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Multislice computed tomography for detecting and assessing intracardiac thrombi

Intracardiac thrombi may develop in numerous cardiac diseases: ischaemic heart disease, primary hypertrophic cardiomyopathy, valvular heart disease and endocarditis. In ischaemic diseases the development of thrombi is favoured by past myocardial infarction with the post-infarction scar or aneurysm and cardiac failure. The incidence of thrombi in patients after anterior myocardial infarction is estimated at 21–41%. In primary hypertrophic cardiomyopathy thrombi may develop in 11–44% of patients. One of the relevant factors promoting intracardiac thrombosis is atrial fibrillation. Moreover, its increased risk is related to the presence of intracardiac electrodes in patients with pacemakers. Some less common factors include: tumours and systemic diseases: collagenosis, amyloidosis, conditions with increased coagulation (1–3).

The thrombus may undergo organization (calcification or malacia), which is the worst event leading to embolism. The material from the right cardiac half causes thrombi in the pulmonary circulation while the thrombi from the left ventricle or atrium result in embolism of the systemic circulation with ischaemic cerebral stroke being the most severe complication. The diagnostics of intracardiac thrombi is based on classical and transoesophageal echocardiography as well as magnetic resonance imaging and multislice computed tomography (4).

METHODS

The analysis included the records of 1900 multislice CT heart or chest examinations which were performed in the 1st Department of Radiology, Medical University of Lublin between 2002–2006 to detect the presence of thrombi in the cardiac cavities.

The examinations were conducted using the 8-row scanner LightSpeed Ultra or 64-row LightSpeed VCT (General Electric Medical Systems); 1600 CTs were performed with ECG-gating and 300 thoracic examinations were conducted in the angiographic option with collimation of 0.6 or 1.2 mm. The largest group consisted of patients diagnosed for coronary disease or pulmonary embolism.

The selected group with intracardiac thrombi was assessed as to the location and morphology of thrombi as well as coexisting pathological changes, in particular the size of cardiac cavities, parameters of the left ventricle function and disturbances of segmental contractility of the myocardium.

RESULTS

Among 1900 CT results analysed the presence of thrombi in the cardiac cavities was found in 33 (1.7%) patients (24 males and 9 females aged 38–75, mean age 57 years (including 29/1600 examined with ECG-gating and 4/300 in the angiographic option.

The patients with detected intracardiac thrombi were most often referred to cardiac CT by the cardiological department/outpatients' clinic (28 cases). The main reasons of referral included: verification of the echocardiography-detected lesions, assessment of changes on the electrodes in patients bearing pacemakers and follow-up examinations of patients with heart defects. Twenty patients had ischaemic heart disease, including 13 with the history of myocardial infarction; the post-infarction scar was detected in 4 patients and cardiac aneurysm in 3. Ten patients had pacemakers, including 7 suspected of bacterial endocarditis. Cardiomyopathy was diagnosed in 2 patients (1 – restrictive, 1 – dilated). In 8 cases heart defects were detected, including 4 cases of mitral defects and single cases of congenital defects (persistent foramen ovale, corrected transposition of great vessels, single ventricle heart).

The thrombi were most often (60.6%) located in the cavities of the left heart: in 11 patients (33.3%) they were found in the left ventricle, in 9 (27.3%) in the left atrium. The right atrium thrombi were demonstrated in 10 patients (30.3%), the right ventricle thrombi in 3 cases (9.1%). In one case the thrombus was impacted in the foramen ovale.

The thrombi varied in size from 13x10x5 mm to 103x81x84 mm. The mean density of thrombi ranged from 30 to 50 HU and their structure was homogenous in the majority of cases. In 3 cases there were calcifications within the thrombus. More than one thrombus inside the cardiac cavities were detected in 4 cases. In 29 patients at least one cardiac cavity was enlarged. In all patients with left ventricle thrombi the disturbances of contractility were demonstrated. The symptoms of pulmonary embolism were CT-diagnosed in 11 patients.

