

## Usefulness of CT for diagnosis of breast malignancy metastasis variants to the vertebrae

### *Przydatność tomografii komputerowej w diagnostyce odmian przerzutów do kręgosłupa w nowotworach piersi*

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### Summary

**Objectives:** Breast cancer is the most common malignancy in women. A clinical state of the patient depends on the stage of cancer and the existing metastases. Breast cancer tends to have venous metastases and the bones are one of the most frequent localization of the lesions.

**Aim of study:** The aim of the study was to investigate breast cancer (CA) metastases with respect to the type and anatomical localization. Special attention was paid to metastases to the vertebrae.

**Material and methods:** The patients with diagnosed CA in stage IV had been involved into the study. A preferable localization of the metastatic lesion in the single spine element and a histopathological type of the lesions were analyzed. The study involved 143 patients treated in the Dnepropetrovsk 4<sup>th</sup> hospital, Department of Surgery. All the patients underwent CT examination of the spine.

**Results:** Most of the metastatic lesions were of the osteolytic type and were localized in the thoracic spine.

**Key words:** CT, breast cancer, metastases, vertebrae.

### Streszczenie

**Wprowadzenie:** Nowotwór piersi jest najczęstszym rodzajem nowotworu złośliwego wśród kobiet. Kliniczny stan pacjentki jest uzależniony od stadium zaawansowania nowotworu i istniejących przerzutów. Nowotwór piersi zazwyczaj rozprzestrzenia się poprzez układ żylny, a przerzuty najczęściej umiejscawiają się w kościach.

**Cel pracy:** Celem badania jest analiza przerzutów nowotworów piersi pod względem ich rodzaju i anatomicznej lokalizacji. Szczególny nacisk położony został na przerzuty umiejscowione w kręgosłupie.

**Materiał i metody:** Przeprowadzone badania dotyczyły pacjentek, u których zdiagnozowany został nowotwór piersi w IV stopniu zaawansowania. Analizowano przypadki pacjentek, u których zmiana przerzutowa określonego rodzaju wystąpiła w pojedynczym elemencie kręgosłupa. Badaniami objęto 143 pacjentki leczone na oddziale chirurgicznym Dnepropetrovsk 4<sup>th</sup> hospital. U wszystkich pacjentek wykonano tomografię komputerową kręgosłupa.

**Wyniki:** Większość zmian przerzutowych była typu osteolitycznego z umiejscowieniem w kręgosłupie.

**Słowa kluczowe:** TK, rak piersi, przerzuty, kręgosłup.

### Introduction

On the epidemiological basis, one million new breast cancer cases appear in the world every year. In the United Kingdom for example, where the age standardized incidence and mortality is the highest in the world, the incidence among women aged 50 approaches two per

1000 women per year, and the disease is one of the main causes of death among women aged 40-50, accounting for about 1/5 of all deaths in this age group [1, 2]. The etiology of this disease concerns the DNA failures (disorders) such as genetic mutations, failure of immune surveillance, inherited defects in DNA repair genes or

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personal factors like not having children or having the first child after the age of 35 and dense breasts.

Breast cancer staging is based on the size of the tumor, whether the cancer is invasive or non-invasive, whether lymph nodes are involved, and whether the cancer has spread beyond the breast.

Stage I: less than or equal to 2 cm and no evidence of axillary or distant metastases.

Stage II: larger than 2 cm but not larger than 5 cm in diameter, or there are tumors with associated involvement of the axillary nodes but without distant metastatic spread.

Stage III: tumors of any size in which the lymph nodes are fixed together in a matted axillary mass or tumors in which there is an extension to the chest wall, or there is skin involvement, or both.

Stage IV: tumor with associated distant metastases [3].

A clinical state of the patient depends on the stage of cancer and the existing metastases. Breast cancer tends to have venous metastases [4] and the bones are one of the most frequent localization of the lesions.

The most common localization of the metastases is the vertebrae. Vertebral metastases occur in 10% of patients with malignant neoplasms and increase with age. It can occur at any age and has no sex predilection. The high incidence rate of the vertebral lesions is caused by a structure of the bone marrow (cells are trapping and quickly dividing) and by high blood flow.

Breast cancer metastases in the vertebrae can be classified according to the type of lesion into the osteosclerotic lesion (Fig. 1), osteolytic metastatic lesion (Fig. 2) and presence of both of them or a mixed type (Fig. 3).

The classification results from the mechanisms of binding molecules in the surface metastatic cells, i.e. cells affecting in 3 ways:

1. Increase bone interaction and this will lead to the osteosclerotic variant.
2. Give signal to enhance bone destruction and this will lead to the osteolytic variant.
3. Both of the above effects occur together and this will lead to the mixed variant [5-7].

