Case Report

Intraoperative Diagnosis Of An Ascending Aorta Dissection In A Patient With Gradually Collapsing Cardiovascular System: An Example Of How The Role Of Perioperative Transesophageal Echocardiography (TEE) Becomes Crucial

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ABSTRACT

Intraoperative diagnosis of an ascending Aorta dissection in a patient with gradually collapsing cardiovascular system: An example of how the role of perioperative transesophageal echocardiography (TEE) becomes crucial.

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Although Computed Tomographic Angiography (CTA) is the established gold standard test for the detection of an aortic dissection, many researches and studies have proofed and established that transesophageal echocardiogram (TEE) can rule in or rule out the diagnosis of this catastrophic disorder, with greater accuracy. Here, we present the case of a 58 year-old male patient that was eventually diagnosed by using a TEE intraoperatively, with an aneurysm dissection of the ascending aorta, a large thrombus in the false lumen and a bicuspid aortic valve. The feature that makes this case interesting is that intraoperative use of TEE established the diagnosis and dictated the final course and exact method of the operating process.

Keywords: Aortic Dissection, Transesophageal Echocardiogram, Bicuspid Aortic Valve.

INTRODUCTION

An aortic dissection is a catastrophic disorder, caused by the separation of the layers of the aortic wall. A tear in the intimal layer results in the progression of the dissection chiefly due to the entry of blood in between the intima and media layer.Aortic dissection is relatively un-

common. It usually occurs in men and older individuals. Symptoms of aortic dissection may mimic those of other diseases, such as coronary artery disease, often leading to delays in diagnosis.

The incidence of thoracic aortic dissection is reported to be 3-4 cases per 100,000 persons per year and is associated with a high mortality[1]. Many patients likely die before reaching the hospital, and in the absence of an autopsy, their cause of death may be attributed to more common conditions, such as an acute MI.

The high mortality rate of patients with acute thoracic aortic dissection warrants immediate and rapid diagnosis. There are multiple diagnostic tools used, in a regular basis, including computed tomographic angiography (CTA) which is the gold standard initial test, magnetic resonance angiography (MRA), and echocardiography (transthoracic echocardiography—TTE, and transesophageal echocardiography—TEE)[2].

Transesophageal echocardiography (TEE) is a critically important cardiovascular imaging modality. The proximity of the esophagus to the heart, as well as the great vessels, makes it an excellent ultrasonic window, so that TEE provides additional and more accurate information than transthoracic echocardiography (TTE) for several specific diagnoses, such as infective endocarditis, evaluation of prosthetic valves, cardioembolic strokes and for many catheter-based cardiac interventions[3].

Moreover, transesophageal examination is of outstanding value for managing patients with aortic diseases (e.g.aortic dissection or aortic trauma).

CASE PRESENTATION

A 58 year old male patient presented himself at the emergency department of a military hospital, due to an intermittent, retrosternal pain, accompanied by an episode of loss of consciousness, which lasted a few seconds.

Upon his physical examination at the emergency department, he had 2 episodes of vomiting and a Blood Pressure of 83/45 mmHg which was accompanied by tachycardia (113 bpm). An ECG was performed, with no pathological findings, however, a transthoracic echocardiogram (TTE) revealed the presence of pericardial fluid (approximately 1,9cm^3 - probably blood) and a large thrombus (8,7x1,9 mm) in the Right ventricle. Urgently, a central venous catheter was inserted in his left femoral vein and a continuous Noradrenaline iv. Infusion regimen was initiated, in order to support the patient's hemodynamic status. A left radial artery catheter was also inserted, in order to establish a continuous blood pressure assessment. A Venturi mask of 40% inspired $O_2$was placed to increase the patient's oxygen delivery, as his cardiovascular breakdown was progressing. His ABGs at this point were pH, 7.33; $PaCO_2$, 26,4 mm Hg; PaO_2, 73,7 mm Hg; HCO_3^-, 13,7 mEq/L, and lactate, 5.86 mmol/L.

According to his medical history, he had several risk factors for cardiovascular disease, including Arterial Hypertension, Paroxysmal Atrial Fibrillation, Hypercholesterolemia and Smoking. His BMI was 31.9 (obesity spectrum). In 2016, he was admitted at a hospital due to a cardiac arrest which was resuscitated. During his hospitalization in the ICU, a transthoracic echocardiogram (TTE), a transesophageal echocardiogram (TEE), a cardiac MRI scan and a Coronary Angiography were performed. The main findings included an asymmetric intraventricular septal hypertrophy, a bicuspid aortic valve and an aneurysmal aortic dilation (max diameter of ascending aorta 5,2 cm). Also, during his hospitalization, an ICD (Implantable cardioverter-defibrillator) was implanted.

After the emergency doctors consulted the Cardiothoracic Surgical department of our hospital, the patient was transferred to us for further medical evaluation and assessment. Upon his arrival to our hospital, the patient was immediately transferred in the operating room (OR) as his clinical and hemodynamic condition was aggravating.