DISCUSSION

In the study we attempted to assess the value of multislice computed tomography in detecting and assessing the thrombi in the cardiac cavities. The modern diagnostics of intracardiac thrombi is mainly based on transthoracic and transoesophageal echocardiography. Both these methods, however, have limited possibilities of their detection. Some studies compared echocardiography and multislice computed tomography for evaluating the left heart thrombi. According to Love and colleagues (5), the concordance of diagnoses obtained using these methods is 78%. The authors stress that difficulties in echocardiographic evaluation are substantially bigger as they found them in 32% of cases while in multislice computed tomography only in 5% of cases. In our study the left heart thrombi constituted 60.6% of diagnoses. Multislice computed tomography also enabled to assess the dimensions of thrombi, cardiac cavities, and parameters of the myocardial function, condition of coronary vessels and presence of coexisting abnormalities. The most common reason of CT referral was verification of lesions detected during echocardiography. There are reports about thrombi undetected by echocardiography and detected by CT (6–8). Kitayama and co-workers (7) underline a special value of CT in the diagnosis of right atrium thrombi, particularly with accompanying atrial fibrillation. In our study the right atrium thrombi constituted 30.3% of diagnoses and occurred mainly in patients treated with permanent pacing. A severe complication of right heart thrombi is pulmonary embolism which was diagnosed in 33.3% of our patients thanks to MSCT imaging.

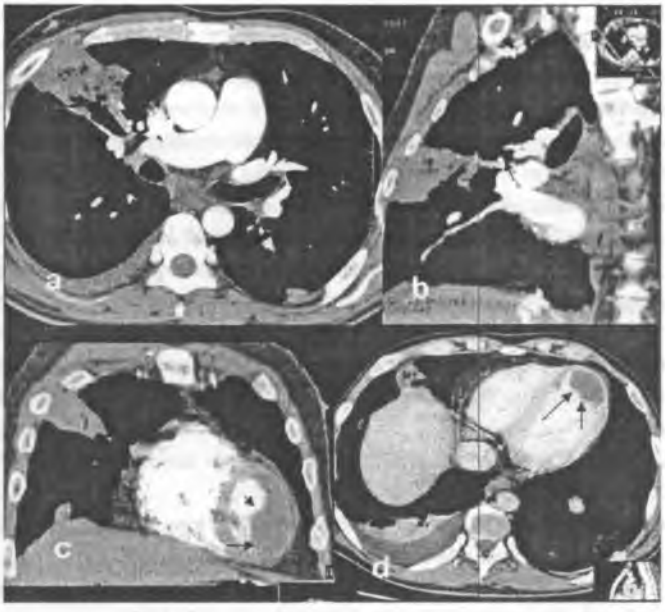

Fig. 1. 47-year-old male treated for acute lower limb ischemia caused by embolic occlusion of the popliteal artery. On the chest X-ray nodular lesion was found. MSCT showed signs of acute pulmonary embolism (a, b) and the large thrombus in the left ventricle close to the post-infarction scar of the anterior wall

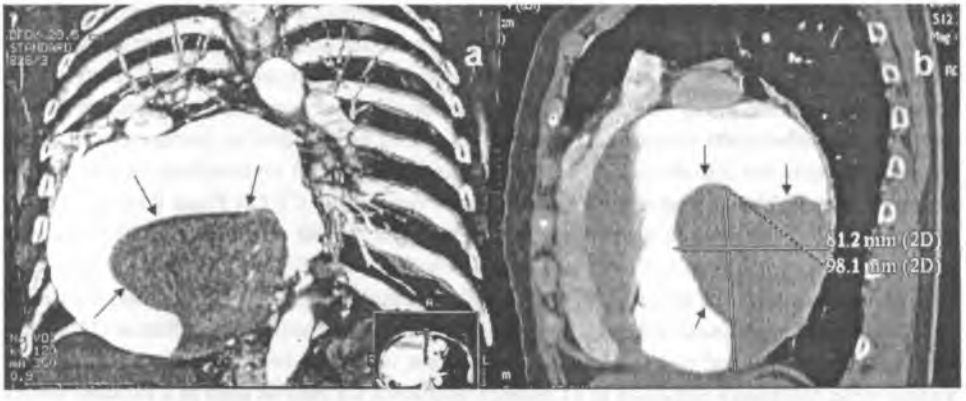

Fig. 2. ECG-MSCT of female patient with severe mitral stenosis and the giant thrombus in the enlarged left atrium; a) 3D volume rendering view, b) sagittal MPR view

CONCLUSIONS

Multislice computed tomography, particularly with ECG-gating is a comprehensive diagnostic tool. It may be used to detect, differentiate, morphologically evaluate and locate the thrombi in the cardiac cavities. It provides additional possibilities of imaging the coexisting lesions.

