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Dissecting aortic aneurysm in computed tomography

In dissecting aortic aneurysm (DAA) tear of the intima takes place, permitting the entry of blood between the intima and adventitia. Passage of blood into this space extend the tear and create so-called false lumen. The majority of this tears take place in the ascending aorta, usually in the right wall, where the greatest shear force upon the artery wall is produced by blood expulsed from the heart under the pressure(4,7) Dissection of aorta is acute when the diagnosis is made within 14 days after the symptoms, and chronic when made later (4,13,14).

The aim of this study is to analyze morphological characteristics of DAA in computed topography examination.

MATERIAL AND METHODS

In the years 1995-2001, 156 aortic aneurysms were examined in II Department of Radiology, Medical University in Lublin, including 12 patients there with DAA, recognized in CT. Among these 12 patients were 9 men and 3 women, aged 42–80 years (mean age 63.3 years). CT examinations were performed using CT scanner Somatom ART, by Siemens, equipped with matrix 512 x 512 pixels. The contiguous axial sections 5 mm in thickness were obtained, with subsequent MPR reconstructions. The examinations were performed after i.v. administering bolus of contrast medium (90 ml Onmipaque 350) in a dynamic protocol.

RESULTS

Patients with aortic wall dissection did not show correlation with the size of its dilatation. In 2 cases the diameter of dissecting aorta was normal according to patients' age. In 8 cases the aortic diameter was slightly increased ranging from 30 to 40 mm, and in 2 cases it was between 40 and 63 mm. In 10 patients DAA involve descending aorta and ascending aorta in 2. In one case DAA involve both, ascending and descending aorta. The length of dissection ranged from 8 to 10 cm in 10 patients, while in other 2 patients the length was 18 and 21 cm, respectively.

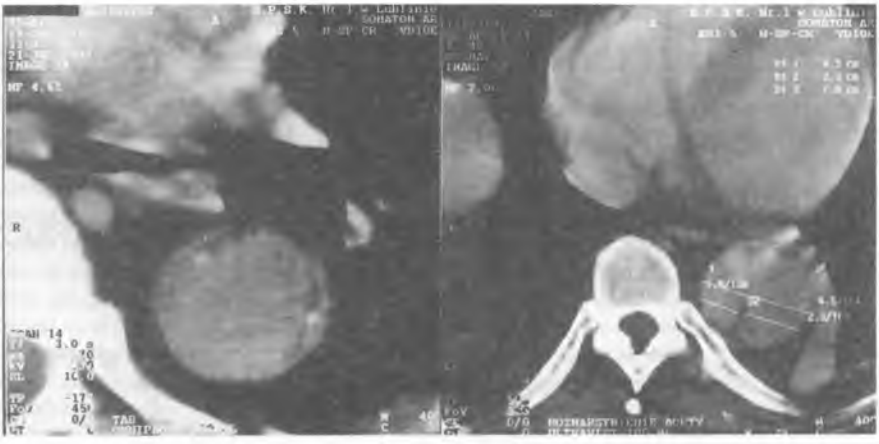

Fig. 1. DAA. Visible dissection of intima and both true and false lumens of aneurysm
Fig. 2. DAA. Visible large dissection of aortic wall with intima flap, and two distinct lumens, false and true

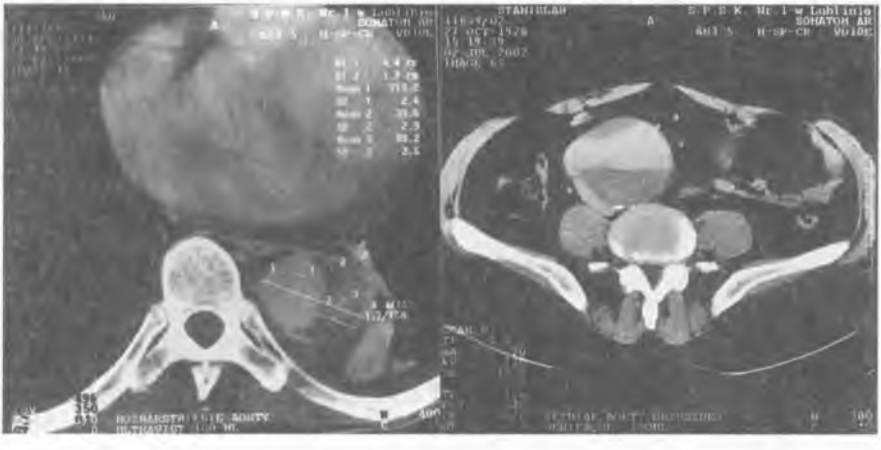

Fig. 3. DAA. The two lumens, false and true may be identified by their different rate opacification of with contrast material. The thrombus inside the false wall
Fig. 4. DAA. In the periphery of aorta the false lumen of dissected wall filled with contrast forms hyperdense streak. Thrombus inside the aneurysm

