



# Upward Displacement of Prosthetic Aortic Valved Conduit after Modified Bentall Procedure for Type A Acute Aortic Dissection

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## Authors' contributions

This work was carried out in collaboration between all authors. Authors MS, FN, AF, EB, MR and GS have made substantial contributions to conception, design and acquisition of data. Authors MS, FN, AF, EB, MR and GS have been involved in drafting the manuscript. All authors revised the manuscript critically for important intellectual content, read and approved the final manuscript.

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## Case Study

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## ABSTRACT

**Aim:** Role of non-invasive coronary artery computed tomography (CACT) in diagnosis of complications of aortic root surgery in patients with chest pain.

**Introduction:** Dehiscence of an aortic valved conduit or pseudoaneurysm development is a rare, but serious and potentially life-threatening complication after aortic root surgery.

**Case Presentation:** We report an interesting case of a 61-year-old man with chest pain and dyspnea, previous history of modified Bentall procedure for type A acute aortic dissection and coronary stenting, that shows a complete detachment and upward displacement of a composite tubular graft with mechanical valve prosthesis detected by a CACT angiography.

**Discussion:** Generally, in the few survivors, the diagnosis is made by means of echocardiography. This is the first case of CACT diagnosis of a prosthetic aortic valved conduit displacement after a

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modified Bentall procedure for type A acute aortic dissection. With the use of this imaging technique was possible a complete evaluation of the coronary stents and the native coronary arteries, avoiding the coronary artery angiography that adds an elevation of the risk for this kind of patients.

**Conclusion:** In symptomatic patients with a previous history of treated aortic dissection and coronary artery disease without evidence of recurrent ischemia, the CACT angiography can be considered a good diagnostic option. It provides detailed informations about the coronary arteries and the aorta allowing an accurate diagnosis.

*Keywords: Computed tomography angiography; echocardiography; Bentall procedure; prosthetic aortic valve; aortic conduit; dehiscence; displacement.*

## 1. INTRODUCTION

Acute aortic dissection is a sudden catastrophic event characterized by longitudinal cleavage of the aortic media by a dissecting column of blood. When the aortic root is involved, the currently preferred surgical approach is the insertion of a composite valve-graft with re-implantation of the coronary arteries into the graft (Bentall procedure) [1].

The complete detachment of the entire composite valved conduit may be an unusual and life-threatening complication after this kind of surgery. Recognition of such an event must be swift and treatment rapid, though corrective surgery is associated with a high mortality.

It is usually diagnosed at echocardiography due to an abnormal position of the prosthetic valve and conduit in relation to the native aortic annulus. A computed tomography assessment is generally subsequently performed only to confirm the echocardiographic findings.

We present a patient with complete detachment and upward displacement of a composite tubular graft with mechanical valve prosthesis after a modified Bentall procedure for type A acute aortic dissection first and quickly detected by CACT.

## 2. CASE PRESENTATION

A 61-year-old Caucasian man with a history of hypertension, abnormal lipid profile and smoking habit was admitted to the emergency room of our hospital for a recently onset of intense thoracic pain and dyspnea.

In his medical history we recorded a percutaneous coronary intervention with primary stenting of the left anterior descending coronary artery and its first diagonal branch for a Non-ST elevation myocardial infarction about one and a half years earlier.

Six months later, for a type A Stanford acute aortic dissection, the patient underwent composite replacement of the aortic root and ascending aorta with a St. Jude Medical Aortic Valved Conduit 23/25mm (St. Jude Medical, Inc., Saint Paul, MN, USA) and coronary arteries reimplantation (modified Bentall procedure). His postoperative stay was complicated by acute respiratory failure and *Pseudomonas Aeruginosa* pneumonia requiring appropriate antibiotic therapy. He was discharged after six weeks, in good clinical conditions.

At this admission the electrocardiogram showed paroxysmal atrial fibrillation with an heart rate of 110 beats per minute. In addition, there was a minimal increase of Troponin I (0.56ng/mL).

Considering the previous history of aortic thoracic dissection and the absence of objective evidence of myocardial ischemia, the patient underwent to a CACT. The patient was informed about the benefits and the potential complications of the CT technique.

