

# Importance of Thoracic Aorta Imaging in Hypertensive Patients: A Case Report

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**Abstract** Hypertension, a prevalent condition in the United States and in the developed world, is a significant risk factor associated with aortic aneurysms. This case study describes a 7.3cm Transverse Aortic Arch Aneurysm identified in a 56-year-old female with a history of smoking and essential hypertension. The size, location, age of the patient, and the fact that this aneurysm was an incidental finding make this case novel. The size of this aneurysm and its ability to remain undetected for such an extended period of time was remarkable, but not unusual for this disease process. Based on current guidelines, this patient was not an appropriate candidate for screening via aortic imaging.

**Keywords:** hypertension, aneurysm

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## 1. Introduction

An aneurysm may be congenital or acquired and is described as a sizeable localized dilation of an artery. [1] There are two types of aortic aneurysms designated based on location; the thoracic aortic aneurysm (TAA) and the abdominal aortic aneurysm (AAA). The histopathology of a TAA reveals medial degeneration with proteoglycan buildup as well as decreased elastic fibers and smooth muscle cells at the site of the aneurysm. [2] TAAs are typically asymptomatic; however, if signs and symptoms of a TAA are present, they are usually caused by compression of the aneurysm on surrounding organs and tissues. An aneurysm located in the ascending aorta can induce symptoms that are indicative of a myriad of other ailments and can often be overlooked until an acute event has occurred. These symptoms can range from pain in the chest, neck, or back, to swelling in the head, neck or arms, as well as advanced heart failure. The presentation of symptoms from an aortic arch aneurysm or descending thoracic aortic aneurysm can vary significantly based on the structures affected. For example, constriction of the trachea can lead to wheezing, coughing, or shortness of breath, while pressure on the esophagus can lead to dysphagia. AAAs are often asymptomatic until they rupture; however, when rupture occurs, the symptoms are abrupt and signify a medical emergency. The symptoms

that precede impending rupture can include a severe or dull pain in the chest, abdomen, lower back, or groin area, while a recent rupture can cause an acute and sudden onset of severe pain in the back or abdomen. [3]

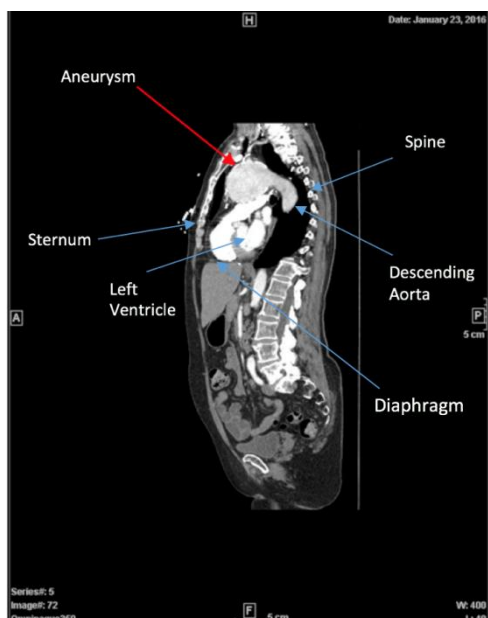
Arterial dilation occurs when the connective tissue within the vascular wall becomes compromised due to a variety of reasons. Although one of the main etiologies associated with aortic aneurysms is the weakening of the arterial wall via hypertension (HTN), connective tissue disorders can also be inherited through various genetic syndromes and lead to the development of vascular abnormalities. The most common of these disorders are Marfan Syndrome, Loeys-Dietz Syndrome, and Vascular Ehlers-Danlos Syndrome. These three as well as other disorders that produce defective connective tissue within the walls of blood vessels should continue to be closely monitored considering the increased risk of aortic dilation. [1]

The patient in this case had a history of HTN and smoking, two major risk factors that contribute to arterial dilation. This case illuminates the crucial role that one's medical history plays in the development of a life-threatening condition especially when the asymptomatic nature of most aneurysms, including ones occurring on the Transverse Aortic Arch, is taken into consideration. This case appreciably illuminates the correlation between HTN and smoking, and the incidence of aortic aneurysms. The awareness of this association must be emphasized among physicians due to the life-threatening nature of this treatable condition.

## 2. Case Study

A 56-year-old Caucasian female consulted her primary care physician (PCP) the first week of December 2015 as she began to experience an exacerbation of her asthma with increased wheezing. She reported fullness in her left chest for several years with a series of consistently negative mammograms. She had a history of HTN, asthma, scoliosis, and Hepatitis C, but no history of Coronary Artery Disease. She had a 20 pack-year history of smoking. The patient's family history was positive for arrhythmia, atrial fibrillation, congestive heart failure and coronary artery disease. The patient was prescribed an inhaler which provided no relief and a chest X-ray was subsequently ordered. The chest X-ray was read as abnormal, with a significant result of an enlarged aorta.