In 11 cases linear dissection of intima was visible, and the diagnosis was made on this basis (Fig. 1). In 3 cases this dissection was prominent (Fig. 2). In one patient the diagnosis was made on the basis of differing rates of opacification of true and false lumen with contrast material (Fig. 3). In 3 patients hyperdense streak was formed by contrast agent filing the false lumen of DAA (Fig. 4). The intralumen thrombus was present in 6 cases and in 2 of them it affected the false lumen of DAA (Fig. 3). The thrombus in 3 patients was annular. In 2 cases there was the hematoma inside the thrombus, forming heterogeneous region of increased density, comparing to surrounding thrombus masses. The atherosclerosis plaques were found in

3 patients, and in 2 of them they affected the dissected intima. The DAAs were fusiform involving wide length of aorta what was presented in MPR reconstructions.

DISCUSSION

The cause of dissection is weakening of the aortic wall. Predisposing factors for the aortic dissection include hypertension, the Marfan syndrome, Ehlers-Danlos syndrome, Turner syndrome, giant cells arteritis, trauma, intra-aortic catheterization (7). Many classifications may be used based on anatomical characteristic. DeBakey's classification recognizes types I and II, which originate in the ascending aorta (in type I, the dissection extends distally to the aortic arch; in type II, it is confined to the ascending aorta) and type III, which originates in the descending aorta. According to Stanford classification dissections are usually described as type A (involving the ascending aorta) and type B (not involving the ascending aorta). This classification is simpler than DeBakey's. About 70% of acute dissections are type A (4,5,13,14).

The most frequent symptom of the aortic dissection is pain of severe intensity. The pain is characterized by abrupt onset and usually is tearing or ripping. It is localized typically in the anterior chest (usually in patients with type A dissection), in the posterior chest or abdomen (usually in patients with type B dissection). The abdominal pain is usually more intense. The pain sometimes radiates to interscapular region or low back. In some patients the initial pain may by followed by a painless interval from a few hours to several days, ending with return of pain. Sometimes the pain may be less specific and may by suggestive of acute myocardial infraction. There was even a case of isolated bilateral testicular pain in the aortic dissection described, most likely due to compression of the surrounding nerves by the expanding aneurysm. (2,4,5,7,9,10,14,16,17). These symptoms may be accompanied by hypertension. Some patients may have signs of shock (pallor, perspiration, clammy extremities) at admission or may develop shock during hospitalization (5,10).

Acute aortic insufficiency and tense pericardial effusion are common when the ascending aorta is involved and produce various degrees of cardiac failure. Dissection may compress or occlude a branch of the aorta and produce acute ischemia. Ischemia occurs in arms or legs, the kidney, myocardium, brain and mesentery or spinal cord (10,14) Thus variable neurologic symptoms may also be present.

Acute aortic dissection is a medical emergency and demands urgent imaging and treatment. It is the most frequent and serious disease of the aorta and it carries a high morbidity and mortality rate (4,7). Patients with dissection of type A carry a high and early mortality due to the risk of rupture into the pericardium causing tamponade, acute aortic regurgitation, and dissection of the coronary or branchiocephalic arteries. Autopsy series conducted before the era of modern treatment estimated that 40% go 50% of patients with dissection of the proximal aorta died within 48 hours, and the 1-year mortality rate was 90% (3,6,7,13,14). Acute aortic dissection is a life-threatening condition; its prompt and reliable diagnosis is essential for successful management. It is critical to provide not only prompt and accurate diagnosis but also detailed information on associated findings such as the extent of dissection, the location of the entry site, evidence of pericardial effusion, whether or not formation of thrombus has taken place in the false lumen. From surgical point of view, the diagnostic modality should confirm dissection, provide information whether or not ascending aorta is involved and demonstrate abnormal anatomic feature (6,12).

Available imaging technologies include aortography, contrastenhanced computerized topography (CT), magnetic resonance imaging (MRI), and ultrasonography (combined transthoriacic/transesophageal echocardiography, abdomen USG). The choice of initial modality usually reflects local expertise and equipment. Rapid response is essential. If the clinical history and examinations lead to suspicion of dissection, initial imaging should consist

of chest radiograph. The chest film may show mediastinal widening, pleural fluid, or other causes of chest pain such as pneumothorax (1,4).

Aortography has long been considered the study of choice for evaluating suspected dissection. The diagnosis of aortic dissection by aortography is made on the basis of direct or indirect signs. The direct signs, which are considered diagnostic, include visualization of double lumen or an intimal flap. The indirect signs, which are considered suggestive of dissection, include compression of the true aortic lumen by the false lumen, abnormalities of branch vessels, and an abnormal position of the catheter in the aorta. The sensitivity of aortography is 88% (3) False negative angiograms may occur in case of thrombosis of the false lumen, faint opacification of the false lumen, equal opacification true and false lumen, so that an intimal flap is not visualized, unusual intimal tears, or intimal tears positioned proximal to the tip of the catheter (3,6).

