RADIOLOGY ASPECTS OF PULMONARY METASTASES IN CHILDREN WITH OSTEOSARCOMA.

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Summary. The purpose of this study is to approach detecting of lung metastases in children with osteosarcoma. In our opinion the factors considered were the appearance of pulmonary nodules, the location of relatively small nodules in relation to the secondary pulmonary lobules, and the detectability on multislice computer tomography (MDCT) scans. It is to compare the appearance of pulmonary metastases on high – resolution CT (HRCT) scans with the histopathologic findings in lung specimens obtained by surgery.We suppose that the secondary pulmonary lobule – subsegmental unit of the lung, which is determined by CT and morphological studies. If the size of the identified noduly less than 5 mm, the analysis of CT images of the secondary pulmonary lobule is the clue to the answer to the question: metastatic noduly or not.

Key words: osteosarcoma, lung noduly, metastases, secondary pulmonary lobule, lobular bundle.

Actuality: Osteosarcoma (OS) is the most frequent malignant tumour of bones of child's age. Concordantly given national cancer register morbidity in Ukraine makes are 6 children in a million, a death rate is 4 children in a million of child's population [1].

Modern treatment protocols that combine chemotherapy (high-dose methotrexate & ifosfamide), advanced surgery, sometimes radiotherapy, the five-year survival rate for patients diagnosed with OS remains at 55-60% [2,3].

However, substantially promoting survivability of patients is not succeeded, because children with OS are at risk of metastatic disease. By the most frequent display of spreading, there is a distribution of process in lungs. Pulmonary metastases of OS are 85 % all cases. At 40 % patients with primary OS at an inspection is diagnosed pulmonary (synchronous) metastases. Almost for 40% patients after resection of

primary tumour disease manifested of pulmonary (metachronous) metastases. The five-year survival rate for patients diagnosed with diffuse OS remains less 30% [4,5].

The necessity of implementation of resection of pulmonary MTS is well-proven, after resection of primary tumour. In opinion of most authors and according to our supervisions, it depends upon, determination of properties of noduly less 5 mm [6].

As known, the multiple detector computer tomography (MDCT) is considered the diagnostic technique of choice for pulmonary staging. CT of the chest is screening at diagnosis, throughout treatment, and during routine follow – up.
At same time, from data of fellow articals, at a hand revision additionally expose to 30 % is unrecognized at CT of noduly sizes of which smaller than 5 mm. The levels of false positive results after thoracotomies are unduly high [7].
CT is significantly more sensitive for nodule detection, particularly nodules smaller than 5 mm, and approaching to 100%. Today, all search programs are directed only on the search of nodules, while these advances have improved the sensitivity of detection of pulmonary nodules [8].

At the same time specificity, even at MDCT, does not expected more than 50%. First of all specificity depends on the advanced radiologist [9,10].

Aim: The purpose is to evaluate the accuracy of diagnostics pulmonary metastases in children with osteosarcoma.
Patients and methods: The retrospective estimation of results of treatment is conducted 86 children, by aged 5 to 18 years (middle age of patients 13,2 years), with diffuse OS, being on treatment in the separation of child's oncology of the National cancer institute of shrine for period of 2000-2011yy. Since from 2007 all patients, on all stages of treatment, MDCT was executed on 4th and to 16-ti detector CT with a slice sickness 3-5 mm, by the reconstruction of 1 mm.

On occasion, at the estimation of noduly the sizes of which were not exceeded by 5 mm, HRCT of interesting areas of lungs was additionally executed. Synchronous metastases were determined at 38, metachronous for 48 patients. Lung resection was performed 35 (31,4%) patients, to 14 patients from them was executed

rethoracotomy. It was to compare the appearance of pulmonary metastases on HRCT scans with the histopathologic findings in lung specimens obtained by surgery. We estimated noduly less 5 mm.

Discussion: It is commonly known that the OS is a highly metastatic tumor, and pulmonary metastases are the most common cause of death. A tumor embolus arrives in a lung on pulmonary arteries. The point of setting for a tumour embolus is a central (lobular) artery of the second pulmonary lobule (SPL).