REFERENCES

1. Waller B. F. et al.: Intracardiac thrombi: frequency, location, etiology, and complications: a morphologic review. Clin. Cardiol., 18, 530, 1995.
2. Aronow W. S.: Etiology and pathogenesis of thromboembolism. Herz, 16, 395, 1991.
3. Wilensky R. L., Jung S. C.: Thromboembolism in patients with decreased left ventricular function: incidence, risk, and treatment. J. Cardiovasc. Risk, 2, 91, 1995.
4. Srichai M. B. et al.: Clinical, imaging, and pathological characteristics of left ventricular thrombus: A comparison of contrast-enhanced magnetic resonance imaging, transthoracic echocardiography, and transesophageal echocardiography with surgical or pathological validation. Am. Heart J., 152, 75, 2006.
5. Love B. B. et al.: Comparison of two-dimensional echocardiography and ultrafast cardiac computed tomography for evaluating intracardiac thrombi in cerebral ischemia. Stroke, 21, 1033, 1990.
6. Rousso I. et al. : CT diagnosis of left atrial thrombus undiagnosed by echocardiography. Comput. Radiol., 8, 293, 1984.
7. Kitayama H. et al.: Value of cardiac ultrafast computed tomography for detecting right atrial thrombi in chronic atrial fibrillation. Am. J. Cardiol., 79, 1292, 1997.
8. Foster C. J. et al.: Identification of intracardiac thrombus: comparison of computed tomography and cross-sectional echocardiography. Br. J. Radiol., 60, 327, 1987.

SUMMARY

The aim of the study was to present the possibilities of multislice computed tomography for the detection and assessment of intracardiac thrombi. The analysis included the records of 1900 multislice CT chest or heart examinations which were performed in the 1st Department of Radiology, Medical University of Lublin between 2002–2006 to detect the presence of thrombi in the cardiac cavities. The selected group was assessed as to the location and morphology of thrombi as well as coexisting pathological changes, in particular the size of cardiac cavities, parameters of the left ventricle function and disturbances of segmental contractility of the myocardium. In the analysed group 33 cases (1.7%) of cardiac cavity thrombi were detected by CT_(24 F and 9 M aged 38–75; mean age – 57). The thrombi were most often localized in the left ventricle – 33.3% (11 cases), followed by the right atrium – 30.3% (10 cases), left atrium – 27.3% (9 cases) and right ventricle – 9.1% (3 cases). The size of thrombi ranged from 13x10x5 mm to 103x81x84 mm, in single cases the multiple thrombi were found. Fifteen patients had symptoms of ischaemic heart disease (11 patients had earlier infarction) and 10 had implanted pacemakers; coexisting heart defects were observed in 8 cases while pulmonary embolism in 11 patients. Multislice CT may be used as a valuable method of detection, differentiation and assessment of morphology and location of cardiac cavity thrombi as well as coexisting pathological changes.

Wielorzędowa tomografia komputerowa w wykrywaniu i ocenie skrzeplin w jamach serca

Celem pracy było przedstawienie możliwości wielorzędowej tomografii komputerowej w wykrywaniu i ocenie skrzeplin wewnątrzsercowych. Analizą pod kątem rozpoznania obecności skrzeplin w jamach serca objęto dokumentację 1900 badań klatki piersiowej lub serca, wykonanych

w latach 2002–2006 metodą wielorzędowej tomografii komputerowej w I Zakładzie Radiologii Lekarskiej AM w Lublinie. W tej wyselekcjonowanej grupie badań oceniono lokalizację i morfologię skrzepliny oraz zmiany współistniejące, w szczególności wielkość jam serca, parametry funkcji lewej komory oraz zaburzenia kurczliwości odcinkowej mięśnia serca. W analizowanej grupie stwierdzono 33 przypadki (1,7%) rozpoznania skrzeplin w jamach serca w badaniu KT (24 K i 9 M w wieku 38–75 lat; śr. 57). Najczęstszą lokalizacją skrzeplin była lewa komora serca – 33,3% (11 przyp.), prawy przedsionek 30,3% (10 przyp.), lewy przedsionek 27,3% (9 przyp.) i prawa komora 9,1% (3 przyp.) Rozmiary skrzeplin wynosiły od 13x10x5mm do 103x81x84mm, w nielicznych przypadkach skrzepliny miały charakter mnogi. U 15 chorych występowały objawy istotnej choroby niedokrwiennej serca (11 pacjentów przebyło wcześniej zawał), 10 pacjentów miało wszczepiony stymulator serca, w 8 przypadkach występowała współistniejąca wada serca, u 11 chorych stwierdzono zatorowość płucną. Wielorzędowa tomografia komputerowa może służyć jako wartościowa metoda wykrywania, różnicowania, oceny morfologii i lokalizacji skrzeplin w jamach serca oraz zmian współistniejących.