Use of TEE for Descending Aorta Surgery: A Case Report

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Abstract
Transesophageal echocardiography is considered the most important imaging technique in the evaluation of aortic pathology. We will present the case of a 65-year-old male patient, who entered for Coronary Bypass and Descending Aortic Replacement Surgery. In the surgery, with the TEE, we observed poor drainage and severe dilatation of the Right Atrium so, the cannula was moved, and we did not see flap of dissection, so simple aortic rafia was performed. We describe the limitations of TEE (blind areas, inaccurate location of the evaluated segment and reverberations) and the causes of peripheral embolism (Aortic atherosclerosis and aortic tumors). Once again, we confirmed the great utility of TEE in the context of acute aortic syndrome and has become an essential tool for the monitoring of aortic pathology before, during and after surgical or percutaneous intervention, where it not only allowed us to verify an early complication, also to establish an adequate therapy and to check the right heart at the outflow of CPB.

INTRODUCTION

Transesophageal echocardiography (TEE) is considered the most important imaging technique in the evaluation of aortic pathology. The main advantage of TEE is that it provides high resolution images [1], given the proximity between the esophagus and the aorta.

In recent years, technological advances in echocardiography have led to improvements in the diagnosis of aortic disease. With transesophageal echocardiography (TEE) the physiopathology understanding of these diseases has widened.

Owing to the high mortality rate in these diseases and the need for early medical and surgical treatment, rapid and accurate diagnostic techniques, which can be applied in critically-ill patients are essential. Echocardiography is precise, rapid and available. Compared with other, highly accurate diagnostic techniques (helical CT, magnetic resonance), echocardiography has the advantage of being applicable in any hospital department (emergency, intensive care, operating theatre), without the need to transfer the patient [2-4].

The accuracy of the diagnosis of aortic dissection will approach and/or exceed the accuracy of other modalities such as MRI or CT scan. Many of the studies on specificity and sensitivity of TEE were performed us in monoplane or biplane probes. Multi plane probes would be expected to improve the specificity of the TEE modality.

In our case, it was really useful in the operating room because it not only helped us to observe the lesion and the remaining of it after the surgery, also to assess the heart in every moment and principally in the finish of pump.

CASE REPORT

We will present the case of a 65-year-old male patient, who entered to the “Hospital Privado Universitario de Córdoba” for Coronary Bypass and Aortic Replacement Surgery. This patient had a personal history of left popliteal femoral bypass and stent placement in both common iliac arteries, arterial ulcers in both lower limbs, oral ulcers (lesion of 1-cm diameter in the left lower jaw, with exposure of dental roots), severe smoking, Chagasic Heart disease with complete right bundle branch block, left renal and splenic infarction secondary to tumor’s embolism in descending aorta diagnosed by computed tomography and transesophageal ultrasound.

Due to this finding of tumor in descending aorta and potential new emboligen risk, anticoagulant therapy was decided, as well as takes sample of mandibular bone biopsy, which isolated Histoplasma Capsulatum. As a preoperative assessment, CACG was performed, exhibiting significant coronary lesions both in the anterior descending coronary artery and the circumflex coronary artery.

Its therapeutic approach was discussed and we decided that He was not candidate for hemodynamic procedure due to the high risk of thrombus detachment. So we decided to perform the surgery.
Surgical technique

A coronary-aortic bypass was performed with saphenous vein to DA and sequential to Second Marginal, plus Tumor resections in descending aorta. The procedure lasted 480 minutes.

General anesthesia with selective intubation was performed on the left lung, an arterial line; a central catheter and the TEE were placed. The approach of the surgery was by left anteroposterolateral thoracotomy on the 5th intercostals space. Through this approach, we made off-pump, an aorta coronary bypass with saphenous vein to DA and M2 in sequential form (Figure 1).

Then, we did the Arterial cannulation in the descending aorta, and we tried to progress through the femoral vein but it was impossible, so the right atrial cannulation was performed (Figure 2). Due to poor drainage and severe dilatation of the Right Atrium (objectified by TEE), the cannula was moved and we placed also a pulmonary arterial cannula, obtaining a good venous return. Systemic cooling until 18°C and circulatory arrest were performed. Subsequently, we did a longitudinal aortotomy distal to the subclavian artery, and we saw a macroscopically mucoid tumor (of 2 × 1 cm) in the interior of it, which was placed in the insertion site of the ligamentum arteriosus. There was no objective flap of dissection, so simple aortic raffia was performed (Figure 3).

