

# Heart Failure and Severe Pulmonary Hypertension Sixteen Years After the Cabrol Composite Graft Procedure Caused by Distal Detachment of the Valve Conduit

## Case165

Clinical Case Portal

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### Case Report

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We report a rare complication occurring in a 72 year old patient previously undergone surgical aortic root replacement with Cabrol technique for an aneurysm of the ascending aorta and aortic valve incompetence. Sixteen years later the patient presented progressive congestive heart failure and a left ventricle-to-right atrium shunt due to the distal detachment of the valved tubular graft at level of the suture to the aorta and persistence of the perigraft space-right atrial fistula. Diagnosis was made by transesophageal echocardiography (TEE) and confirmed at surgical inspection. The tubular graft was resutured and normal function was reestablished as confirmed by the TEE control postintervention.

Patient history prior to current observation :

On 1987, a 72-year-old male patient with history of aneurysm of ascending aorta and aortic valve regurgitation underwent composite graft insertion and reimplantation of the coronary arteries. The composite graft was made intraoperatively by suturing a 30-mm Dacron tubular graft with a 25-mm Allcarbon mechanical valve prosthesis (Sorin Cardio SpA, Saluggia, Italy). The residual aneurysm was wrapped around the graft (inclusion technique) and a 1,5 cm fistula was created between the wrapped ascending aorta and the right atrial appendage. Coronary arteries were reimplanted using a 8 mm Dacron graft and the technique described by Cabrol fig. 1. The patient went well (NYHA functional class I) till 2001. Since 2001 his functional capacity deteriorated progressively reaching NYHA class III, and he started complaining frequent palpitations

Clinical findings on admission, evolution and outcome :

Clinical examination revealed mild peripheral edema, increased jugular venous pressure and bibasal pulmonary crackles; normal prosthetic clicks and a continuous aortic basal murmur were heard. Frequent episodes of paroxysmal atrial fibrillation were confirmed by ambulatory electrocardiogram. On July 2003, the patient was referred to our echo-lab for re-evaluation of left ventricular and valve prosthesis function. The transthoracic echocardiographic examination (Sonos 5500, Philips, Andover MA) showed a normal functioning prosthetic aortic valve (peak gradient = 31-mmHg, mean gradient= 28-mmHg, effective orifice area= 2.2 cm<sup>2</sup>) fig. 2, eccentric hypertrophy of the left ventricle (LV) that

appeared mildly dilated with normal systolic function (LV ejection fraction = 70%) fig. 3 and a mild mitral regurgitation (effective regurgitant orifice area= 0.05 cm<sup>2</sup>). Right cardiac chambers were moderately dilated and a severe pulmonary hypertension (systolic pulmonary pressure= 83 mm Hg) was also detected.

Since both pulmonary hypertension and the continuous cardiac murmur were not explained by transthoracic echocardiographic findings a transesophageal study was performed. Transesophageal echocardiography showed a persistent blood flow entering the enlarged perigraft space from the native aorta through to a dehiscence of the distal suture line fig. 4, fig. 5. In addition, a significant high velocity, turbulent flow was detected in the right atrium coming from the perigraft space fig. 6. The mechanism we hypothesized was that a significant left-to-right shunt was created from the aorta to the right atrium via the persistence of the surgical fistula, and that this condition led to right chamber volume overload and progressive pulmonary hypertension. The presence of left-to-right shunt and pulmonary hypertension were confirmed at cardiac catheterization. However, despite demonstrating opacification of right chambers, aortography was unable to identify the site of the shunt.

The patient underwent repeated surgery. At surgery, it was confirmed the detachment at the site of the distal suture of the valve conduit that was re-sutured. The remnant of the native aorta was removed and the perigraft space right atrium fistula closed.

Follow-up at 2 years showed normal function of the aortic valve prosthesis, normal LV EF (69%) and systolic pulmonary pressure decreased to 69 mm Hg.

## Discussion

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Our case underline the concept that a detailed knowledge of the technique used for surgical repair of the aortic aneurysm is the key point to accurately evaluate postoperative echocardiographic findings and correctly interpret signs and symptoms in a patient with a history of ascending thoracic aorta repair. Only the knowledge of the surgical report detailing the wrapping of the native aorta remnant around the graft and the creation of the fistula between the perigraft space and the right atrium allowed us placing echocardiographic findings in a physiopathological framework able to explain the patient's clinical picture.

