



LUNG PERFUSION SCINTIGRAPHY IN PULMONARY METASTASES

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ABSTRACT

The lungs are one of the common metastatic places for different carcinomas with other primary localization when there is generalization of the process. Lung perfusion scintigraphy is a valuable method for detection of the changes in lung perfusion at metastatic process. We have performed lung perfusion scintigraphy on 19 patients, 8 women and 11 men, in the range of 36 -68 years of age with single or multiple metastases in the lungs from carcinomas with other primary localization. Perfusion changes vary from impaired at different extent perfusion in small zone encompassing parts of one or several segments in one of the lungs to perfusion defect and in some cases to distant mediastinum. Perfusion indices, independently of the metastases localization in the lungs were mean = 46,92%, SD = 11,87%. The single metastases in the lungs cause predominantly oval zone of impaired perfusion. The involvement of one or the two hili and the distant mediastinum are indirect sign for advanced metastatic process or presence of multiple metastases. Metastases in the left lung more often induce greater changes in perfusion indices.

Key words: lung perfusion scintigraphy, pulmonary metastases

INTRODUCTION

The lungs are one of the common metastatic places for different carcinomas with other primary localization when there is generalization of the process. Lung perfusion scintigraphy is a valuable method for detection of the changes in lung perfusion at metastatic process, for determination of functional operability when the metastasis could be operated on.

MATERIALS AND METHODS

We have performed lung perfusion scintigraphy on 19 patients, 8 women and 11 men, in the range of 36 -68 years of age with single or multiple metastases in the lungs from carcinomas with other primary localization. In one of the female patients the metastasis in the lungs is operated on.

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Lung perfusion scintigraphy was performed in all patients with ^{99m}Tc- human albumin microspheres with a particle size of 23-45µm (kit Sferotec – Sorin Biomedica-Italy). The injection was applied in supine position, intravenously in bolus, 1ml at an activity of 55-74MBq. The period of examination was between the 15th min and the 2nd hour after injection, at anterior, posterior, lateral and 45° detection, perfusion indices from 6 fields in front and posterior projection were calculated (Picker Dyna Camera 4 Scintillation Camera System – Picker Corporation Nuclear and Ultrasound, USA).

RESULTS

Pulmonary metastases are searched in 14 patients. In 4 of the patients there has been suspicion of primary tumor in the lungs. In one patient with operated colon carcinoma was suspected second localization of carcinoma in the lungs which intra-operatively is proven as metastasis of the primary carcinoma. The distribution of the patients by diagnosis is shown in **Table 1:**

Table 1. Distribution of the patients with metastases in the lungs by diagnoses and sex

Diagnosis	Number of cases	Men	Women	Percentage
Unknown primary focus	5	5		26,32%
Carcinoma of the larynx	2	2		10,53%
Carcinoma of the rectum and colon	2		2	10,53%
Breast carcinoma	2		2	10,53%
Sarcoma	2	1	1	10,53%
Carcinoma of the corpus of uterus	1		1	5,26%
Carcinoma of the cervix of the uterus	1		1	5,26%
Stomach carcinoma	1	1		5,26%
Medullar carcinoma of the thyroid gland	1	1		5,26%
Ectodermal tumor of the left kidney	1	1		5,26%
Carcinoma of the cervix of the uterus in situ Carcinoma with unknown primary focus	1		1	5,26%
Total	19	11	8	100%