Once the desired systemic temperature was achieved, CPB was restarted and then without complications we left pump (Figure 4). We finished surgery and the patient was moved to Coronary Unit for recovery (Figure 5).

The operative times were: CPB 95 min, clamping 35 min and circulatory arrest 28 min.

The patient recovered very well without any complications.

Ten days after, pathological anatomy of the tumor was received, which was inconclusive.

DISCUSSION

The most important views for assessing the ascending aorta are the aortic longitudinal view at 120-150°, and the aortic transverse view at 0°, with the probe placed in the upper esophagus. In order to obtain images of the aortic arch and the descending thoracic aorta, the TEE probe must be rotated at 180°. With the transducer at the level of the middle esophagus
and 0° (transverse projection), without losing the image of the aorta, the transducer is advanced to sequentially visualize the distal descending thoracic aorta and the proximal abdominal aorta up to the celiac trunk, and finally the transducer is removed to visualize the proximal descending thoracic aorta and the aortic arch. By transverse projection at 0° in the most upper part of the esophagus, a longitudinal view of the aortic arch is obtained. With this orientation, it is possible to visualize the output of the left subclavian artery, located at 2 o’clock, and rarely the left carotid and the innominate artery or brachycephalic trunk. Through the longitudinal projection at 90° the short axis of the aortic arch is visualized (Figure 6-8).

LIMITATIONS

The main limitations of TEE in aortic assessment are

Blind areas

TEE does not allow assessing the upper third of the ascending aorta, the origin of the brachiocephalic trunk and the left carotid artery. This limitation is due to the interposition of the trachea and the right bronchus between the esophagus and the aorta. Similarly, TEE does not allow the visualization of the abdominal aorta beyond of the superior mesenteric artery.

Inaccurate location of the evaluated segment

It is difficult to determinate the exact location of the aortic segment during the transesophageal echocardiogram. But on the other hand, there are arteries of reference, so it is recommended to rotate the transducer to identify anterior cardiac structures or large vessels as clues.

Reverberations

The presence of reverberations in the ascending and descending aorta is not infrequent, especially when the aorta is dilated [3]. Reverberations from the wall of the left atrium and the posterior wall of the right pulmonary artery are located within the root of the Aorta or ascending aorta, respectively (Figure 9).

The best way to identify reverberations is using the M-mode. The reverberations located at the aortic root from the posterior aortic wall are located at a double distance from the transducer of the original structure and it follows the same movement of these structures, with double amplitude of displacement. The reverberation of the posterior wall of the right pulmonary artery is located within the aortic lumen at the same distance from the posterior wall of the aorta to it. On the other hand, the structure that gives rise to reverberation and the reverberation itself show a mirror-like displacement and equidistant with the posterior wall of the ascending aorta (Figure 10).

In the descending aorta, reverberations are images which simulate the aorta, located posterior to this (double aortic canyon). The M-mode and the use of Color Doppler are the most useful tools to differentiate a reverberation from an intimal flap.

In our case, we need to make a differential diagnosis due to suspected aortic dissection.

It was very important because if the aortic dissection was real the surgeon would have to change the Incision site and replace the aortic valve and ascending aorta too.
Figure 8 View of descending thoracic aorta low axis at 0°.

Figure 9 TEE in longitudinal aortic view at 110°. Ascending aorta with a reverberation image inside, which can be confused with an intimal dissection? The reverberation occurs from the posterior wall of the right pulmonary artery.