During his immediate and direct admission in the operating room the patient's blood pressure was 79/39 mmHg (by administering a continuous intravenous infusion of Noradrenaline to support his hemodynamic status). Hypotension was accompanied by tachycardia (116 bpm) and a Glasgow Coma Scale of 11/15. Immediately, a 5 lead ECG and a right femoral artery catheter were placed in order to establish a continuous blood pressure assessment and full monitoring. Induction of anesthesia and endotracheal intubation were performed by administering intravenously 2 mg midazolam, 20 mg etomidate, 0,2 mg fentanyl and 70 mg rocuronium. Afterwards, a Swan-Ganz catheter was inserted in patient's right jugular vein in order to evaluate central venous blood saturation (SvO_2) and patient's continuous cardiac output (CCO). ABIS monitoring and a continuous non-invasive transcranial cerebral oximetry monitoring, using the (INVOS) monitoring system were also placed. Anesthesia was maintained using a propofol and a remifentanyl infusion regimen, both administered intravenously via the central venous catheter.

After induction of anesthesia and before the surgeon's first cut, a TEE was performed in the OR, by the leading anesthesiologist. Using the TEE, we confirmed the intraventricular septal hypertrophy and established the diagnosis of an aneurysm dissection of the ascending aorta with the presence of a large thrombus in the false lumen. Furthermore, we confirmed the presence of a bicuspid aortic valve with a minimal stenosis and insufficiency. All these findings, provided by the TEE, finally dictated the surgeons plan on the operating process, which was a "Bentall Open Heart Surgery". The Bentall procedure involves the replacement of the aortic root (base of the aorta) as well as the aortic valve (three flaps that ensure the one-way flow

of blood from the heart to the aorta). The operating procedure also involves a re-implantation of the coronary arteries (that branch out from the ascending aorta). The current and most common type of surgery is called the button Bentall surgery (Figure 1, 2). Following the end of surgery our patient was, finally, transferred intubated to the intensive care unit.

Figure 1. TEE image. Three chambers view. Transoesophageal echocardiography is focused on the root of the Aorta and the Aortic valve. Aortic valve and Coronary sinuses can be seen on the center of this image.

