules and operations that have to be performed in a certain order to establish a precise/accurate diagnosis in a useful therapeutic time. In this respect, we should take into account the degree of noxiousness regarding certain imagistic investigations, the complexity of their accomplishment, the proper equipment, as well as the costs of these examinations. An important step in the positive and differential diagnosis of the formations that replace the glandular space was the use of the ultrasound investigations: ultrasonography (US) or echography.

In my opinion, this imagistic investigation method should represent either the first step of the investigations algorithm in breast cancer diagnosis, or the main method, which completes mammography. The value of this method has largely increased in the last decade, being determined both by the technique progress of the applied electronics that brought about to the improvement of the equipment and by the fact that the direct malign semiology was better understood, as well as the signs associated to breast cancer.(3)

Method sensitivity varies between 65% and 78%, while specificity between 80% and 92%.

American College of Radiology of 2000-2001 recommends:

- The use of a transducer with a frequency of at least 7MHz;
- The use of imagistics should be made in the depth of the lesion;
- Gain should be adjusted in order to allow the differentiation of a transonic (cystic) image from a echogenous (solid) image, which replaces the mammary glandular space;
- The interest area will be examined in at least two incidences, one perpendicularly to the other;
- The formation will be viewed by specifying the orientation of the large diameter in relation to the tegument, knowing the fact that in the malign tumoral

CLINICAL ASPECTS

formations of the breast, the large diameter of the formation is perpendicularly to the tegument.

The echographic examination is indicated:

- In the imagistic initial study of the formations of the mammary gland in general, and especially in the young women under the age of 30, in the pregnant women or in those breast feeding, except for the patients with a suspect clinical examination or those with a genetic positive anamnesis;
- In the evaluation of the mammographically dense breast or in the case of the palpable formations but without mammographic correspondent;
- In the men with ginecomastia, cases in which a tumoral formation could be observed;
- Echography may establish whether a palpable formation at the periphery of the breast area is or not part of the ganglionar area.

This investigation brings new important data in the assessment of the areas that appear inhomogeneous, as a result of mammography. It confirms and may visualize completely the formations emphasized upon the partial mammography or those that cannot be viewed mammographically, such as those placed at the periphery of the breast or in the neighbourhood of the thoracic wall. Regarding the inflammatory processes, diagnosed clinically or in laboratories, echography is required in order to establish the diagnosis, mammography being difficult to be accomplished. It may establish the solid or liquid nature of a palpable formation whose imagistic diagnosis remains uncertain. Due to the fact that this method is not noxious, it may be indicated any times it is needed, especially after the conservatory surgeries or as guidelines in the interventional proceedings: aspiration punctures, bioptic punctures, a mark of the formations that are to be removed subsequently etc. Mention must be made of the low costs of the investigation but not of the apparatus.

In breast cancer, the method is not suitable for screening, as it does not emphasize the microcalcifications, an important sign in “the imagistic diagnosis” of the ductal carcinoma in situ, although the examination is made with professional transducers, being difficult to differentiate from artefacts, or from Cooper’s ligaments etc.; the sizes of these microcalcifications are very small and do not allow the posterior acoustic shade cone.

Due to the hyperechogenous aspect of the formation’s echostructure in certain cases, the differentiation of the neighbouring greasy lobules is difficult.

In the women aged between 30 and 50, the pathology of the mammary gland is dominated by the dystrophic or cystic processes. During this period of time, the risk for carcinoma may also occur, especially between 40 and 45 years old. In this age group, mammography is recommended as a first intention investigation, followed by echography.

After this age, any palpable formation raises the suspicion for a malign process, mammography remaining

the first intention investigation, echography being necessary in the case of a dense breast or upon an echo-guided puncture.

In the patients treated for a mammary malign process, the presence of a palpable formation at breast level or contralaterally, raises the major suspicion of malignity and the investigation algorithm will be mammography-echography-echo-guided bioptic puncture.

Special echography methods.

From the B classical echography, new special echographies resulted in the last decade, aiming at detecting in very early stages and at classifying as accurately as possible, the image of two large imagistic syndromes: benign and malign.

The colour US Doppler, US Doppler Angio-Power and the use of the ultrasonic contrast through the detection of the neof ormation vessels increase the value of the ultrasound investigations in the positive and differentiate diagnosis of the mammary tumoral formations.