The use of CT scanning for the diagnosis of aortic dissection has several advantages, and unlike aortography it is noninvasive. Furthermore, the equipment is readily available in most hospitals, and scanning can usually be done on an emergency basis. The diagnosis of aortic dissection by CT scanning requires identification of two distinct lumens with a visible intima flap. Although in many instances this criterion is fulfilled, in other cases the two lumens are identified only by their differing rates of opacification with contrast material. CT is also helpful in identifying causes of aortic widening other than dissection, such as the presence of abnormal layers of fat, periaortic hematomas, or adjacent tumors, it can also be used to distinguish intraluminal thrombus and to identify the presence of a pericardial effusion. The sensitivity of CT scanning is 82–100% (6). However, it does not provide hemodynamic information such as degree of aortic regurgitation, use of intravenous contrast agents. The biggest disadvantage to the use of CT scanning in the diagnosis of aortic dissection is the low likelihood of detecting the entry site (3,6).

MRI is noninvasive and can visualize the aorta in detail without the aid of intravenous contrast material. Anatomic delineation of aorta is better with MRI than with other techniques. The sensitivity and specificity of this procedure have been reported to be as high as 100% (3). It can also identify the site of entry in almost 100% of cases (3,4,6,12). The criterion used to diagnose an aortic dissection by MRI is, as with contrast CT, the presence of a double lumen with a visible intimal flap. However, it cannot be safely performed in patients with pacemakers or patients who have certain types of metallic prosthesis in any body organ. Also, and most importantly, many patients with acute aortic dissection are hemodynamically unstable, are often receiving intravenous antihypertensive agents, and may be intubated. Performing an MRI study requires that such patients lie in an MRI tube with limited electronic support system, and inaccessible for the 15 to 65 minutes of the scan (3,4,6).

Ultrasound, and in particular echocardiography, is well suited for the evaluation of patients with suspected aortic dissection. The criteria for diagnosis of aortic dissection by echocardiography include an undulating intima flap in the aorta. In the case in which the false lumen is thrombosed, it has been proposed that central displacement of intima calcification is evidence of a dissection. The sensitivity of transthoracic echocardiography averages to 59–85% (3). The difficulties in diagnosing dissection include factors affecting quality of the image, such as obesity, emphysema, mechanical ventilation, chest wall deformities or small intercostals spaces. Transesophageal echocardiography overcomes many of the difficulties. The procedure is safe and provides very high sensitivity, averaging 99% (3). However, it is contraindicated in patients with known esophageal disease, including varices, strictures, and tumors, and it may not be tolerated in up to 3% of patients. (3,6,12) Standard transabdominal ultrasound may by useful, as well as color Doppler ultrasonography. The rupture is demonstrated songraphically with the presence of two luminas, true and false, separated by an intima flap. Sometimes diagnosis is difficult when the distinction between the thrombosed false lumen of the dissection and the eccentric mural thrombus of the abdominal aortic aneurysm cannot be made (11).

CONCLUSIONS

1. CT manifestation of aortic wall dissection is presence of two lumens, true and false, with visible linear intima flap. The different rate of opacification of both, true and false, lumens is also important.

2. The dramatic clinical course of DAA requires immediate diagnostic, suitable treatment and emphasizing the diagnostic value of CT examination.

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SUMMARY

The dissecting aortic aneurysm (DAA) is an emergency, and because of that it requires urgent diagnosis and treatment. Many methods may by used to diagnose dissection, including aortography, CT, MRI, traditional and transesophageal ultrasonography. The computed tomography is often used in diagnostic of DAA, thus the knowledge of morphological characteristic of dissection is very important. The most important features of dissection in CT are presence of dissection of intima and two lumens, true and false. Nevertheless, the CT

pictures of dissection not always appears like this, and sometimes the two lumens are identified only by their different rates of opacification with contrast material.

Tętniak rozwarstwiający aorty w tomografii komputerowej

Tętniak rozwarstwiający aorty (TRA) jest stanem zagrożenia życia i dlatego wymaga pilnej diagnostyki i leczenia. Wiele metod może być wykorzystanych do diagnostyki rozwarstwienia, wśród nich aortografia, CT, MRI, ultrasonografia tradycyjna i przezprzełykowa. Tomografia komputerowa jest uznaną metodą stosowaną w diagnostyce TRA, stąd też znajomość cech morfologicznych charakterystycznych dla rozwarstwienia jest istotna. Najbardziej istotnymi cechami w rozpoznaniu rozwarstwienia w CT są obecność odwarstwionej błony wewnętrznej i dwu świateł aorty, fałszywego i prawdziwego. Niemniej nie zawsze tak przedstawia się obraz rozwarstwienia i czasami rozpoznanie może być postawione na podstawie różnego stopnia zakontrastowania obu świateł rozwarstwionej aorty.