

IMAGING OF METASTATIC BREAST CANCER

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Abstract: Metastases represent the most frequent and most redoubtable complication of breast cancer. Breast cancer with metastases to other organs of the body represents an incurable disease, with the survival duration depending on the clinical form. The early detection of metastases is important, and computed tomography represents a valuable imaging method in their diagnosis and in monitoring the evolution under treatment. The patients were diagnosed (confirmed) through computed tomography and the response to the oncological treatment has been monitored through the same imaging method.

Cuvinte cheie: cancer mamar metastatic, organ țintă, computer tomografie.

Rezumat: Metastazele reprezintă complicația cea mai frecventă și mai redutabilă a cancerului mamar. Determinările metastatice la distanță în cancerul mamar reprezintă o boală incurabilă, cu durata de supraviețuire dependentă de forma clinică. Depistarea cât mai precoce a metastazelor este importantă, iar computer tomografia reprezintă o metodă imagistică de mare valoare în diagnosticarea acestora și în urmărirea evoluției sub tratament. Pacientele au fost diagnosticate (confirmate) prin examen computer tomografic, iar răspunsul la tratamentul oncologic a fost urmărit prin aceeași metodă imagistică.

INTRODUCTION

Despite the progress made in detecting and treating breast cancer, which increased the duration of global survival, a relatively important part of the patients shall have metastatic relapses even in the case of breast cancers localized during treatment (with no detected relapses). Breast cancer that metastasizes to other organs of the body fundamentally represents an incurable disease; the survival duration under treatment depends though on the clinical form. The metastatic process is a complex process which supposes the invasion of the tumour cells through the basal membrane, their passing into the vascular system, the survival of the tumour cells in blood circulation, the colonization of the vascular wall and the extravasation of the tumour cells in the target organs and, finally, the tumour cells proliferation at the level of the target organs, thus forming a metastasis.(1)

Epidemiology of Breast Cancer Metastases. Breast cancer metastases are more frequent in the case of large tumours, in the 3rd degree tumours (2) and in young women.

Metastasis Localization. Metastasis Semiology in Medical Imaging. Bone Metastases. The bone is the most frequent metastatic organ and it represents the first place where metastasis occurs in more than a half of the patients.(3) The clinical signs of bone metastases are represented by bone pains, pathological fractures, hypercalcemia and possible signs of medullary compression (in the case of vertebral metastases). Bone metastases are localized predominantly at the level of the bones which contain hematopoietic marrow, so more frequently at the level of the axial bones. Bone metastases are more frequently osteolytic or mixed and more rarely osteocondensing. They are more frequently multiple. Bone scintigraphy represents the most frequent examination used for highlighting bone

metastases. In conventional radiology, bone metastases are osteolytic, mixed and rarely osteocondensing. Computed tomography is highly superior to conventional radiology, especially for the study of spine; the sensitivity of this method is of more than 80%. This allows detecting the metastatic lesions situated at the level of the marrow before the visualization of bone destruction in classical radiology. Magnetic Resonance Imaging represents the most sensitive technique for detecting the tumoral infiltration of bone marrow. This method can identify this infiltration before detecting, with the help of scintigraphy, the osteoblastic reaction associated with metastases. The use of the diffusion sequences can be useful for the "whole body" balance of metastases, and the injection of paramagnetic contrast can make the differential diagnosis between an active tumour and the necrotic tissue, which allows a better evaluation of the answer of the tumour to therapy.(9)

Hepatic Metastases. They are more frequently methacrone and more rarely synchronous. In ultrasound examination, they generally are hypoechoic, under the form of multiple nodules or infiltrative lesions and exceptionally hyperechoic. In computed tomography, hepatic metastatic lesions are most frequently hypodense in the portal contrast-enhanced phase; in less than a quarter of cases, they show a hypervascularization, traceable in the arterial contrast-enhanced phase. Nevertheless, the arterial phase detects additional lesions in less than 5% of the patients in whom the portal contrast-enhanced phase has already permitted the visualization of other hepatic lesions and the diagnosis of the metastatic disease.(3) Classically, a diffuse infiltration with vascular and fibrotic reshaping and a hepatic dysmorphia with a cirrhosis aspect can be met in the case of breast cancer metastases, especially if it is associated with a cytostatic treatment. For that matter, an

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increase or a diminution of the hepatic metastasis dimensions in the course of the evolution under treatment is frequently accompanied by a hepatic retraction.(4) The patients under treatment with Tamoxifen develop in more than 40% of the cases a hepatic steatosis (8) which, if it has a nodular aspect, can be mistaken for hepatic metastases. This steatosis regresses most frequently when the treatment is stopped.