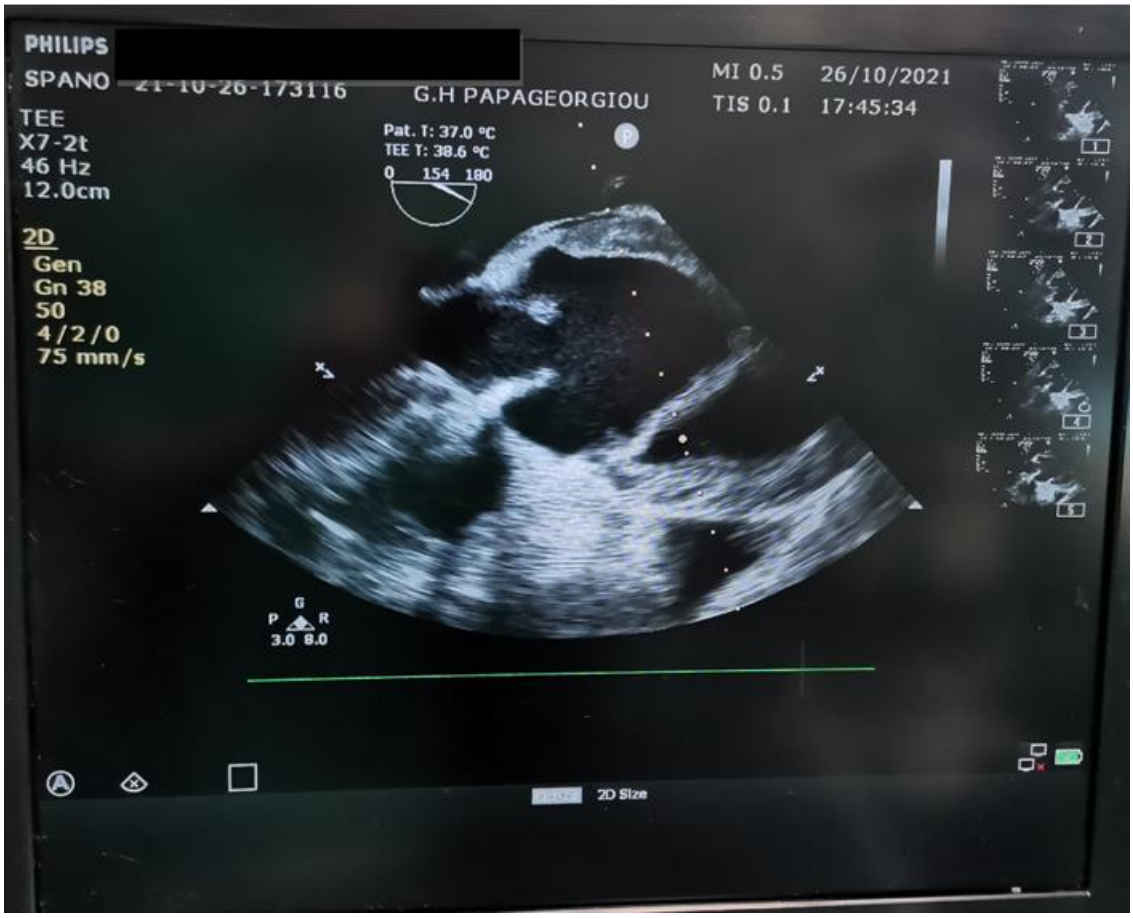

Figure 2. TEE image. Long axis view of TEE. False lumen of the aortic dissection between the separated intima and media aortic layers can also be seen on the right side of this image.

DISCUSSION

Among the cardiovascular catastrophes, aortic dissection is one of the deadliest- a "life-threatening cardiovascular event". The age of the patient is important because the aortic diameter increases with age.

All mechanisms that can weaken the strength of the aortic wall, leading to an increase of wall stress, can also induce aortic dilatation and aneurysm formation, making the lumen easier to dissect. Common causes of aortic aneurysm and dissection include hypertension, connective tissue disorders (Marfan's, Noonan's, Turner's syndromes), degenerative diseases (cystic media necrosis, arteriosclerosis, inflammatory diseases, tumor, and trauma), pregnancy and delivery, family history and congenital heart diseases, including bicuspid aortic valve (BAV) and aortic coarctation[1].

Ascending aortic dilatation occurs more frequently and at a younger age in patients with bicuspid aortic valve (BAV) than tricuspid aortic valve (TAV). A thoracic aortic aneurysm (TAA) is present in approximately 50% of BAV patients, who also have an 8-fold higher risk of aortic dissection than the general population[4].

The site of dissection can be any part of the aorta, although the ascending aorta and the thoracic descending aorta immediately distal to the take-off of the left subclavian artery are the commonest sites. Once the primary rupture of

the intima has occurred, the dissection process usually progresses in the direction of blood flow, although retrograde dissection can also occur. Based on the extent of the aorta involved in the dissection, two classifications are commonly accepted, Stanford and DeBakey: *Stanford A*, involving the ascending aorta, *Stanford B*, involving only the descending or *DeBakey I*, involving both the ascending (proximal) aorta (distal) and descending aorta, *DeBakey II*, involving only the ascending aorta, *DeBakey III*, involving only the descending aorta.Dissection of the ascending aorta is an indication for emergency surgery (Figure 3)[5].

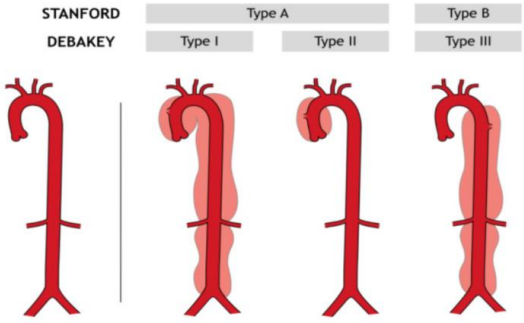

Figure 3. Dissection Classification.

Most guidelines recommend either CT aortography or transesophageal echocardiogram (TEE) for the diagnosis of AAD. It appears that TEE is of critical importance, diagnostically, in the presurgical evaluation of patients with aortic dissection. The main advantage of TEE in imaging aortic dissections is that it provides diagnostic information faster than other modalities, and it can be easily used perioperatively, by well-experienced staff[6].

TEE when performed before surgery, not only provides a certain diagnosis but also leads to the choice of the best surgical option. In other words, it dictates the best possible plan of the operating procedure, as it happened in our case.

Important elements, defining the diagnosis or the surgical plan, are better identified by TEE than TTE or other imaging modalities. Some of them are the diameters in the descending aorta, sites of entry and reentry, direction of jet through intimal tears, possible false lumen thrombosis with spontaneous echocontrast, coronary involvement, intramural hematoma, and aortic fissuration[6].

The echocardiographer is, also, typically, able to identify a variety of structures including the cardiac chambers, valves, lungs, liver, superior vena cava, inferior vena cava, hepatic vein, pulmonary veins, pulmonary arteries, aorta, and stomach. A restriction to transoesophageal echocardiography is that is does not allow visualization of the brachiocephalic arteries.

Despite its superior image resolution, TEE needs expertise and theoretical background in both physics and anatomy for avoiding potential erroneous diagnosis resulting from misinterpretation of normal and abnormal anatomy.

Absolute contraindications to the use of TEE are esophageal pathology, upper gastrointestinal bleeding, poor airway control and severe respiratory depression.

Finally, TEE may be also proposed as an easy access, repeatable, and less expensive method for a long-term surveillance program of patients who have had surgery for aortic dissection[7].

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