Computed Tomography Diagnosis of an Acute Extensive Type A Aortic Dissection: Case Report

Akut Gelişen Yaygın Tip A Aortik Disseksiyonun Bilgisayarlı Tomografi ile Tanısı

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ABSTRACT Computed tomography (CT) serves as an excellent modality for the diagnosis of aortic dissection based on its common avaliability, speed and high diagnostic performance, especially in emergency conditions. Herein, we describe a 43 year-old male patient who presented with a Stanford A, DeBakey type 1 massive aortic dissection that involved major aortic branch vessels, main abdominal aorta branches and left common iliac artery. We performed a CT angiography which enabled us to demonstrate the intimal flap, type of dissection, all involved vascular structures and associated complications during a single examination. The patient was referred to cardiovascular surgery and subjected to endovascular treatment. This case demonstrates that multidetector CT has an important role for identifying patients with aortic dissection and provides an early diagnosis in emergency conditions. As a result of early recognition of these patients, surgical treatment can be performed immediately.

Key Words: Multidetector computed tomography; angiography

ÖZET Bilgisayarlı tomografi (BT) özellikle acil durumlarda yaygın olarak bulunması, hızı ve yüksek tanısal performansı nedeniyle aort disseksiyonu tanısında mükemmel bir modalite olarak işlev görür. Biz olgu bildirimizde majör aortik branş dallarını, ana abdominal aort dallarını ve sol ana iliak arteri tutan Stanford A, DeBakey tip 1 yaygın aortik disseksiyonu olan 43 yaşındaki bir erkek hastayı tanımladık. BT anjiografi tekniği ile intimal flepin ortaya konması, disseksiyonun tipi, tutulan tüm vasküler yapılar ve eşlik eden komplikasyonlar tek bir incelemeyle gösterildi. Takiben hasta kardiovasküler cerrahi kliniğine sevk edilerek endovasküler tedavi uygulandı. Bu olgu bildirisi çok detektörlü BT incelemenin aort disseksiyonlu hastaların tanınmasında ve acil durumlarda erken tanı konmasında önemli rol oynadığını göstermektedir. Bunun sonucu olarak hastaların erken dönemde tanınması, hızlı cerrahi girişimin gerçekleştirilmesine olanak sağlar.

Anahtar Kelimeler: Multidedektör bilgisayarlı tomografi; anjiyografi

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The clinical diagnosis of acute aortic dissection seems to be very challenging and it is reported to be one of the most undiagnosed serious conditions.[1] Approximately 2.000 deaths per year result from aortic dissection in the United States.[2] Given a mortality rate of 1% per hour in patients with untreated thoracic aortic dissection, diagnosis must be prompt.[3] Early dignosis of this emergency condition results in a significant decrease in the morbidity and mortality rates. Although most patients with acute aortic dissection have severe pain with rapid onset, fewer than one-third will have physical findings.[4]

The Stanford and DeBakey classification systems are two widely used methods of classifying aortic dissection. In the former system, dissections involving the ascending aorta are categorized as Stanford type A and those involving only the descending aorta are classified as Stanford type B. Type A dissections may extend into the descending aorta but type B dissections do not extend proximal to the left subclavian artery. Type A dissections are usually surgical lesions and type B are medically managed ones. In selected cases, type B dissections may be managed surgically.

The DeBakey system is slightly more complex but allows for more detailed characterization of an aortic dissection. In the Debakey system, a Stanford type A dissection, may be classified as type 1, when it involves the ascending aorta, arch and descending aorta and as type 2 when it is confined to the ascending aorta alone. A Stanford type B dissection may be classified as type 3a when confined to the descending thoracic aorta and type 3b when they extend into the abdomen.

Computed tomography (CT) especially multi-detector row CT (MDCT), is often the preferred imaging test for the evaluation of acute aortic dissection. Unenhanced CT images, usually followed by contrast-enhanced arterial imaging enables rapid and comprehensive assessment of the entire aorta. CT has advantages with its wide availibility, speed and high level of diagnostic performance. Furthermore, it is located in or near the emergency department which led to CT as the principal imaging technique used for the evaluation of the emergent thoracic aorta. In this case report, we described a 43 year-old male patient with an extensive thoracic aortic dissection diagnosed on CT imaging.