The retrospective electrocardiography (ECG)-gated CT scan was extended to the entire thoracic aorta and showed signs of the previous aortic dissection without involvement of supra-aortic branches and no evidences of coronary artery stenosis. The main CT-finding was an upward displacement of the prosthetic aortic valved conduit approximately 14 mm from the native aortic annulus. The valve prosthesis and its tubular graft were floating within a huge pseudoaneurysm (diameter 52mmx58mm) that surrounded both the tubular prosthesis (up to its distal anastomosis with the native aorta) and the left main stem (Fig. 1).

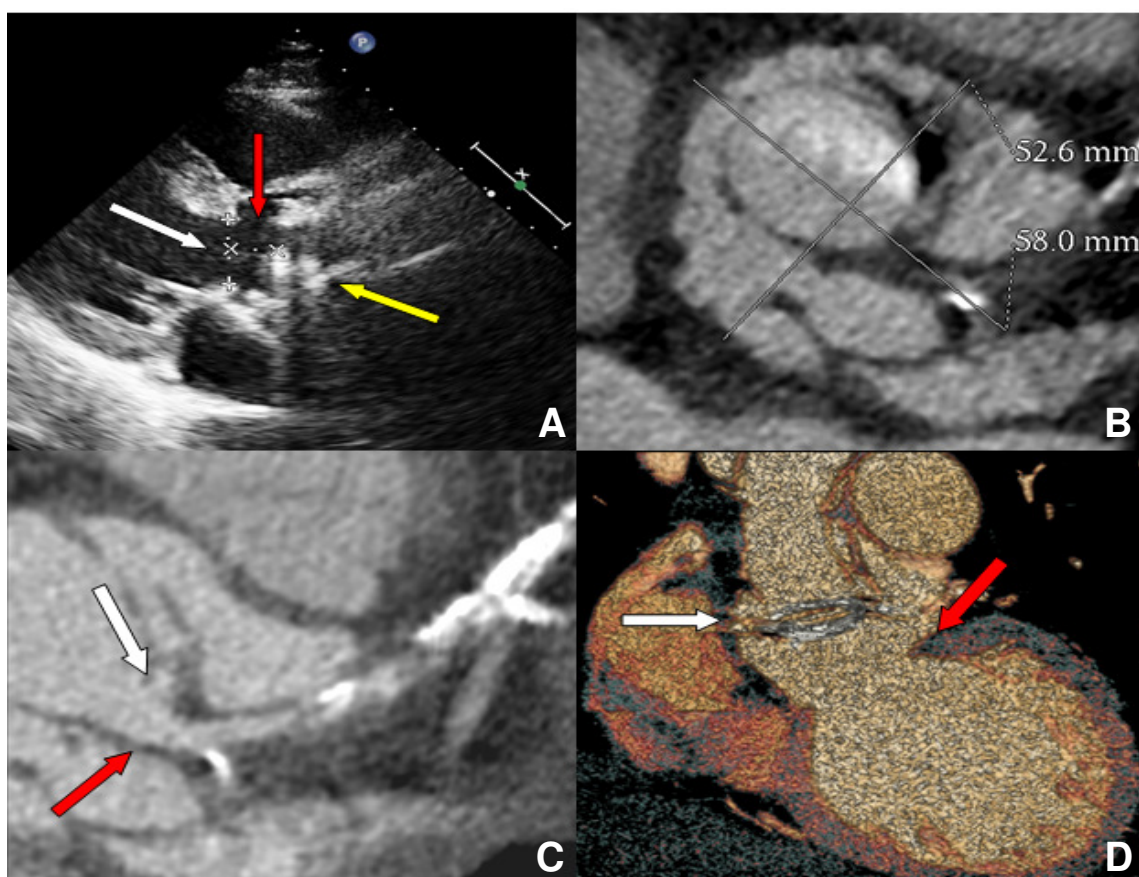
The patient was then admitted to the Operative Unit of Cardiac Surgery for a further more detailed clinical and instrumental evaluation. Physical examination showed a blood pressure of

140/70mmHg. Heart rate was 80bpm and electrocardiography showed sinus rhythm. In addition to the mechanical clicking sound of the aortic valve prosthesis, there was an ejection systolic murmur at the left sternal border. Chest x-ray showed considerable increase in cardiac silhouette. Laboratory tests were in the limits of normality, with a minimal increase in inflammatory markers. No fever was present.

