Misdiagnosis of Aortic Dissection: Experience of 361 Patients

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Aortic dissection (AD) is a life-threatening condition that requires immediate diagnosis and surgical correction. Patients with acute AD usually present clinically with an insignificant medical history, leading to a high probability of misdiagnosis. The aim of the present study was to investigate the number of misdiagnoses of patients with AD in order to understand this problem and to avoid future misdiagnosis in the emergency department. Clinical data from 361 patients with AD admitted between January 2003 and June 2008 were reviewed as part of a retrospective chart review. Diagnosis of AD was made using either chest x-ray, computed tomography, magnetic resonance imaging, or angiography. Fifty-one patients had an initial misdiagnosis (14.1%), later found to have experienced AD. The condition may clinically present in a varied number of manifestations, including syncope, chest pain, abdominal pain, back pain, acute congestive heart failure, or alternatively with minimal symptoms. Persons of any age can experience an AD, with key clinical manifestations of pain. Echocardiography can be used for primary examination of patients with suspected AD; however, a definite diagnosis is usually made using computed tomographic or magnetic resonance angiography. Care should be taken, particularly in the emergency department, to maintain a level of suspicion for AD diagnosis in order to avoid the potential for misdiagnosis. *J Clin Hypertens (Greenwich).* 2012; 14:256–260. ©2012 Wiley Periodicals, Inc.

Acute aortic dissection (AD) is a cardiovascular emergency that requires prompt diagnosis and surgical correction. AD is a relatively uncommon, although catastrophic, illness that often presents with severe chest pain and acute hemodynamic compromise. The earlier and more accurate the diagnosis, the better probability the patient will survive. AD is defined as a tear in the wall of the aorta that causes blood to flow between the layers of the wall and force the layers apart.[1] AD can quickly lead to death, even with optimal treatment. If the dissection tears the aorta open entirely (through all three layers), massive and rapid blood loss usually occurs. ADs resulting in rupture have an 80% mortality rate, with 50% of patients dying before reaching a hospital. If the AD reaches 6 cm, the patient must be rapidly transported for emergent surgical correction.[2]

This disease was first described by Morgagni in 1761; however, new challenges have arisen since the advent of advanced diagnostic and therapeutic modalities. Clinical manifestation of AD is diverse, proving difficulty in accurate diagnosis.

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METHODS

The present study was approved by the hospital ethics committee. Data from 361 cases of AD were retrospectively reviewed, including cases from January 2003 to June 2008. These patients were enrolled and admitted to a tertiary hospital at the Department of Cardiac Surgery, Zhongshan Hospital, Shanghai, China. Patient age ranged from 16 to 77 years with a mean of 49.75±11.71 years. We analyzed sex, age, medical history, DeBakey score, clinical characteristics, initial imaging studies, electrocardiography (ECG), cardiac troponin levels, time of misdiagnosis, frequency of misdiagnosis, level of hospital service, and type of misdiagnosis.

Statistical Analyses

Statistical analyses were performed using SPSS 16.0 (SPSS, IBM, Armonk, NY). Continuous data in the present study were expressed as mean±standard deviation (SD) and categorical data were presented as percentages.

RESULTS

The demographic data from patients with AD are presented in Table I. Fifty-one (15%) of the cases were misdiagnosed. Diseases where misdiagnosis occurred included numerous cardiovascular (acute coronary syndrome and congestive heart failure) and neurological (cerebrovascular accident, renopathy, spinal pathology, and cystitis) as well as other diseases (Table II), with 85 found to be normal. There were a total of 199 ECG abnormalities noted, with an incidence rate of 70.1%. Cardiac troponin was examined in 86 patients

TABLE I. Misdiagnosis of Aortic Dissection

	No.	DeBakey I	DeBakey II	DeBakey III
Sex				
Male	43	29	2	12
Female	8	6	1	1
Age, y				
<40	7	2	1	4
40–60	34	24	2	8
>60	10	9	0	1
Time of misdiagnosis				
≤1 d	11	8	1	2
≤3 d	4	4	0	0
≤1 wk	9	7	1	1
≤2 wk	6	4	0	2
≤3 mo	17	9	1	7
>3 mo	4	3	0	1
Frequency of misdiagnosis				
1	45	31	3	11
2	5	3	0	2
3	1	1	0	0
Misdiagnosis-related hospital class				
I	4	2	0	2
II	35	25	2	8
III	12	8	1	3
Misdiagnosis related to diseases				
Pancreatitis	5	3	0	2
Acute coronary syndrome	24	16	2	6
Cerebrovascular accident	2	2	0	0
Cholecystitis	3	1	0	2
Acute gastroenteritis	3	2	0	1
Acute renal failure	1	0	0	1
Thyroid tumor	1	1	0	0
Congestive heart failure	2	1	0	1
Spinal pathology	1	1	0	0
Cystitis	1	1	0	0
Pulmonary tuberculosis	1	0	1	0
Pneumothorax	1	1	0	0
Pulmonary infection	4	4	0	0
Acute gastroenteritis	1	1	0	0
Mesenteric ischemia	1	1	0	0