CASE REPORT

A 43 year-old man was admitted to the emergency department complaining of headache, nausea, chest pain, palpitation and respiratory distress. He had a history of hypertension, anemia, hypothyroidism and hepatitis B in his past and also is a heavy smoker of tobacco. Physical examination showed a blood pressure of 260-130 mm Hg, a 92 beats / min of pulse and a respiratory rate of 20 breaths / min. A chest X- ray and Electrocardiogram (ECG) were taken and showed no abnormalities. The patient was given aspirin and lopressor. Laboratory tests revealed an increase in urea and creatinine levels. Therefore the patient was initially diagnosed as having acute renal failure and therefore hospitalized in the nephrology clinic where he was subjected to a dialysis. He was referred to an ultrasound (US) examination which demonstrated a slight decrease in the left kidney's dimensions and bilateral diffuse renal parenchymal disease presenting with a grade 4 parenchymal increased echogenity. The patient 's complaints were not resolved despite the medical therapy given. He also described an increase in his chest pain and a new developing leg pain accompanied by absence of the femoral pulse on the left.

The patient underwent a CT examination with a multi-detector row helical CT scanner (Somatom Sensation 16, Siemens Medical Systems, Erlangen, Germany). Both un-enhanced and contrast-enhanced CT studies were performed. Contrast-enhanced CT images were obtained following 150 mL of nonionic contrast material administration (Ultravist 300, Iopromide injection 300 mg I/mL) by using a power injector at a rate of 2-4 mL/sec. Following contrast media administration, CT data acquisitions were obtained at 20-30 seconds and 120-150 seconds. Contiguous axial images in a 5 mm section thickness were generated, starting from upper thorax and ending at the femoral arterial level. These axial images were reconstructed with a 2 mm section thickness in three planes in order to get multiplanar reformation images (MPR). Maximum intensity projection (MIP) and 3 D volume rendering images were also generated.

On these images an extensive dissection flap was determined starting from aortic root and extending to the ascending aorta, aortic arcus and the descending aorta distal to the left subclavian artery origin (Figure 1). The intimal flap was also involving all of the major aortic branch vessels (Figure 2). Inferiorly, the main abdominal aorta branches were also detected to be involved by the intimal flap including the ciliac origin (Figure 3), the mesenteric origin and the left renal artery which had

FIGURE 1: Axial image through the thorax , hypointense intimal flap seen along the aortic arch.

FIGURE 2: Axial image reveals the dissection flap extending through major aortic branch vessels.

FIGURE 3: Axial image of the abdomen, dissection flap extends inferiorly and involves the ciliac artery origin.

FIGURE 4: Coronal MPR image, a thrombosed false lumen of the left renal artery is seen without contrast enhancement secondary to dissection. Right renal artery is clearly visualized with contrast material.

a thrombosed false lumen (Figure 4) leading to abscence of contrast enhancement of the left kidney. Below the bifurcation level, the left common iliac artery showed no intraluminal contrast enhancement because the dissection again led to a thrombosed lumen and also a perivascular hematoma due to bleeding was present surrounding it (Figure 5). All of the above findings were also clearly delineated on MIP and 3 D volume rendering images (Figure 6).

The patient was diagnosed as having a Stanford type A, DeBakey type 1 aortic dissection as described above. After performing CT examination, the patient was subjected to another dialysis procedure as a precaution due to renal impairment. Once the patient was hemodynamically stabilized, he was referred to a hospital capable of vascular and cardiothoracic surgery for the endovascular re-

FIGURE 5: Coronal MPR image shows abscence of flow in the left common iliac artery due to thrombosis related to aortic dissection. A perivascular hematoma is also seen surrounding the vessel. Right common iliac artery is patent.

pair of his dissection. During the surgical procedure, extensive aortic dissection was confirmed and the patient underwent endovascular treatment. The patient was discharged from hospital without any problem and currently he is doing well.

FIGURE 6: 3 D volume rendering image clearly demonstrates intimal flap and abscence of arterial flow along the left renal and left common iliac arteries.
(See color figure at http://www.turkiyeklinikleri.com/journal/turkiye-klinikleri-journal-of-case-reports/1300-0284/tr-index.html)

DISCUSSION

Dissection is the result of a spontaneous longitudinal separation of the aortic intima and adventitia caused by circulating blood gaining access to and splitting the media of the aortic wall. The intimal tear allows blood to enter the media from the vessel lumen. The blood-filled space within the medial layer becomes the false lumen. This results in two lumina-a true lumen and a false lumen-with the false lumen having pressures greater than or equal to those in the true lumen.[5]