Pulmonary Metastases. They take place both hematogenously and lymphatically. All the radiological aspects of pulmonary metastases are observed; isolated or associated with other localizations, such as the parietal muscular, mediastinal or ganglionic ones.(5) Pulmonary metastases typically appear under the form of multiple parenchymatous nodules, localized predominantly at the periphery of the pulmonary parenchyma, sometimes excavated especially in the patients under chemotherapy.(9) The second form of presentation of pulmonary metastatic lesions with the breast as a starting point is the carcinomatous lymphangitis which, even if is classically bilateral, can be unilateral in the case of breast cancer. Computed tomography reveals nodular and irregular thickening of the interlobar (pulmonary) septa and of the peribronchovascular interstitial tissue.(9) More rarely, pulmonary metastases appear under the form of a unique parenchymal nodule. Metastases can also be localized at the pleural level; they usually associate a pleural effusion with the thickening of the parietal or visceral pleura.(9)

Cerebral Metastases. Even if breast cancer metastases more rarely at the cerebral level than at the bone or hepatic level, it represents the second cause of cerebral metastases. They are rarely isolated, being usually associated with hepatic or pulmonary metastases. The symptomatology of these metastases is generally represented in cephalalgia, comitial crises, cognitive disorders, motor deficit and more rarely, paralysis of cranial nerves or cerebellar syndrome. Cerebral metastases are highlighted through Computed Tomography and Magnetic Resonance Imaging. At the computed tomography, metastases appear as frequently round, spontaneously hypodense, iodophilic lesions, with a spontaneous hypodense halo (adjacent edema). At the MRI examination, cerebral metastases appear under the form of round lesions in hypo- or isosignal on the native T1-weighted sequences and in hypersignal on the T2-weighted sequences. They have frequently round gadolinium uptakes and after injection they can take a homogenous, heterogeneous or cockaded aspect. Sole metastases can difficultly be differentiated from a glioma. MRI is more sensitive than Computed Tomography in detecting cerebral metastases.(6) Besides cerebral metastases, meningeal metastases constitute an increasing metastatic complication in breast cancer.(7)

Rare Metastases. Bone, hepatic and pulmonary metastases represent more than 90% of the breast cancer metastases. However, they can also affect other organs, too: the peritoneum, the ovaries, the teguments. The choroid represents the most frequent place of the ocular metastases of breast cancer and it constitutes the most frequent cause of ocular metastases.(8) After the digestive tube, breast cancer also represents the second cause of ovary metastases. In the case of a patient suffering from breast cancer, which presents a solid ovarian tumour, the problem is to differentiate a metastasis from a primitive ovarian cancer, associated with breast cancer.

PURPOSE

The purpose of the study is to highlight the structure of breast cancer metastases on age groups, target organs, association of metastatic lesions in more organs and their medical imaging aspects.

METHODS

This paper represents a retrospective study for a 3-year period of the patients with metastatic breast cancer evaluated by computed tomography in our department, most of patients undertaking chemotherapy. Thus, there have been evaluated 78 patients with metastatic breast cancer with different localizations. Among these, a number of 22 patients, representing 28% of the patients, deceased during the study. The study was performed over a period of 3 years, from 2010 to 2012. The patients have been grouped according to age, number of affected organs and metastases, the metastatic target organ (sole or multiple). The examinations for highlighting metastases and their follow up have been performed with a CT Siemens Somatom Emotion multislice (16 slices), the examinations being performed with and without intravenous injection of iodinated contrast media. According to age groups, the patients have been grouped as follows (the secondary metastases have been present and confirmed by computed tomography in one or more organs):

Table no. 1. Distribution of the study batch per age group

Age	No. of patients	Percentage
31 – 40 years old	4	5,1%
41 – 50 years old	9	11,6%
51 – 60 years old	25	32%
61 – 70 years old	22	28,2%
71 – 80 years old	15	19,3%
81 – 90 years old	3	3,8%

Of the patients aged 31–40 years old, one of them presented multiple (hepatic, cerebral, right suprarenal, pulmonary) secondary metastases, and the others presented bone and hepatic, respectively pulmonary metastases.