Specifically, surgical treatment of ascending aorta aneurysm may be approached by two basic methods: placement of an interposition graft with resection of the aneurysm tissue, and the inclusion graft technique in which the remnant of the native aorta is wrapped around the Dacron graft. The latter is done to ensure better hemostasis and prevent late sepsis. However, controversy exists about the need to wrap the native aorta around the graft and some surgeons are convinced that this method not only does not prevent bleeding, but it may be associated to a high risk of false aneurysms or graft tamponade [10].

As a result of this clinical considerations and of the development of new techniques and materials (zero porosity grafts, tissue glue, Teflon felts as buttress for anastomotic sutures, aprotinin) the inclusion technique is rarely performed today [11,12].

In addition, in patients in whom the inclusion graft technique has been used, a fistula between the perigraft space and the right atrium may be created or not. This shunt is created to drain the blood from the perigraft space and decompress the perigraft space in order to avoid external graft compression or tension on anastomotic suture line that is considered the principal mechanism of pseudoaneurysm formation. When the fistula is created, it usually occludes within hours or days as bleeding stops. Nevertheless, some surgeons consider the creation of the fistula useless or at worst deleterious with high incidence of persisting left-to-right shunt requiring reoperation shortly after [8].

As far as we know, this is the first case reporting heart failure and severe pulmonary hypertension as a long term complication of the Cabrol procedure due to detachment of the valve conduit localized at level of the suture to the aorta, coexisting with a patent perigraft atrial fistula leading to a significant left-to-right shunt.

Gelsomino et al [9] reported excellent clinical outcome of the Cabrol procedure in 45 patients followed for 16 years: reoperation rate was only 2.2% and freedom from re-intervention was 97 + 2 %. The incidence of endocarditis was 6.6%, and periprosthetic jet due to valve detachment 10.7% (three patients out of 45). In the series of Gelsomino et al [9], the persistence of a patent perigraft space-right atrial fistula was detected by TEE in one case only. Bachet et al [8] found an incidence of 36% of persisting left-to-right shunt (2 of their 4 patients required reoperation) among 11 patients who underwent this procedure and were followed up for 46±10 months.

This case report confirms the usefulness of TEE for follow-up of patients undergoing replacement of the ascending aorta and aortic valve with the Cabrol procedure[13,14]. However, we would like to reemphasize the critical importance of a detailed knowledge of the technique used for surgical repair of the aortic aneurysm to properly interpret images obtained. Currently, TEE is still the first choice tool to investigate patients who underwent composite graft procedure but also CT or Cardiovascular Magnetic Resonance (CMR) are becoming widely used. The study of blood flow hemodynamics with CT is not possible and consequently this technique does not allow differentiating within a true leak, a persistent dissection and a perigraft patent fistula, and the use of the technique for serial follow up is hampered by the

important exposition of patients to ionizing radiations. [15] CMR could be complementary or an alternative to TEE in case of contraindications to the latter. CMR accuracy in imaging the thoracic aorta has been previously documented and, in a specific study dedicated to composite graft replacement, the technique allowed accurate imaging of suture detachment and bleeding sites using gadolinium enhanced techniques.[16]

## Conclusion

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In conclusion, our case shows that late manifestations of surgical complications of the Cabrol procedure may occur, and the use of imaging techniques that may display morphology and flow like echocardiography and CMR are mandatory for a comprehensive assessment of patients presenting with otherwise unexplained symptoms. Finally, since surgical management of aneurysms of ascending aorta involving the aortic root has been changed so much in the last decades, a detailed knowledge of the surgical technique used is mandatory for adequate interpretation of imaging tests results.