Figure 10 Longitudinal view of the ascending aorta showing a reverberation of the posterior wall of the right pulmonary artery. The reverberation maintains a distance with the aortic wall identical to the one from the wall of the pulmonary artery to the aortic wall. The movement between the two images is mirrored. A: pulmonary artery; B: Reverberation of the pulmonary artery inside of the Ascending Aorta

CAUSES OF PERIPHERAL EMBOLISM

Atherosclerotic injury is the most common source of embolism from the aorta. Rarely, embolism may arise from aortic tumors. Atherosclerotic plaques in the aorta can give two different types of embolism (thromboembolism and cholesterol crystals) and two different syndromes: arterioarterial embolism (aortic thromboembolism syndrome - STA) and cholesterol embolism syndrome (SEC). In STA, a thrombus that covers an atheromatous plaque is disrupted and distally displaced to occlude large arteries such as carotid arteries and their branches. In aortic thromboembolism, there is usually a sudden release of thrombus that results in acute ischemia of a distal organ. Clinical manifestations of STA include stroke, TIA, renal infarctions, and infarctions in another zones. In the SEC, multiple cholesterol crystal embolies are released. The clinical manifestations of ESA include renal failure, blue toe syndrome, hypereosinophilia and diffuse rather than focal neurological damage (eg, mental confusion rather than stroke). The pathophysiology of ATS and ESC involves six basic elements: The presence of an atherosclerotic plaque in the aorta, plaque rupture and/or thrombus formation, embolization of plaque content, embolus in the distal arteries and damage to final organ.

Aortic tumors

Primary aortic tumors involve the root, the thoracic and abdominal aorta, and they are extremely rare. Most of them are classified as sarcomas, including intimal sarcoma of the aorta, angiosarcoma and sarcoma of soft tissues. Benign non-sarcomatous tumors are extremely rare; most often affect young adults and children, and are implanted on the adventitia of the vessel. Other rare tumors are paragangliomas, with sometimes benign and sometimes malignant behavior. The differential diagnosis should be made with aortic wall tumors. Most sarcomas originate in the intima, and may present with symptoms of vascular obstruction due to narrowing of the aortic lumen or, more commonly, with peripheral embolization, just like atherothrombotic embolisms. Primary aortic tumors have no predilection for a particular sex and appear in middle age patients. Their treatment requires the excision of the compromised vascular segment and they have, in general, a poor prognosis.

Aortic atherosclerosis and aortic thrombosis

The prevalence of aortic atheromatosis has been associated with age and classic cardiovascular risk factors and is considered a source of embolism [5].

The prevalence of aortic atheromatosis differs according to the population studied. In a recent study, a prevalence of 51% was observed (using TEE), being complex in 7.6% of the cases [6].

Aortic atherosclerosis is characterized by the presence of multiple plaques of atheromatosis along the aortic wall and in other medium or large caliber arteries, visualized as an irregular intimal thickening with increased echogenicity of at least 2 mm. The morphology of the atherosclerotic plaques is dynamic. The TEE can characterize the injury by measuring its thickness, degree of ulceration, calcification and determining if there is presence of mobile thrombi on its surface or not.
Depending on these characteristics, the embolic risk associated with each plaque will be determined. The characteristics that have been associated with an increased embolic risk are: the presence of mobile lesions, ulceration equal to or greater than 2 mm and plaques that are not calcified. Therefore, plaques of atherosclerosis defined as complex are those with a thickness of more than 4 mm, moving elements or ulceration.

The severity of atheromatosis can be classified into five grades according to the thickening and the presence of moving elements:

- **Grade I:** Normal - Normal intimal thickening (less than 3 mm)
- **Grade II:** Light - Diffuse intimal thickening equal to or greater than 3 mm and without irregularities.
- **Grade III:** Moderate - Atheroma sessile less than 5 mm
- **Grade IV:** Severe - Atheroma sessile equal to or greater than 5 mm
- **Grade V:** Very severe - Atheroma with moving parts or ulceration

Large mobile thrombi in the aorta are an uncommon cause of systemic embolism and often appear as a complication of atheromatosis. Anticoagulant therapy seems to be the most logical treatment, but surgical treatment should be considered in cases with recurrent embolic events.

**CONCLUSION**

The TEE is one of the better diagnostic techniques in aortic pathology, because of its easy availability, the possibility of use it in emergency situations and the ability to offer high quality images about anatomy and functionality. Together with computed tomography, they are the techniques of choice for acute aortic syndrome and has become an essential tool for the monitoring of aortic pathology before, during and after surgical or percutaneous intervention.

Once again, we confirmed the great utility of TEE in the context of cardiac surgery, where it not only allowed us to discard a dissection of the aorta which would change the entire surgery and expose the patient to a harder one, also to verify an early complication, to establish an adequate therapy and to check the right heart at the outflow of CPB [7].

**REFERENCES**