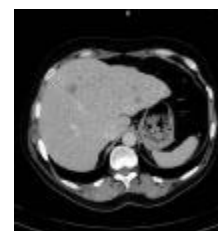
Most patients had one-organ metastases, but a part of them had two or more-organ metastases. The study patients had metastatic lesions in different organs, as follows:

- ✓ Bone metastases 44 (figure no. 1)
- ✓ Hepatic metastases 25 (figure no. 2)
- ✓ Pulmonary metastases 14 (figure no. 3)
- ✓ Pleural metastases 8
- ✓ Ganglion metastases 5
- ✓ Cutaneous metastases 5 (figure no. 4)
- ✓ Peritoneal metastases 3
- ✓ Cerebral metastases 2
- ✓ Ovarian metastases 1

Figure no. 1. G.P., 47 years old, bone metastases

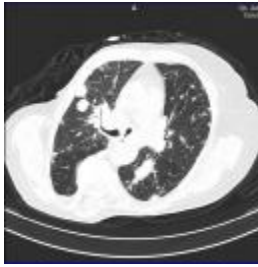


Figure no. 2. V.M. 60 years old, hepatic metastases



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Figure no. 3. N.E., 66 years old, lung metastases



Bone metastases represent about 57%, being the most frequent, the hepatic ones – about 32%, and the pulmonary ones – 18%.

Figure no. 4. B.I., 53 years old, cutaneous metastases

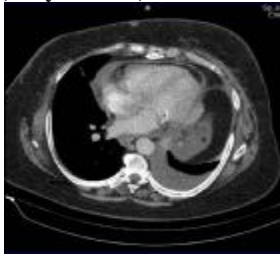
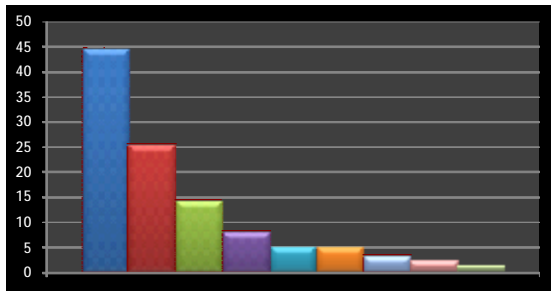


Figure no. 5. Distribution of secondary metastases regarding the localization



From the point of view of the number of organs affected by metastases, the patients have been grouped as follows:

Table no. 2. Distribution of the study batch according to the number of the affected organs

Number of affected organs	Number of patients	Percentage
1	51	65,4%
2	19	24,4%
3	3	3,8%
several	5	6,4

The most frequent metastatic lesions have been highlighted at the level of the bone tissue. Most of them had an osteolytic aspect and they have been localized at the level of the spine and of the bones of the basin. In some cases, these lesions brought about the complete destruction of the vertebral corpora with a consecutive compression on the medullary duct at this level. Some vertebral metastatic lesions revealed remission under chemotherapy, in the sense of the appearance of some peripheral osteosclerosis areas. From the studied group, 3 patients undertook surgery for the fixation with rods and screws at the level of the spine with destroyed vertebral corpora, and in some patients the vertebral corpora have been “stopped” with cement by the neurosurgeons. In most cases, the hepatic metastases have been present under the form of hypodense focal lesions on the native sections, slightly iodophilic at the periphery and well visible in the portal contrast-enhanced phase.

In some cases, after chemotherapy, the liver acquired a pseudo-cirrhotic aspect. The patients under hormonal treatment registered a diminution of the spontaneous density of the hepatic parenchyma, with the emergence of hepatic steatosis, generally global, but sometimes with a segmental aspect. At the pleuropulmonary level, the metastatic lesions generally had an aspect of nodular focal lesions, generally multiple and well-delineated; they have been associated with pleural collections, especially if there have also been present pleural metastases (revealed by Computed Tomography under the form of pleural nodules of various dimensions). Most metastatic lesions of breast cancer have been highlighted in the age groups of 51-60, respectively 61-70 years old; in most of the cases, they appeared in surged, chemotherapy patients, after a variable asymptomatic free interval. Of the patients included in the study, 22 deceased, in a percentage of 28%, most of them from the age group of 45–55 years old. The patients have been evaluated through computed tomography at an interval of about 3 months, at the recommendation of the oncologist.

CONCLUSIONS

1. Metastatic breast cancer is a serious and incurable disease, with a lethal evolution after a period of time variable according to the type of cancer, to the organs affected by metastases and to the patients' age.
2. The most frequent metastatic lesions have been the bone ones (more than 57% of the patients) and they have been localized most frequently at the level of the spine, mostly under the form of osteolytic lesions.
3. The most frequent metastatic lesions have appeared in the age group of 51–60 years old.
4. Most frequently, the metastatic lesions have appeared only in one organ. There have also been consecutive metastatic lesions in more organs, present especially in younger patients.

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