Finding of distent mediastinum in one or two projections has been established in 7 of the patients. The perfusion changes vary from impaired in different extent perfusion in small zone encompassing part of one or several segments in one of the lungs to perfusion defect. The perfusion scintigraphy in front, posterior and right lateral projections of 59 years old woman is shown on **Figure 1**. Final diagnosis of the patient is status post hemicolectomy for colon carcinoma. Metastasis in right lung. Status post right upper lobectomy. Diabetes mellitus. (Status post hemicolectomiam pro carcinoma colonis. Meta pulmonis dex. Diabetes mellitus.) The patient has been operated on for colon carcinoma with performed hemicolectomy 3 years before. Due to complaints from cough with scarce expectoration and oppression in right chest an X-ray has established rounded homogenous shadow with unclear boundaries, connected widely to the mediastinum. The echography does not find data for metastases on abdominal metastases. The perfusion scintigraphy establishes perfusion defect apically in right lung with curve-like medial outline with convexity towards the lung in segment 1 and partly on the border with segment 2, localized predominantly dorsally. Perfusion indices: right lung – 53,93%, left lung – 46,07%. Intra-operatively a very dense solid tumor with diameter 5/6 cm in 1 - 2 segment of the upper lobe of right lung has been found. Histology – adenocarcinoma (non-bronchogenic) probably metastasis from other primary tumor. As the tumor on its longitudinal axis reached close to the hilum an upper lobectomy was performed. Two lymph nodes have been taken

out without macroscopic signs of metastatic. The post-operative period has been normal.

Single metastasis in the right lung has been found in 8 patients and in 1 – two metastases. Single metastasis in the left lung has been found in 5 patients. A zone with polycyclic outlines and impaired perfusion in homolateral hilum have been established in 11 patients, and in 5 in the both hili. In 4 patients with bilateral metastases have been established multiple zones of impaired in different extent perfusion to perfusion defects in both lungs. The zones of impaired perfusion are with different sizes, one part with rounded form or subsegment defects. On **Figure 2** is shown perfusion scintigraphy in front, posterior, right-posterior semi-oblique and left-posterior semi-oblique projections of a male of 49 years of age with diagnosis Metastatic lung with unclear primary focus. Multiple zones with moderate to severely impaired perfusion in all segments of right lung and right hilum have been established. Multiple zones of severely impaired perfusion in 2, 3, 6 and 8 segments of the left lung and left hilum have also been found. Distent mediastinum in front and posterior projections is present. Perfusion indices: right lung – 49,49%, left lung – 50,51%.

In one patient with pleural effusion lacked perfusion in the lower lobe of the right lung. In another patient has been established perfusion only in 2 segments of the affected right lung and lacking in all other segments. In one female patient has been found perfusion only in one segment of the affected left lung and lacking in all others.



Figure 1. Perfusion scintigraphy in front, posterior and right lateral projection of a 59 year old woman with apical metastasis in the right lung before right upper lobectomy.