The most reliable characteristic features of acute aortic dissection are tearing aortic pain with immediate onset, unequal extremity pulses or blood pressures, and mediastinal widening on chest radiograph. This combination of findings may identify 83%-100% of cases, but 4%-7% of patients with aortic dissection may have none of these findings.[4,6,7] In a study by Hagan et al [3] a widened mediastinum was noted in 61.1% of aortic dissection cases. Displacement of calcification of the aorta was reported in 14.1% of cases, with an abnormal cardiac contour being noted in 25.8%.[3] Marked enlargement of the heart indicating a pericardial effusion or the presence of a new pleural effusion is suggestive of complications from aortic dissection. No specific biochemical markers are avaliable for detection of an aortic dissection.

There are 4 main imaging modalities used to diagnose aortic dissection: retrograde angiography ; ultrasound (US) including transesophageal echocardiography (TEE); CT scanning; and magnetic resonance imaging (MRI). However, retrograde angiography is invasive and may extend the dissection. The patient is also exposed to contrast media and radiation. It may appear inappropriately normal if the false lumen is thrombosed. TEE is reliable for localizing intimal tears and has the added potential benefit of assessing valve function and flow in the false lumen.[8,9]

In experienced hands, MRI is highly sensitive and specific for aortic dissection. Contrast- enhanced MR angiography is more suitable for the investigation of aortic dissection in medically stable patients or those with chronic dissections. MRI is accurate and noninvasive, has excellent spatial and contrast resolution, and allows multivascular imaging phases with fast postprocessing.[10,11] Contrast-enhanced MR angiography has several advantages over CT angiography, including lack of nonionizing radiation and greater vessel coverage at high resolution with fewer sections. Nevertheless, three-dimensional contrast- enhanced MR angiography has its limitations. It cannot be performed in unstable patients due to longer acquisition time and difficulty in monitoring, and it is not appropriate for patients with implanted electronic devices.

CT accurately demonstrates intimal flap in aortic dissection cases. Detailed characterization of a dissection and associated complications are unique strength of CT. For endovascular repairement, distinction of the true from the false lumen has become important for therapeutic planning.[12] The true lumen is often smaller, located anteromedially, and shows brisk arterial enhancement. The false lumen shows relatively lower enhancement or may be thrombosed.[13,14] It may contain linear low attenuation 'cobwebs', representing residual ribbons of the aortic media. The 'beak sign', specific to the false lumen, is a wedge of hematoma protruding from the false lumen. Rupture or extension of a dissection into branch arteries is also readily identified by CT.[14-16] In our case report, the patient demonstrated a Stanford type A, DeBakey type 1 aortic dissection and we were able to clearly delineate extension of the dissection into all branch arteries by CT angiography.

It should be kept in mind that a non-contrast CT study is also necessary to assess for high attenuation within the aortic wall resulting from either a high attenuation false lumen or the presence of intramural hematoma.

Triple-rule-out CT is a new protocol used to assess the aorta, coronary arteries and pulmonary arteries and the middle and lower portions of the lungs during a single scan with use of several optimally timed boluses of contrast material and ECG gating in patients who are at low risk for acute coronary syndrome. The aim is to minimize the contrast material dose and radiation exposure while achieving optimal image quality, providing coronary artery image quality equivalent to that of dedicated coronary CT angiography; pulmonary artery image quality equivalent to that of dedicated pulmonary CT angiography and high quality images of the thoracic aorta without pulsation artifact. Biphasic injection of iodinated contrast material is tailored to provide simultaneous high levels of arterial enhancement in the coronary arteries and aorta and in the pulmonary arteries. In an appropriately selected emergency department patient population, triple-rule-out CT can safely eliminate the need for further diagnostic testing in over 75% of patients.[17]

In a meta-analysis of 16 studies involving 1139 patients MRI, TEE and CT were found to be 98%, 98% and 100% sensitive respectively, and 98%, 95%, and 98% specific for aortic dissection, respectively.[18] In a study correlating CT and surgical findings, accuracy for detection of Stanford type A dissection or intramural hematoma was 100%.[19]

CONCLUSION

In conclusion, we can claim that in the acute aortic dissection cases, because multidetector CT has wide avaliability with short acquisition times, it plays an important role in establishing a prompt diagnosis in the acute setting. Establishment of a prompt diagnosis and treatment are essential for a successful outcome. In this case report, prompt diagnosis of aortic dissection by using CT which followed by endovascular treatment led to a good prognosis.

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