The ductal echography allows the study of the epithelium that covers the ductal tree from the interior of the mammary lobules, through successive examinations in longitudinal sections in the sense of the longitudinal axle of the galactofor ducts.

Three-dimensional echography through electronic scanning in course of accomplishment, allows a better evidentiatio n of the tumoral structures from the mammary glandular space.

Rontgen rays investigations – Mammography

Although, recent data of the specialized literature state that mammography is not an objective investigation method, it still remains the basic method in breast cancer diagnosis, the other imagistic methods being considered complementary methods.

According to age, mammography may be used as a screening method for the women above the age of 40, the microcalcifications being emphasized in 70% of the cases, which represent the sub-layer of the ductal carcinoma in situ.

These microcalcifications are brought about by a mammary malign process in only 90% of the cases. Legal makes a morphological classification of these microcalcifications in three types:

- type 1: arciform, annular or polyedric microcalcifications, breast cancer risk being practically absent;
- type 2: round microcalcifications of variable size, carcinoma risk being of 22%;
- type 3: pulverulent microcalcifications, cancer risk being of 36%;
- type 4: irregular microcalcifications, cancer risk being of 56%;
- type 5: vermicular microcalcifications, cancer risk being of 91%;

Malignity suspicion increases along with the number of microcalcifications. The inferior limit is considered to be a number of 4-5 microcalcifications.

In combination with the echographic

examination, sensitivity raises to 94,2%.

The price of the examination is more accessible in comparison to the price of other examinations. As it is an irradiating investigation, the recommendation for this kind of examination should be made very carefully, especially in the women under the age of 30 years old and in those pregnant. In the case of breasts with hyperdense structures, during lactation, uninterpretable images would be obtained. Simple hyperplasiae, during menstruation may also generate difficulties in interpretation. Therefore, it is recommended to make the mammography during the first 10 days after menstruation, before ovulation.

The small tumoral formations placed at the periphery of the mammary areas may escape the incidences used in making the mammography. There are patients complaining about a certain discomfort in the accomplishment of the examination, determining a sort of anxiety when they must undergo such an investigation or for check up. The value of mammography results may be influenced, both by the performance of the device and by the accuracy of the technique used, especially of the positioning and of the quality of the radiographic films.

Digital mammography

It derives from the conventional mammography. As a result of the use of certain automatic detection programmes, the accuracy in emphasizing the microcalcifications is of 85%. A disadvantage of this technique is the very high price of the device.

Mammography techniques with contrast substance

Galactography – consists in rendering opaque the galactofor ducts with a iodine-based contrast substance, following the direct catheterization of the nipple. The purpose of this technique is to emphasize the presence of an intraductal tumour or the communication with a cystic formation in the presence of secretory breasts “bleeding breasts”. Cystography - after the removal of a mammary cyst, the iodine-based hydrosoluble contrast substance (positive contrast) or air (negative contrast), with a view to emphasize the presence of possible intracystic tumours. Both techniques are less used today.

Computed tomography (CT)

It is an investigation technique under study regarding its use in the screening of the mammary tumours, in general. Exceptionally, it is used in the detection of mammary metastases.

Magnetic resonance imaging in breast cancer diagnosis

Besides the echographic explorations for the completion of the mammography examination, new complementary imagistic techniques have occurred. Thus, in the last decade, magnetic resonance imaging (MRI) seemed to be used more often in the pathology of the mammary gland in general and especially in breast cancer. The value of this method has largely increased, as a result of the use of the paramagnetic contrast in the differentiated diagnosis of breast benign and malign tumours.

Radiotracers investigations.

Mammary scintigraphy

It is a method complementary to echography and mammography, which used radiotracers: Technetium 99 m (Tc99m) or Thallium 201 (Th201).

Positron emission tomography

Positron Emission Tomography (PET) highlights the metabolic aspect of the mammary tissue, that is the excessive glycolysis of the tumoral cells. Fluorodeoxyglucose (FDG) tracer is frequently used, which proves the excessive glycolysis at the level of the malign cells through the overexpression of the GLUT molecule, molecule that transports glucose. In the absence of the inflammatory process, the increased accumulation of FDG suggests the presence of malign tumours.

PET has 100% sensitivity for the tumours larger than 1 cm. For the tumours with a diameter less than 1 cm, the results are much modest and are due to the small resolution of the scanner.