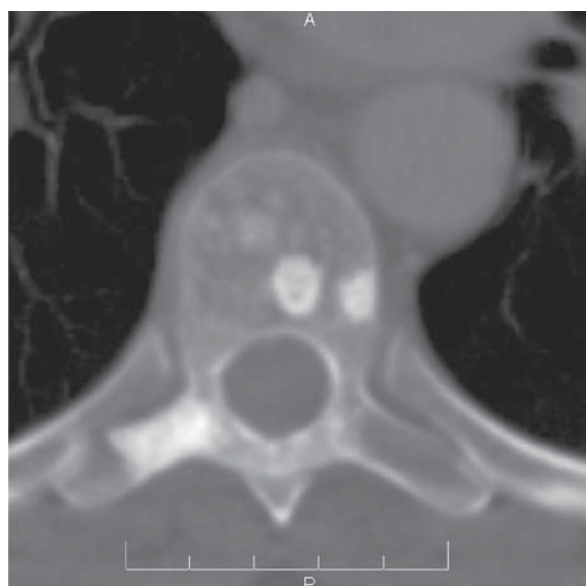


Fig. 1. Osteosclerotic type of lesion

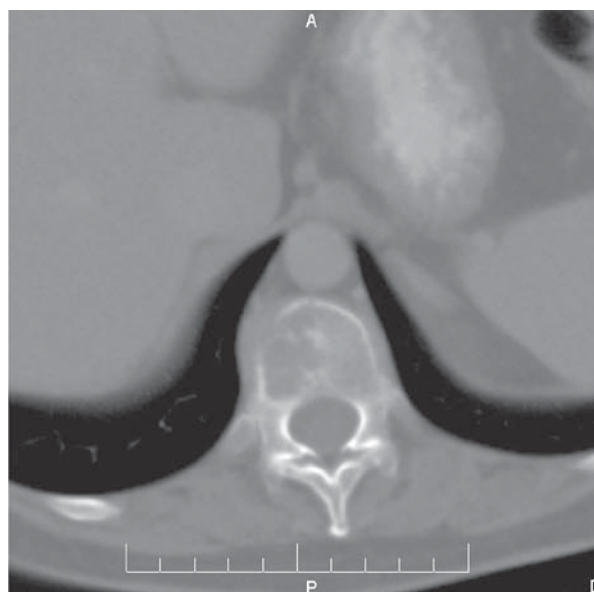


Fig. 2. Osteolytic type of lesion

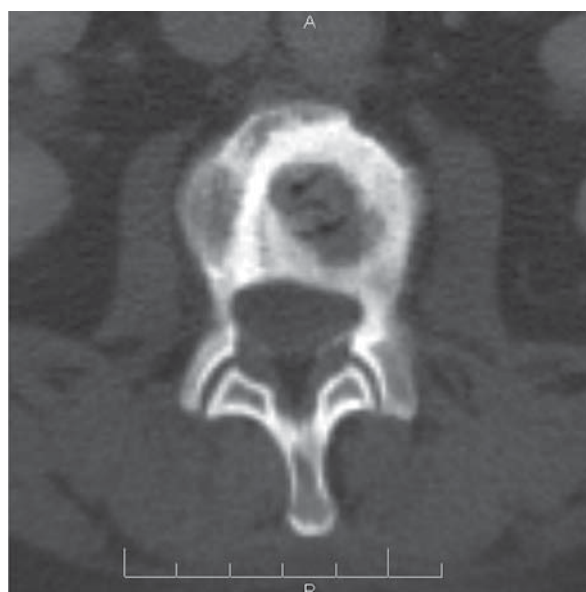


Fig. 3. Mixed type of lesion

The above images were taken in the CT department of the 4<sup>th</sup> Hospital, Dnepropetrovsk, Ukraine.

**Aim of study**

The aim of the study was to investigate breast cancer (CA) metastases with respect to the type and anatomical localization. Special attention was paid to metastases to the vertebrae.

**Material and methods**

The patients with diagnosed CA in stage IV had been involved into the study. For avoidance of a false tendency in results, all patients at the postmenopausal age and treated with neither chemotherapy nor hormonal therapy, were included in the analysis.

The patients chosen for the analysis were then twice divided into subgroups, i.e.:

firstly according to the localization of metastases: the vertebrae (I) or the other bones (II) and then group I again divided according to the part of the vertebral column where metastatic changes were found: thoracic IA, lumbar IB and dissipated in the whole volume IC.

For subgroups IA, IB and IC, the following aspects were analysed:

- preferable localization of the metastatic lesion in the single spine element (centric or eccentric) and

- histopathological type of the lesions (osteolytic, osteosclerotic or mixed).

**Results**

The study involved 143 patients treated in the Dnepropetrovsk 4<sup>th</sup> hospital, Department of Surgery. All of them fulfilled the criteria of selection listed in the previous section (i.e. Material and methods).

The percentage distribution in group I and II was the following:

- group I : 60.9%, 87 patients,
- group II: 39.1%, 56 patients.

Figure 4 shows these results.