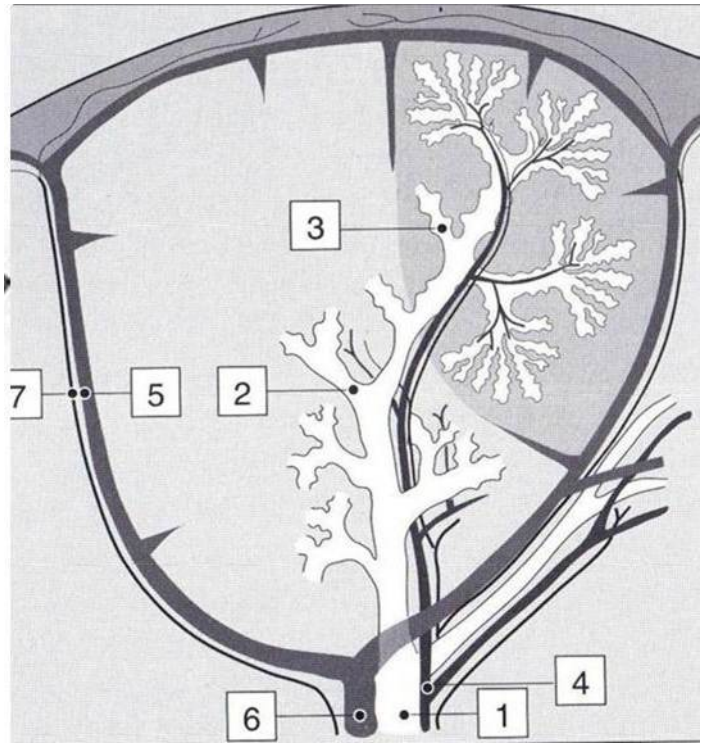
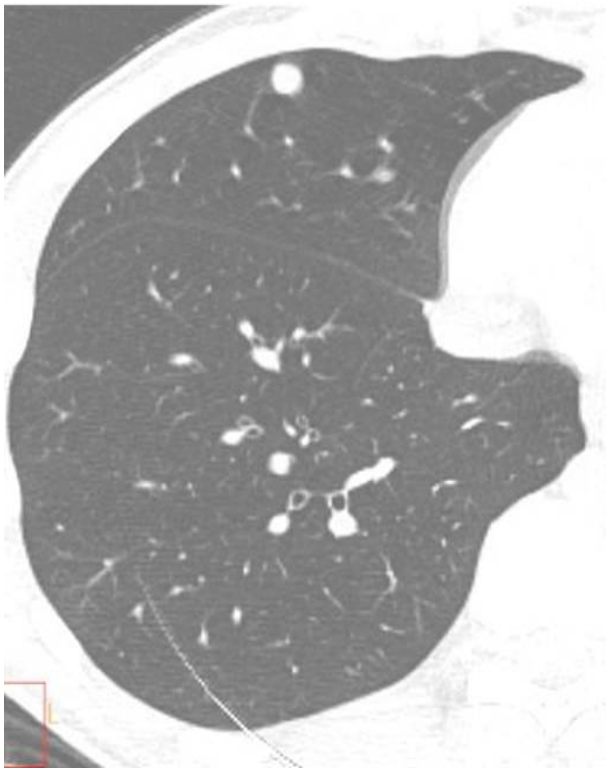


Fig. 1: 1-3 airways, 4 lobule artery, 6 venulae, 5/7 interlobular septa

The SPL is defined as the smallest unit of lung function, size of SPL measures approximately 10 mm to 20 mm and well approached at CT. The secondary pulmonary lobule is the ideal unit of subsegmental lung organization with which the CT and pathologic abnormality can be correlated [11].

There is main question: distinguishing malignant from benign noduly. For a noduly of a size more than 5 mm, to decide not difficult it is a metastases or not. Pulmonary metastases of OS has properties signs: round, has clear shape, usually has the petrified including and surrounding pulmonary parenchima does not have changes [12, 13]. Difficulties arise up with determination of character of a nodule that is less than 5 mm. Such noduly are disposed only wardly SPL, because sizes of lobule over

the noduly size. Disposed a nodule can in a center SPL, where it is related to the central vessel – lobular artery, or on the edge of SPL – by lymphatic vessels. In addition MDCT, especially HRCT, allow to visualize SPL and changes inside lobule [14]. In our opinion it determines properties of nodule, because OS metastases located in terminal branches of pulmonary artery. A presence suffices morphological confirmation of pulmonary innidiation there are intravascular tumour embolus. The diagnosis of pulmonary intravascular tumor emboli is impossible to establish on CT studies. But, as soon as tumour mass will spread outside a central vessel (the lobular artery of SPL). Or the size of vessel will be increased (spindle expansile), these changes become the structures of the SPL, which, as we know, are visualized on CT [15,16]. Therefore, as for small nodules were connected with the centralobular bundle (by the terminal branch of pulmonary artery) is a metastasis. Thus, we come to the result, to demonstrating the identity of CT and morphological images [17, 18]. (fig. 2).