This investigation is especially applied in the detection of the primary tumours that develop in the breast with high density and in monitoring the female patients with silicon prosthesis.

Due to the large consumption of the device, of the short time of diminishing the radiotracer and of the radioisotope production technique, the putting into practice of the PET is limited.

CONCLUSIONS

Breast cancer diagnosis cannot be conceived without the important contribution of the radio-imagistic techniques.

We define algorithm as a complex of rules and operations that have to be performed in a certain order to establish a precise/accurate diagnosis in a useful therapeutic time.

Regarding the women under 30 years old, after the clinical examination, ultrasonography is the first intention investigation. Echography is also recommended as a first intention investigation in the pregnant women, in the women lately confined, in monitoring the mammary implants and generally, in any breast with high density.

After the age of 30, the examination of breast is made by associating echography to mammography, especially in the dense breasts or in the presence of an irrelevant mammography.

After menopause, the periodical examination of women (screening) is recommended: initially, the mammography and in the unclear, suspected cases, the association with the ultrasound investigations, which in 90-95% of the cases lead to a correct diagnosis.(29)

Mammography remains the main screening method; it is uncertain whether, in the near future it will be replaced with the new techniques, regarding the imagistic diagnosis of the breast cancer.

Bioptic puncture is the technique that will finally certify the benignity or malignity of the lesion.

REFERENCES

1. Anderson I. Invasive Cancer. European Radiology 2000(Suppl 10), Springer Verlag.
2. Baz E, Madjar H, Reuss C, Vetter M, Holz K. The Role of enhanced Doppler ultrasound in differential diagnosis of benign vs. malign scar lesions after breast surgery for malignancy. Ultrasound Obstet Gynecol 2000;(15):377-382.
3. Geogian D. Smith et al. Sonography of Palpable Breast Cancer. Journal of Clinical Ultrasound vol. 28, no 5, June 2000.
4. Dixon JM, Anderson TJ, Lamb. Fine needle aspiration in cytology in relationship to clinical examination and mammography in the diagnosis of solid breast mass. Br J Surg 1984;(71):593-596.
5. Elefterescu R, Grosu F, Marin M. Valoarea si limitele examenului ecografic in diagnosticul formatiunilor inlocuitoare de spatiu ale glandei mamare-Sibiul Medical, anul XI, nr.2, aprilie-iunie 2000, p. 227-228.
6. Elefterescu R. Curs de fomare in ultrasonografie-Facultatea de medicina "V.Papilian" Sibiu 1998.
7. Fornage BD. Interventional ultrasound in the breast, in-Interventional Ultrasound, McGahan (Ed.), Williams&Wilkins, 1990, 71-83.
8. Baker JA, Scott M. Breast US: Assessment of Technical Quality and Image Interpretation - Radiology- April 2002;(223):229 238.
9. Keith LG, Oleszczuk JJ, Laguens M. Are mammography and palpation suffiecnt for breast cancer screening? A dissenting option, J. Women's Helth Gend Based Med 2002;(11):17-25.
10. Maestro B, Brutenon JN, Melia P et al. High frequency ultrasound detection of breast calcifications- European Journal of Ultrasound, 1994.
11. Mitra I, Baum M, Thornton H. Is clinical examination an acceptable alternative to mammographic screening? BMJ 2000;(321):1071-1073.
12. Moss MA, Britton PD, Flower CD. How reliable is modern breast imaging in differentiating benign from malignant lesions in the symptomatic population? Clin Radiol 1999;(54):676-682.
13. Muller Schimpfle M, Oellinger H, Patt R, Teubner J, Friedrich M, Newstead G, Holland R, Schauer A, Sickles EA, Tabar L, Weismann J. International investigation of breast MRI: results of a mulicentric study (11 sites) concerning diagnostic parameters for contrast enhanced MRI based on 519 histopathologically correlated lesions, Eur Radiol 2001;(11):531-546.
14. Petterson H. The NICER Centennial Book 1995- A Global Textbook of Radiology, Series on Diagnostic Imaging from the NICER Institute.
15. Stuart S. Kaplan. Clinical Utility of Bilateral Whole-Breast US in the Evaluation of Women with Dense Breast Tissue-Radiology 2001;(221):641-649.
16. Wilson ARM. Contrast enhanced breast ultrasound, the clinical context. Eur Radiol 2001;11(Suppl 3):35-40.