The percentages of particular histopathological types of the lesions for group I were as follows:

- osteolytic type 58.7%,
- osteosclerotic type 31.0%,
- mixed type, both osteolytic and osteosclerotic – 10.3%

The results are presented graphically in Fig. 5.

The localization of the metastatic lesions in the single spine element was as follows:

- central – 40%,
- peripheral or eccentric – 60%.

Figure 6 shows these results.

For group I, the distribution of the lesions according to the part of the vertebral column where metastatic changes were found was the following:

- thoracic IA group: 61 patients – 70.1%,
- lumbar IB group: 8 patients – 9.2%,
- the whole volume IC group: 18 patients – 20.7%.

The results are presented graphically in Fig. 7.

**Comments and discussion**

A relatively high frequency of CA in stage IV among Ukrainian women is the consequence of the low level of breast screening and health care in the country and high costs of medical care services in association with

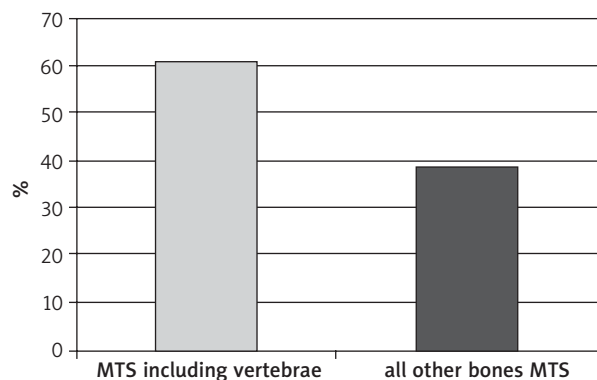


Fig. 4. Percentage distribution in group I and II

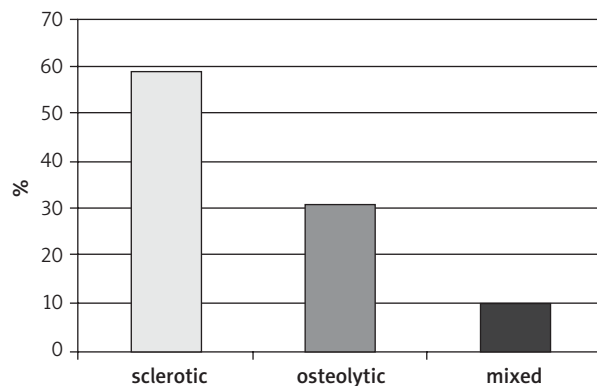


Fig. 5. Percentages of particular histopathological types of the lesions

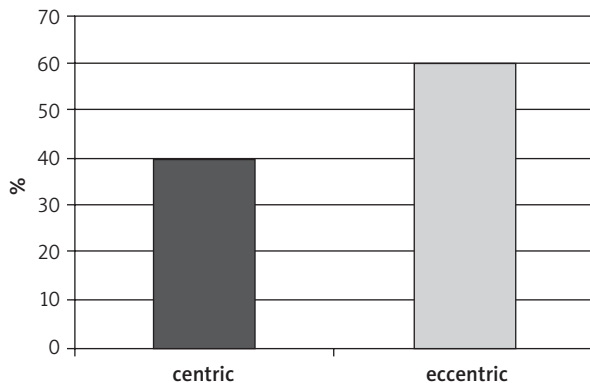


Fig. 6. Localization of the metastatic lesions in the single spine element

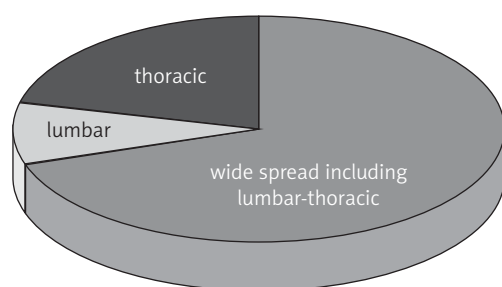


Fig. 7. Distribution of the lesions according to the part of the vertebral column

low per capita income. The way to make the situation better is a large-scale social education and professional education of physicians on mammary diagnosis and treatment. Additionally, the provision of early diagnosis or screening programs supported by international health organizations have to be implemented in order to be available free of charge or at a low cost. Most of the patients are diagnosed in an advanced stage of the disease and the vertebral metastases are mainly of the osteolytic type, and thus it is very important to support new methods of treatment and pain relieving like vertebroplasty and kyphoplasty [8]. They are minimally invasive, non-surgical procedures guided by X-rays and designed to relieve the pain by injecting a small amount of orthopedic cement in the halls of metastasis. The results presented in the paper can be used for help in

rapid diagnosis of vertebrae illness and evaluation of prognosis for oncological treatment of the patients.

## Conclusions

The obtained results are the basis for the following conclusions:

1. The most frequent localization of CA metastases is the vertebral column in its thoracic part.
2. Most of the metastatic lesions are of the osteolytic type.
3. The pathological changes are most often localized in the peripheral part of the vertebral body.

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