A mono-dimensional and bi-dimensional transthoracic echocardiography was then performed and revealed hypo-akinesia of the interventricular septum and akinesia of the lower wall with an ejection fraction of 50%. It also confirmed dehiscence of aortic valve prosthesis and conduit from both the native aortic annulus

(about 14 mm) and the intraventricular septum (about 10mm) (Fig. 1). The pseudoaneurysm area was approximately 8cm<sup>2</sup>. There was a dislocation of the free wall of the pseudoaneurysm into the left atrium and a flattening of the tubular graft during systole. Mechanical prosthetic valve was apparently well working.

Although the patient had no fever, blood cultures were collected and revealed the presence of *Enterococcus faecalis*. Therefore, a 18F-FDG positron emission tomography-CT scan (PET-CT) was performed showing an area of pathological hyperfixation of the metabolism marker in the site of the composite tubular conduit.



**Fig. 1. A) Ecocardiographic long axis view: native annulus (white arrow), prosthetic aortic valved conduit (yellow arrow) and its displacement from the native annulus (red arrow); B) MPR 64-slice CT reconstruction: prosthetic aortic valved conduit surrounded by a 52,6x58mm pseudoaneurysm; C) MPR 64- slice CT reconstruction: left main coronary artery origin dislocation with inflow both from the pseudoaneurysm (white arrow) and from the aortic prosthesis (red arrow); D) Volume Rendering 64- slice CT reconstruction: pseudoaneurysm extension and mechanical valve (white arrow) displacement from the native annulus (red arrow)**

In consideration of this finding, an appropriate antibiotic therapy was started and the patient was then admitted to the department of infectious diseases, hemodynamically stable.

When a new surgical evaluation was performed, the patient informed about all the risks and benefits, refused the surgery and preferred come back home where he is still alive.

### 3. DISCUSSION

The complete detachment of the prosthetic aortic valve alone or of the entire composite valve graft is an unusual and catastrophic complication of the aortic root surgery [2]. While the first adverse event is relatively "more common" [3], the displacement of the aortic valved conduit is rare and produces unusual clinical findings based on hemodynamic alterations without the normal adaptive processes having time to occur. In some cases a periconduit cavity development has been described too [4,5]. Many common factors, such as endocarditis, anatomic characteristics, surgical management and blunt chest trauma are thought to predispose to this complication.

Generally, in the few survivors, the diagnosis is made by means of echocardiography.

A review of the literature revealed an exiguous number of patients with a complete dehiscence of a valved aortic conduit. Ivens et al. [4] described echocardiographic findings of dehiscence of the aortic valve prosthesis and conduit from the native aortic annulus, a circumferential periconduit cavity, and mitral regurgitation due to involvement of the intervalvular fibrosa. Clarke and Banning [5] identified an 8cm mycotic false aneurysm around an aortic conduit with cranial systolic displacement of the valve by up to 10mm. Only in the first case a computed tomography assessment was subsequently performed only to confirm the echocardiographic findings. None of these patients had a history of aortic dissection or coronary artery disease.

For the best of our knowledge this is the first case of CACT diagnosis of a prosthetic aortic valved conduit displacement after a modified Bentall procedure for type A acute aortic dissection. With the use of this imaging technique was possible to well describe the extent of the pseudoaneurysm and the distance between the native aortic annulus and the prosthetic aortic valve. In addition, a complete evaluation of the coronary stents, the native coronary arteries and

their relationship with the pseudoaneurysm was demonstrated, avoiding the coronary artery angiography that could add an elevation of the risk for this kind of patients [6,7]. Using the helical scan technique, the image data of the whole cardiac cycle can be continuously acquired [8]. Thus, the additional end-diastolic and end-systolic images can be reconstructed retrospectively from the same group of data; for this reason it was possible to well describe the valve prosthesis floating in the different phases of the cardiac cycle.

Previous reports have revealed that it is feasible to use 64-slice helical CT to assess left and right heart function but it is still unclear which effect have the techniques that minimize the patient dose on resolution of multiphase data [8].

For this reason, the evaluation of the left ventricular motion, the determination of functional parameters (such as the ejection fraction) and the assessment of the aortic valve prosthesis function, were performed by means of the transthoracic echocardiography.

### 4. CONCLUSION

CACT angiography has an important role in diagnosis of cardio-vascular causes of chest pain. In symptomatic patients with a previous history of treated aortic dissection and coronary artery disease without evidence of recurrent ischemia, the CACT angiography can be considered a good diagnostic option. It provides detailed informations allowing an accurate diagnosis.

### CONSENT

Not applicable.

### ETHICAL APPROVAL

Not applicable.

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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