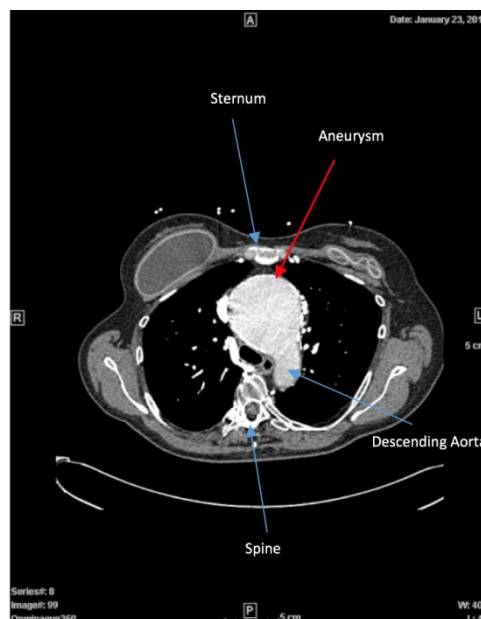
The patient was then sent to a local hospital for further evaluation of her thoracic aorta. During the physical examination, a positive left carotid bruit and diffuse expiratory wheezes were noted. An echocardiogram and a computed tomographic study (CT) were then obtained. The echocardiographic findings revealed a dilated transverse aorta demonstrating an aneurysm as well as mildly increased left ventricular wall thickness. The CT of her chest revealed the abnormal findings of dense vascular calcifications of the thoracic aorta, severe fusiform aneurysmal dilation of the distal ascending aorta and proximal aortic arch. The diametric measurements were alarming with a size of 2.6cm at the aortic root, 3cm at the proximal ascending aorta, 6.5cm at the distal ascending aorta, 7.3cm at the proximal aortic arch, 2.5cm at the distal aortic arch, and 2.5cm at the descending thoracic aorta.



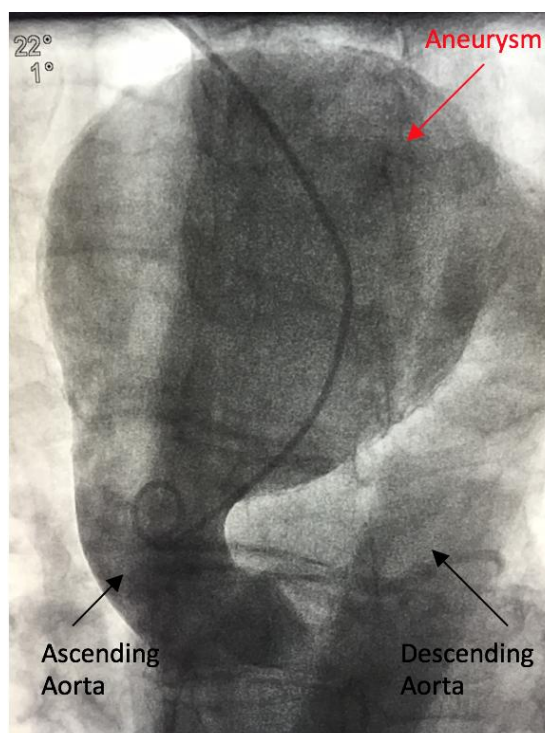
**Figure 1.** Computed Tomographic scan revealing a massive transverse aortic arch aneurysm

She was transferred to a tertiary academic hospital for evaluation by a cardiothoracic surgeon. Prior to the surgery, the patient was seen in the hospital by a cardiologist. The patient's blood pressure was slightly elevated at 141/83, resulting in the addition of Losartan to the patient's Metoprolol and Amlodipine treatment

regimen. The surgery occurred the following week after her blood pressure returned to an acceptable range for surgery. Three days later the patient was discharged and instructed to follow-up with her cardiologist.



**Figure 2.** Computed Tomographic scan revealing a massive transverse aortic arch aneurysm



**Figure 3.** Coronary Angiography; Red arrow indicates the location of the transverse aortic arch aneurysm

A week later, the patient presented to her Cardiologist's office for follow-up on her aortic arch aneurysm repair. The patient stated that she was compliant with her post-operative activity and medications. During the physical examination, no carotid bruits were appreciated and normal, equal carotid pulses were appreciated bilaterally. The abdominal aorta was normal as well with no enlargement or appreciable bruits.



**Figure 4.** Risk factors for TAA [7]

### 3. Discussion

The patient, a 56-year-old female with a history of smoking, HTN, and asthma, who complained of chest fullness, had a finding of a massive transverse aortic arch aneurysm, a subset of TAAs. The patient had a complaint of left chest fullness for several years to which mammograms were ordered in an attempt to ascertain the cause; however, each one returned negative for any masses or abnormalities. Despite the patient's risk for a TAA and other types of vascular dysfunction, no cardiac workup was performed or recommended. The discovery was not made until the patient complained of an exacerbation of her previously diagnosed asthma which was not relieved by her prescribed inhaler. The PCP then ordered a chest X-ray which found the cause of the patient's discomfort, the massive aortic aneurysm.

This case reaffirms the finding that many patients with a TAA are often asymptomatic or have vague nonspecific symptoms and the diagnosis comes later in their natural history when an X-Ray or a CT scan of the chest is conducted for alternative reasons. [4] Due to the asymptomatic nature and the difficulty of detection through physical examination, physicians have a low threshold to suffice a TAA screening. This case highlights the importance of considering the establishment of TAA screening guidelines based upon the presence of significant risk factors rather than symptoms and physical exam findings.

