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The usefulness of computed tomography spatial imaging in diagnosing lung tumours

Three-dimensional reconstructions of computed tomography (3D CT) are used in the diagnostics of lung tumours to reveal their morphological details essential for determining their benign or malignant character as well as for qualifying for surgical treatment (1, 3, 6).

The aim of the study is to assess the value of 3D CT in diagnosing different kinds of lung tumours in authors' own material.

MATERIAL AND METHODS

The material comprises 17 patients (3 women and 14 men) aged 45-74 years (mean age 59.5 years) with recognised lung tumours. Spatial reconstructions (3D CT) were done from the data of axial sections of standard CT examination.

CT examinations of the lungs were performed with Somatom AR T apparatus by Siemens in continuous layers, in 5 or 10 mm thick axial sections, in patient's supine position at a maximal inspiration. Spatial reconstructions were done at the –500 H.u. reconstruction threshold.

RESULTS

In 12 cases of single lung tumours the morphology of their surface was revealed, in 10 cases uneven and folded with the presence of radial projections (Fig. 1a), and in 2 cases the surface was smooth. Multiple tumours found in 5 patients had smooth surface. In 6 cases of central tumours their contact with hilar vessels was revealed by perspective reconstruction of mutual relations of the bronchi, hilar vessels and tumour volume (Fig. 2).

Fig. 1A. Tumour 5 mm in diameter of the left lung apex. 3D reconstruction shows extensive infiltration of the apical pleura and uneven tumour surface

Fig. 1B. 3D reconstruction revealed numerous and wide vessels connecting the tumour with the pulmonary hilus and vessels coursing on the tumour surface

In the group of 11 cases of peripheral tumours their connection with hilar vessels was shown twice (Fig. 3 and 1B). In 6 cases of peripheral lung tumours spatial reconstructions showed infiltration of the pleura (Fig. 4A and 1A) visible in only 2 patients exam-

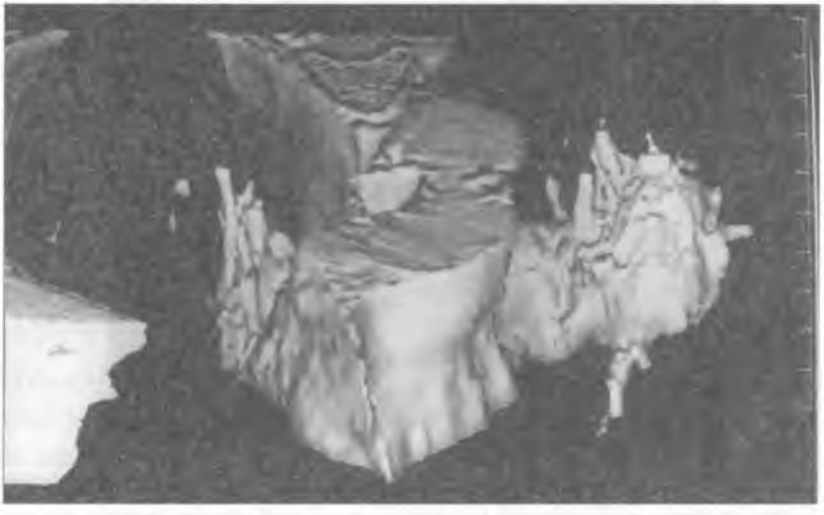

Fig. 2. Central tumour of the left lung infiltrating vascular hilus

Fig. 3. Tumour of the left lung 3 mm in diameter with uneven surface, wide vessels connected with lung hilus

Fig. 4A. Subpleural metastatic focus.
Prominence of the internal chest surface

Fig. 4B. Two metastatic tumours in the supradiaphragmatic region (arrows)

ined with conventional CT. In 3 cases 3D CT revealed changes localised beyond the domes of the diaphragm (Fig. 4B) and in 2 cases the changes were extracardiac. The diameter of the examined tumours ranged from 0.5 to 5 cm.

DISCUSSION

3D CT is useful in the assessment of the morphology of tumour changes in the lungs due to the possibility of revealing their size in three dimensions, usually irregular shape and uneven surface.