TABLE II. Demographics and History of Patients

	No.	DeBakey I	DeBakey II	DeBakey III
Sex				
Male	273	189	18	66
Female	88	63	10	15
Age, y				
≤40	74	49	10	15
40–60	224	153	16	55
>60	63	50	2	11
History of hypertension	228	161	11	56
Diabetes mellitus	7	6	0	1
Smoking	83	55	6	22
Drinking	29	20	2	7
Motivation	40	29	4	7
Acute course of disease	279	207	15	57
Chronic course of disease	82	45	13	24
Important medical history				
Prior cardiac surgery	14			
Aortic valve replacement	5			
Endovascular repair of aortic aneurysm	3			
Operation of Bentall	2			
Replacement of mitral and aortic valve	1			
Replacement of aorta	1			
Neoplasty of ISD	1			
Coronary artery bypass grafting	1			
Marfan syndrome	16			
Bicuspid aortic valve	5			
Giant cell arteritis	1			
Surgical trauma	2			
Late pregnancy	1			
PDA	1			
Infective endocarditis	1			
Renal transplantation	1			

Abbreviations: ISD, interventricular septal defect; PDA, patent ductus arteriosus.

suspected to have had a myocardial infarction, with increased troponin levels found in 30 of 86 patients. Transthoracic echocardiography (TTE) studies were performed in 337 of the cases, suggesting moderate aortic insufficiency in 68 cases.

Data presented in Table III show that the majority of patients presented with severe pain (90.8%) accompanied by the presence of an aortic dissection (87.8%). Numerous other symptoms were present; however, the majority were secondary to these two key symptoms. Table IV shows the initial imaging studies performed using computed tomography (CT) in 241 cases (66.8%), TTE in 71 cases (19.9%), magnetic resonance imaging (MRI) in 28 cases (7.8%), chest x-ray in 17 cases (4.7%), and coronary angiography in 3 cases (0.8%).

Findings of a positive image are shown in Table V. For x-ray reports, aortic widening and mediastinal widening were recorded as positive and pleural effusion or no significant mediastinal widening was recorded as negative. There were a total of 131 chest x-ray reports prior to surgical correction of the AD; 101 cases included abnormalities (77.0%). In the TTE reports, the only finding of AD was recorded as positive, with all other reports negative. A total of 337 TTE studies were performed before surgical correction of the AD, with 330 cases recorded as positive (97.9%). The CT and MRI reports gave 100% positive results for the diagnosis of AD.

DISCUSSION

In previous studies, the rate of initial misdiagnosis of AD was 14.1% in patients diagnosed with this devastating clinical event. An initial diagnosis of acute coronary syndrome accounted for 47.1% of misdiagnoses.

TABLE III. Presenting Symptoms

	No.	Percentage
Painful aortic dissection	317	87.8 (total)
Pain level severe	287	90.8
Medium	6	1.9
Mild	23	7.3
Migration pain	53	20.1
Chest pain total	279	77.3
Only chest pain	141	39.1
With back pain	101	28.0
With abdominal pain	31	8.6
With lumbar myalgia	6	1.7
Upper abdominal pain	16	4.4
Back pain	22	6.1
Only back pain	15	4.2
With lumbar myalgia	7	1.9
Concomitant symptoms		
Syncope	18	5.0
Sensory or motor disability of extremity	25	6.9
Hypotension or shock	7	1.9
Dark stools	5	1.5
Coma	3	1.0
Amaurosis or blurred vision	3	1.0
Dizziness or headache	3	1.0
Dyspnea	3	1.0
Abdominal distension or diarrhea	3	1.0
Oliguria or dysuria	3	1.0
Hoarseness	2	0.6
Slurred speech	2	0.6
Hematemesis	2	0.6
Bloody urine	2	0.6
Neck pain	2	0.6
Jaundice	1	0.3
Painless aortic dissection	44	12.2
Chest distress	15	4.2
Health examination	8	2.2
Dyspnea	7	1.9
Syncope	3	1
Coma	1	0.3
Paralysis or hemiplegia	6	1.7
Cough	5	1.4
Fever	3	1.0
Hoarseness	2	0.6
Pulsating mass	1	0.3
Hemoptysis	1	0.3
Hypertension	1	0.3
Choking sensation	1	0.3
Edema of lower limbs	1	0.3

TABLE IV. Analysis of Imaging Studies

	No.	DeBakey I	DeBakey II	DeBakey III
Chest x-ray	17	6	1	10
Transthoracic echocardiography	72	47	14	11
Computed tomography	241	181	10	50
Magnetic resonance imaging	28	16	2	10
Coronary angiography	3	2	1	0

TABLE V. Positive Rate of Image Findings

	Positive	Negative	Positive Rate
Chest x-ray	101	30	77.1
Transthoracic echocardiography	330	7	97.9
Computed tomography	241	0	100
Magnetic resonance imaging	28	0	100

These data suggest that chest pain is the most common symptom seen in patients with AD.