a

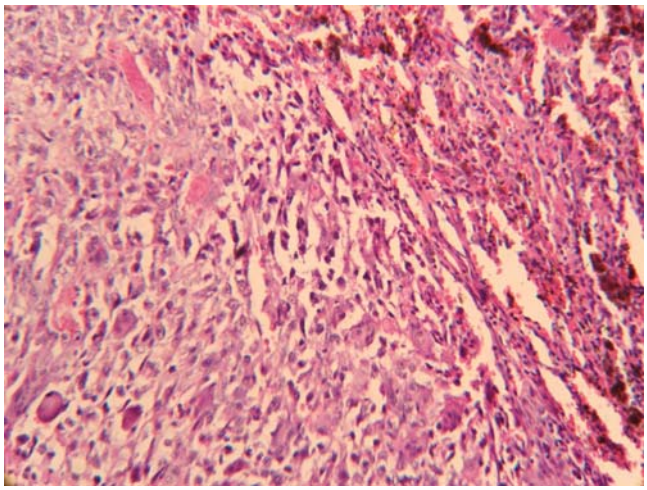
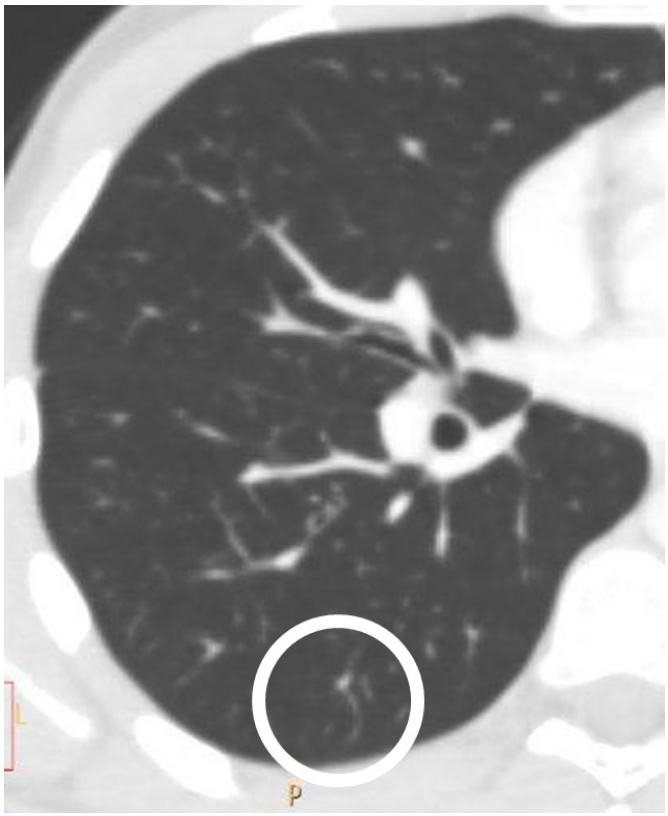

b

Fig. 2: OS metastase: a) CT right lung, noduly suspected metastase; b) postoperetiv microview – malignant nodule.

It will be observed a dynamic supervision for today remains same by the reliable diagnostic method of estimation of character of nodule [19]. In the presented images the appearance and evolution of metastases is well visible in S6 of a right lung for a boy 7,5 years of age for period of 6 months (fig. 3).



a

b

c

Fig. 3*:* Dynamic CT images of right lung from 7,5 year old boy with OS: a- without noduly, b- appear noduly, c – for one month size of noduly bigger in two times

The described dynamics of images confirms malignant character of the revealed nodules.

Conclusions: The second pulmonary lobule is the clue to the answer for a question: malignant nodule or not, if his sizes are not exceeded by 5 mm. Got by comparison morphological and CT of images information demonstrate with all evidence: MDCT with subsequent HRCT allows to visualize the second pulmonary lobule, where on the location of nodule in relation to a lobular artery (lobular bundle) or septa of lobule it is possible to define with large exactness, if nodule is malignant or not. Offered by us diagnostic approach, from our point of view, will allow to promote considerably specificity of CT researches of thorax organs for children with spread OS. Therefore the possibility to determine a presence and character of key educations in lung to the operation will help in good time to execute thoracotomy.

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