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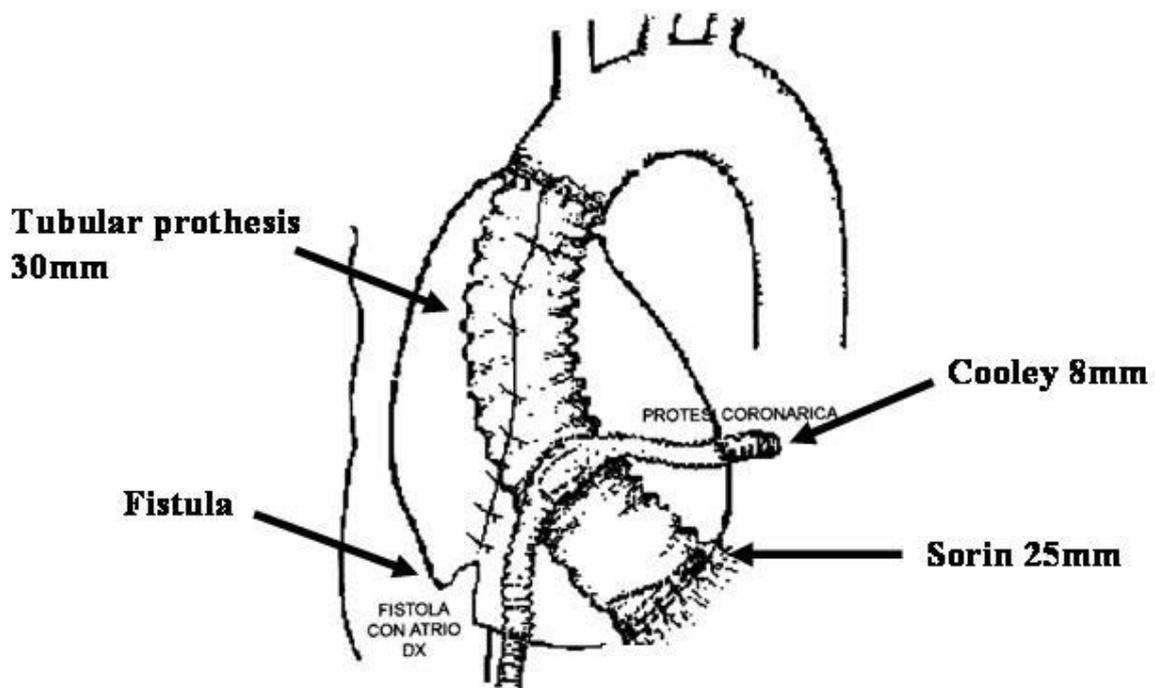
## Resources

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**Fig. 1 :**

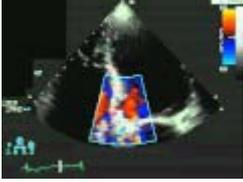
### **Drawings describing the Cabrol composite graft procedure**

The Cabrol composite graft procedure used in the management of aneurysms of the ascending aorta associated to involvement of the sinus of Valsalva segment consists of an aortic inclusion graft technique that involves an aortotomy in which a composite graft that incorporates a prosthetic valve (also known as valve conduit) is anastomosed to the native aortic annulus proximally, an to the healthy aortic segment distally in an end-to-end fashion. The remnant of the ascending aorta is wrapped around the graft material and a fistula is created between the perigraft space and the right atrium. Reimplantation of the coronary arteries is accomplished incorporating a second Dacron tube that is anastomosed perpendicular to the aortic graft to which the coronary arteries are anastomosed in an end-to-end fashion



Video 1 :

**Cabrol Composite Graft \_ Transthoracic echo: apical long axis \_Doppler color flow mapping**  
<http://www.youtube.com/watch?v=n4Fwa4MFn9o>



Video 2 :

**Cabrol Composite Graft Distal Detachment\_ Transthoracic echo (apical 4-chamber view)**  
<http://www.youtube.com/watch?v=oNJ88iR3Wic>



Video 3 :

**Cabrol Composite Graft Distal Detachment\_ Transesophageal echocardiography**  
<http://www.youtube.com/watch?v=RrPd7AHwWbA>



Video 4 :

**Cabrol Composite Graft Distal Detachment\_ Transesophageal echo: longitudinal view of the ascending aorta**  
<http://www.youtube.com/watch?v=dmBTLHY7MFw>



Video 5 :

**Cabrol Composite Graft Distal Detachment\_ Transesophageal echo with color Doppler flow imaging**  
<http://www.youtube.com/watch?v=t6hw4Z-i80g>