In a previous study, acute AD presented with an abrupt onset of severe chest, back, or abdominal pain. A total of 95.5% of patients recalled a history of pain, with the majority complaining of chest pain (72.7%); migrating pain was found in 16.6% of patients.[1] Our study showed that most patients (87.8%) complained of pain, with chest pain accounting for 87.7% and migrating pain accounting for 16.2%. These data are in accordance with a previous study.[1]

Other than pain, the main symptoms included syncope, neurologic symptoms, and hypertension. Patients presenting with chest pain were more likely to be misdiagnosed with acute coronary syndrome, especially using ECG with ST-T elevation and a positive cardiac troponin test. In our study, 3 patients with abnormal ECG findings showed elevations in ST-T and a positive cardiac troponin test, with 1 patient having a cardiac troponin test of 25.0 ng/mL. The cardiologists decided to perform percutaneous transluminal coronary intervention and coronary angiography, which showed that AD can impede the flow of coronary ostium.

Patients presenting with abdominal pain are likely to be misdiagnosed as having acute pancreatitis or cholecystitis, especially those with a history of cholecystitis or biliary calculus, regardless of positive amylase levels. Back pain was easily misdiagnosed as urolithiasis, particularly in patients with a history of urolithiasis or hematuria. Distal hemiparesis or paralysis (with a history of hypertension) was usually misdiagnosed as cerebrovascular accident or as spinal pathology in younger patients. Patients presenting with hematemesis or melena (with a history of ulcerative disease) tended to be misdiagnosed as having an upper gastrointestinal hemorrhage. Patients presenting with fever, cough, or pleural effusion were often misdiagnosed with pneumonia or pulmonary tuberculosis, whereas patients presenting with chest pressure, abdominal distention, or edema of both lower limbs shown by x-ray were readily misdiagnosed as having heart failure.

The majority of patients presenting with painless AD noticed a sensation of chest pressure, and the

symptoms associated with painless AD were diverse, including chest pain, routine health examination, dyspnea, syncope, coma, paralysis, or hemiplegia. In our group of patients, the clinical manifestation of painless AD was variform.[2–13]

ECG findings were present in less than one third of our patients, suggesting that this test was not especially helpful in the differential diagnosis.[1] If AD impeded the flow of the coronary ostium, the ECG may show ST-T elevation or type III third-degree atrioventricular block. Studies by our group suggest that abnormal ECGs, especially those with ST-T elevation, lead to the misdiagnosis of acute coronary syndrome. If the cardiac troponin test results were positive, the patient could be easily diagnosed as having a myocardial infarction and undergo a percutaneous coronary intervention (PCI). This misdiagnosis would then be found using coronary angiography.

Findings from plain chest radiographs of patients with AD are variable and often overlap with those of patients without AD. According to a previous study, radiologists achieved an overall accuracy of 85%, with a sensitivity of 81% and a specificity of 89%.[14] Widening of the mediastinum on chest x-ray was moderately sensitive (67%) in the setting of an ascending AD[15]; however, it had low specificity, as many other conditions could cause a widening of the mediastinum on chest x-ray. In our group, the first diagnostic test findings of the x-ray were 4.7%, with a sensitivity of 77.0%.

Transthoracic/transesophageal ultrasound provides an indication of site and extent of dissection. TTE is safe, rapid, and readily available in the emergency department and should be performed without delay in patients with suspected acute AD.[16] In our group, the first diagnostic test findings from TTE were 19.9%, with a sensitivity of 97.9%. TTE is usually used prior to surgical correction and after anesthesia in order to evaluate the status of the aortic valve and the ostia of the coronary arteries. TTE was reported to have a sensitivity of 94% to 100% and specificity of 77% to 100% in identifying an intimal flap.[17]

CT scans are fast, noninvasive tests that give an accurate 3-dimensional view of the aorta. CT has traditionally been the initial study performed; however, with the rise in new technology (eg, multidetector-row CT), important diagnostic possibilities and very interesting future perspectives are afforded.[16,18]

MRI is currently the gold standard for the detection and assessment of AD, with a sensitivity of 98% and a specificity of 98%. An aortic MRI will produce a 3-dimensional reconstruction of the aorta, allowing the physician to determine the location of the intimal tear, involvement of branch vessels, and location of any secondary tears. This test is noninvasive, does not require the use of iodinated contrast material, and can detect and quantitate the degree of aortic insufficiency.[17]

D-dimer may be a valuable diagnostic marker for the exclusion of AD; however, the sensitivity of diagnosis remains controversial. Current evidence supports routine measurement of D-dimer for the exclusion of acute AD. A D-dimer <0.1 μg/mL will exclude acute AD in all cases.[19] Marill[20] insisted that serum D-dimer is sensitive for acute AD and represents a useful test for patients who present with a low likelihood of disease. Ersel and colleagues[21] also supported the idea that D-dimer testing is helpful for emergency physicians in the detection of suspected acute AD in patients in the emergency department. However, Paparella and coworkers[22] suggest a word of caution regarding the negative predictive values of D-dimer tests in the diagnosis of AD.

CONCLUSIONS

Adults can experience AD during their entire life, with the main clinical manifestations of AD including chest and back discomfort. Echocardiography can be used for the primary examination of patients with suspected AD, including patients with AD diagnosed by CT and MR angiography.

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