Fig. 5. Single metastatic tumour 0.5 cm in diameter localised in the retrosternal space (arrow-head)

In small tumours, under 10 mm in diameter, the assessment of the volume and growth of tumour in consecutive examinations is more accurate in 3D CT than on axial sections (9). 3D CT reveals the relationships of the tumour to pulmonary vessels and chest walls. In small lung tumours it enables their identification and differentiation with vessels, especially those with twisted course.

3D CT reconstructions provided important information determining mutual relations between focal pulmonary changes and vessels in 32% cases (3). There is emphasised the supplementary role of 3D CT in the diagnostics of lung tumours by 2D CT and endoscopy (5). The accuracy of 3D CT in revealing the invasion of blood vessels amounted to

96%, while the accuracy of axial CT sections was 47% and of thin high resolution sections – 87% (8). 3D CT enables differentiation of peripheral localisation with subpleural one exceeding 2D CT imaging in the assessment of pleural infiltration in peripheral bronchial cancers (2). In central lung tumours conventional 2D CT exceeds 3D CT in the assessment of bronchial infiltration while 3D is better in the assessment of hilar vessels infiltration (4). 3D CT gives additional possibilities of the assessment of changes with extracardiac localisation and those localised beyond the domes of diaphragm, which constitute 25% of pulmonary parenchyma.

The presence of inflammatory infiltrate and atelectatic areas in the tumour region hinders assessment with 3D CT.

CONCLUSIONS

3D CT spatial reconstructions of lung tumours area valuable supplement of conventional CT examination providing important information on the localisation, volume, surface structure, mutual relations of the tumour and vessels as well as on the assessment of pleural infiltration.

REFERENCES

1. Kuhlman J. et al.: Two-dimensional and three-dimensional imaging of the *in vivo* lung: combining spiral computed tomography with multiplanar and volumetric techniques. J. Digit. Imaging, 7, 42, 1994.
2. Kuriyama K. et al.: Pleural invasion by peripheral bronchogenic carcinoma: assessment with three-dimensional helical CT. Radiology, 365, 191, 1994.
3. Mori K. et al.: Three-dimensional computed tomography image of small pulmonary lesions. Jpn. J. Clin. Oncol., 159, 22, 1992.
4. Quint L. E. et al.: Three dimensional CT of central lung tumors. Clin. Imaging, 323, 14, 1990.
5. Remy J. et al.: Multiplanar and three-dimensional reconstruction techniques in CT: impact on chest diseases. Eur. Radiol., 335, 8, 1998.
6. Silverman P. et al.: Helical CT of the upper airway: normal and abnormal findings on three-dimensional reconstructed images. AJR, 165, 542, 1995.
7. Udupa J. et al.: Surface and volume rendering in three-dimensional imaging: a comparison. J. Digit. Imaging, 4, 159, 1991.
8. Yamada K. et al.: Three-dimensional computed tomography for the evaluation of peripheral small lung cancers. Nihon, 1993, 31, 959.

9. Yankelevitz DF. et al.: Small pulmonary nodules: volumetrically determined growth rates based on CT evaluation. Radiology, 251, 217, 2000.

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SUMMARY

Diagnostic value of spatial CT reconstruction was analysed on the material of 17 patients with histopathologically confirmed lung tumours. Spatial 3D CT reconstructions of lung tumours were found to be a precious supplement of conventional CT examination providing important information concerning localisation, volume, surface structure, mutual relations of tumour and vessels as well as the evaluation of pleural infiltration.

Przydatność obrazowania przestrzennego tomografii komputerowej w diagnostyce guzów płuc

W materiale 17 chorych z potwierdzonymi histopatologicznie guzami płuc analizowano wartość diagnostyczną rekonstrukcji przestrzennych TK. Stwierdzono, że rekonstrukcje przestrzenne 3D TK guzów płuc są cennym uzupełnieniem konwencjonalnego badania TK, dostarczając istotnych informacji dotyczących lokalizacji, objętości, struktury powierzchni, stosunków wzajemnych guza i naczyń oraz oceny naciekania opłucnej.