An aortic aneurysm is a condition which is at high risk for developing an acute aortic dissection. An aortic dissection (AD), which occurs when the layers of the of the aortic wall are separated due to an intimal tear, is an emergency condition as it can cause a catastrophic hemorrhage, cardiogenic shock or organ malperfusion. [4] Guidelines exist for physicians to use for identifying possible candidates for AD screening, including patients with certain high risk conditions, pain features, and physical examination features. It is recommended that these individuals have their aorta regularly evaluated for possible AD via CT, magnetic resonance, and echocardiographic examinations. Conditions at high-risk for developing an aortic aneurysm and possible acute dissection include connective tissue diseases, family history of aortic disease, known aortic valve disease, known thoracic aortic aneurysm, and previous aortic manipulation. The symptoms included are chest, back, or abdominal pain described with any or all of the following features: an abrupt onset, severe intensity, ripping, or tearing. Finally, the physical exam findings are pulse deficit, systolic blood pressure difference, focal neurologic

deficit in conjunction with pain, new aortic diastolic murmur with pain, hypotension, or shock. [4] According to these guidelines, aortic imaging is appropriate when at least one of the above high risk conditions or features is noted [2].

The ability of physicians to recognize patients at risk for aortic aneurysms can be an important preventative measure for reducing the incidence of AD since aortic aneurysms, as stated previously in the guidelines, are considered one of the leading risk factors for AD. What makes a patient high risk for developing a TAA? The risk factors are numerous and include HTN, smoking, chronic obstructive pulmonary disease (COPD), connective tissue genetic syndromes, bicuspid aortic valve and other congenital cardiovascular anomalies, inflammatory diseases, and familial thoracic aortic aneurysm syndrome (Figure 4). [2]

A strong correlation between HTN and smoking, and the incidence of TAA in these patients has classified them as major risk factors. This association is further supported by this case since there was a negative history of any genetic connective tissue disorders as well as any other major risk factors. As a result, her history of HTN and smoking likely played a role in the development of her TAA. Not only is HTN a key risk factor for TAA development, it has also been shown to increase the risk of thoracic aortic dissection (TAD) progression from a TAA. A meta-analysis in the American Journal of Hypertension analyzed 8,086 TAD cases from 75 articles over a period of eight decades. The data displayed a 5.6% increase in the prevalence of HTN in TAD patients with a concurrent rise in the prevalence of TAD over this same period. [5] This increased incidence of TAD is alarming due to the improved ability in recent decades to control HTN via medications. This increased TAD occurrence is likely the result of the significant surge of HTN prevalence across both the United States and the developed world. If this trend continues, then the incidence of TAAs and the resulting TADs will continue this dangerous climb and regular thoracic aorta screening may need to be incorporated.

The AD screening guidelines, although seemingly comprehensive, fail to incorporate patients with a history of HTN and smoking, two leading risk factors for both AD and TAAs. Based on the current AD screening recommendations, the patient in this case was not an appropriate candidate for aortic imaging. This highlights the importance of potentially expanding the current AD guidelines to include patients with a history of HTN and smoking, or even possibly establishing guidelines based on the presence of high risk factors to identify appropriate candidates for TAA screening since the presence of a

TAA indicates the need for further evaluation via aortic imaging.

A recent study in the Journal of the American College of Cardiology found that only 40% of routine care includes a heart risk check, with only 39% of PCPs making Cardiovascular Disease (CVD) a top priority. With this thought in mind, only 22% of PCPs as well as only 42% of cardiologists feel well prepared to assess CVD risk. Physicians report insufficient training in utilizing guidelines to assess CVD risk, which is a major contributing factor to this deficiency. [6] A lack of training on proper methods to apply these current guidelines to patients, in addition to other contributing factors including unintentional exclusion of high risk patients likely contribute to this unpreparedness. An increase in the awareness of the correlation between HTN and TAAs is imperative to the improved treatment of these potentially life-threatening conditions. An increased awareness on this connection can lead to an inclusion of this possible complication of uncontrolled HTN in patient-doctor conversations about HTN treatment and compliance. This knowledge will allow the expanded usage of thoracic aorta monitoring via various imaging techniques.

PCPs need to be aware of the compelling association between HTN, smoking, chest discomfort and aortic aneurysms for the sake of their patients. The current AD screening guidelines as a result must be reevaluated to incorporate these high-risk factors to properly assess individuals truly at risk. The inclusion of these elements into the guidelines will allow imaging studies to catch aneurysms prior to the progression of a size that verges on catastrophe. The increased use of appropriate imaging studies would improve the overall mortality rates, a result of the ability to monitor and treat TAAs without surgical intervention.

Based upon the previously stated information, it is imperative for physicians to consider the possibility of a TAA and the resulting risk of AD in patients presenting

with chest discomfort as well as a history of HTN and smoking. These may be the only warning signs of a potentially disastrous condition.

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