Ventricular assist device
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Section: Cardiovascular
Area of Interest: Cardiac Arteries / Aorta
Procedure: Computer Applications-3D
Procedure: Contrast agent-intravenous
Procedure: Imaging sequences
Imaging Technique: CT
Special Focus: Foreign bodies Case Type: Anatomy and Functional Imaging
Authors: Diaz Angulo, Carolina
Patient: 56 years, male

Clinical History:

A 56-year-old male patient with an end-stage heart failure in whom a ventricular assist device was implanted as a bridge to transplantation. After the surgery a CT was performed to rule out thrombus formation after a prolonged arrhythmic episode.

Imaging Findings:

Plain thorax radiography after VAD system implantation shows an enlarged heart with a pump overlying the left ventricle silhouette and its drive-line (Fig. 1).

Computer tomography shows the pump with the integrated inflow cannula and the tube connection to the ascending aorta. No thrombus formation was confirmed (Fig. 2, 3).

Discussion:

Ventricular assist devices (VAD) are mechanical pumps indicated for end-stage heart failure. VADs are used as a bridge to transplantation, bridge to myocardial recovery and in some countries as an alternative for patients ineligible to transplantation (“destination therapy”) [1].

The first assist device was implanted by DeBakey [2] in 1963. This circulatory support system consists of a pump that takes over the function of a falling ventricle, the pump is connected directly to the ventricles, from which the blood exits through a tube to the greater vessels. The VADs are run by an external computer (controller) that is connected to the pump by a drive-line.

Ventricular assist devices can be classified as short-term (for myocardial recovery) or as long-term devices (used as a bridge to transplantation or for destination therapy) [3]. There are two basic types of VADs, the left ventricle assist device (LVAD) and the right ventricle assist device (RVAD); both of them can be used at the same time, called biventricular assist device (BIVAD). The LVADs divides into two categories: one with a pulsate flow and one with a continuous flow [1].

Radiologists should be familiarized with this devices and how they appear on the different imaging techniques.

We present a case of a 56-year-old male patient with end-stage heart failure in whom a LVAD was implanted as a bridge to transplantation. The device implanted was a third generation LVAD (HeartWare) with a continuous flow run
by a centrifugal pump. The inflow cannula is integrated to the pump and is inserted directly to the left ventricular apex; the outflow cannula is connected to the ascending aorta. The small size of the pump (with a displaced volume of 50 mL) allows its implantation in the pericardial space [3]. Computer Tomography (CT) can be used for preoperative planning [3], and in a postoperative scenario to rule out possible complications such as haemorrhage, pericardial tamponade, thrombus formation, right heart failure and infection [1, 3].

The CT ideal protocol should be a contrast-enhanced CT with retrospective ECG-gating when assessment of the inflow cannula and the left ventricle chamber is needed. CT can be performed without ECG-gating if the study is centred to evaluate possible driveline infection to reduce radiation dose [3].

Magnetic resonance (MR) is contraindicated for assessment of VADs [3].

**Differential Diagnosis List:** Ventricular assist device, no postoperative complications., Ventricular assist device with complications (infection, haemorrhage, pericardial tamponade...), Ventricular assist device malfunction (heart failure signs)

**Final Diagnosis:** Ventricular assist device, no postoperative complications.

**References:**


Figure 1

Description: Plain thorax radiography in a 56-year-old man after VAD system implantation shows the pump and the integrated inflow cannula (straight black arrow) overlying the left ventricle and its driveline (white arrow). Origin: Diaz C, Department of Radiology, Complejo Hospitalario A Coruña, Spain.
**Description:** CT coronal volume rendering shows the pump with the integrated inflow cannula (straight black arrow) and the tube connection to the ascending aorta (white arrow).

**Origin:** Diaz C, Department of Radiology, Complejo Hospitalario de Universitario de A Coruña, Spain.
**Figure 3**

**a**

*Description:* CT axial images obtained with mediastinal window settings show the VAD pump (black arrow) attached to the ventricle with the outflow graft (white arrow). *Origin:* Diaz A, Department of Radiology, CHUAC, A Coruña, Spain.

**b**

*Description:* CT axial shows the outflow graft (white arrow). *Origin:* Diaz A, Department of Radiology, CHUAC, A Coruña, Spain.
Description: CT axial images shows the outflow graft (white arrow) anastomosed to the ascending aorta. Origin: Diaz A, Department of Radiology, CHUAC, A Coruña, Spain.