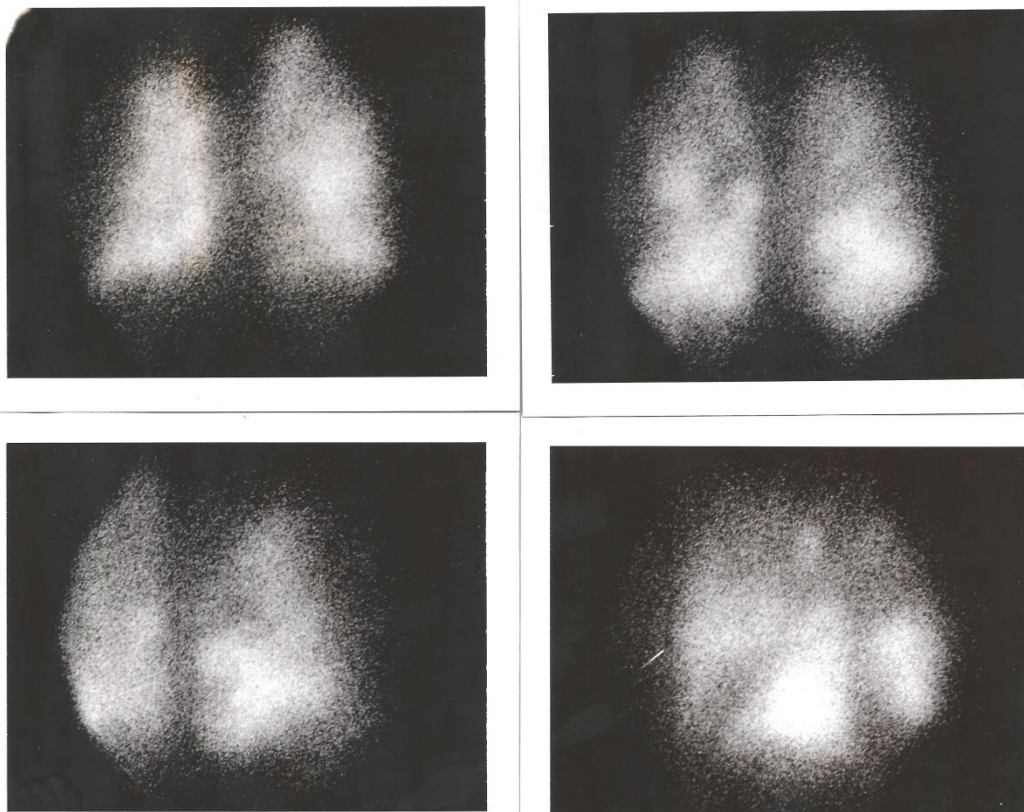


Figure 2. Perfusion scintigraphy of a 49 year old man in front, posterior, right-posterior semi-oblique and left-posterior semi-oblique projections with multiple metastases in both lungs from carcinoma with unknown primary focus.

The perfusion indices in metastases of the right lung have been mean = 49,06%, SD= 12,75%. The perfusion indices in metastases of the left lung have been mean = 41,06%, SD = 7,28%. The perfusion indices independently of which of the lungs are the metastases in have been mean = 46,92%, SD = 11,87%. In 6 of the patients perfusion indices have not been estimated due to technical reasons.

DISCUSSION

Central lung carcinoma is characterized with decreased in different extent perfusion or with perfusion defect of segment, lobe or whole lung (8, 1, 2). The peripheral lung carcinoma presents with isolated zone of decreased in different extent accumulation or defect in accumulation and it is considered that it has scintigraphic image when the tumor is over 4 cm in diameter (8). The tumors smaller than 2 cm in diameter usually are not established with perfusion scintigraphy except if they encompass the vessels of the hilum. Similar inclusion may be present in metastases in the lymph nodes, direct

invasion of the mediastinum or not so often in invasion or thrombosis of pulmonary veins or rarely of pulmonary arteries (13). Exists correlation between the extent of perfusion impairments and inclusion of the different groups lymph nodes (14, 3). The microscopic tumor embolism presents on perfusion scintigraphy with multiple small peripheral or sub-segmental perfusion defects (4, 5, 7, 10, 11). In open pulmonary biopsy multiple clusters of the adenocarcinoma are found, and after autopsy solid pancreatic masses with carcinomatose emboli in the small branches of the pulmonary artery are established (11). In renal carcinoma perfusion changes are owing to tumor thrombosis in pulmonary veins (9, 12).

In our examinations the single metastases in the lung provoke perfusion alterations which are observed in peripheral tumor. When the metastasis is situated in the hilum, a perfusion defect in the whole lobe may be observed. In single solitary metastases in the right lung and in bilateral metastases the perfusion indices are most often around the normal ratios right – left.

The solitary metastases in the left lung induce decreases perfusion in the affected organ.

Perfusion indices in lung sarcoma are mean = 48,5%, SD = 5,8% (6). In our examination perfusion indices are around normal values in presence of metastases in both lungs. When the localization of the process is in the right lung perfusion indices are in normal range but only in one of the patients (the one with perfusion only in 2 segments of the affected lung) is 12,65%. When the process is localized in the left lung in 3 of the patients a decreased perfusion has been found (39%, 33%, 43,97%).

CONCLUSIONS

Solitary metastases of the lungs induce predominantly rounded area of impaired perfusion. The involvement of one or both hili and distent mediastinum are indirect sign for advanced metastatic process or presence of multiple metastases. The metastases in the left lung more often induce larger changes in perfusion indices.

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