



# Complete Disruption and Eversion of the Right Coronary Ostium after Acute Aortic Dissection

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## Abstract

A 64-year-old man with no known medical history was admitted to the hospital with suspicion of inferior wall cardiac infarction and antifibrinolytic and antiplatelet therapy was administered. As the patient continued with ongoing chest pain an emergent coronariography was performed. No lesions were found in the left coronary artery. However, a complete occlusion of the right coronary ostia and an acute aortic dissection was diagnosed. CT scan revealed an aortic dissection affecting the ascending aorta with no flow through the right coronary artery. An aortic calcified valve was also found. Patient was referred to the operating room for emergency surgery. Time elapsed between patient admission and surgery was 12 h. Transesophageal echocardiogram was performed showing an ascending aorta dissection with a severe aortic valve stenosis. Severe right ventricle dysfunction was also present. Aorta tear was found one centimeter above the sinotubular junction. Aortic dissection reached the proximal part of the aortic arch. A severe aortic stenosis was also found. A total section of the right coronary artery was found. The right coronary ostia were completely everted and protruding inside the aorta lumen. An aortic valve replacement and ascending aorta and Hemiarch replacement was performed. A bypass with vein graft to the right coronary artery was also performed. When weaned the bypass a severe right ventricle dysfunction was observed. Also severe bleeding in the surgical field happened due to the medical therapy previously given. Patient could hardly be weaned from bypass and died a few hours after surgery.

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**Keywords:** Aortic dissection; Acute coronary syndrome; Coronary ostia rupture

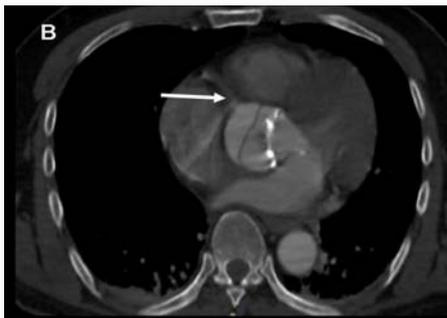
## Introduction

Ascending aortic dissection is a life-threatening disorder with a high mortality rate [1]. This disorder can even have a worse outcome if the aortic dissection is extended into the aortic root affecting the coronary ostia. Some studies have shown that this may occur in about 7% of necropsies according to Hirst et al. [2]. This may cause a malperfusion coronary syndrome that would eventually produce ventricle dysfunction, myocardial infarction or cardiac tamponade. In addition, some patients may suffer a delay in the diagnosis of aortic dissection because they can present a clinical scenario that can mimic an acute coronary syndrome. Thus, fatal accidents resulting from the thrombolytic and antiplatelet therapy given to these patients can lead to very high risk bleeding scenario when surgery is performed [3]. Due to the nature of the pathology, misdiagnosing the condition and delaying management can dramatically affect patient survival.

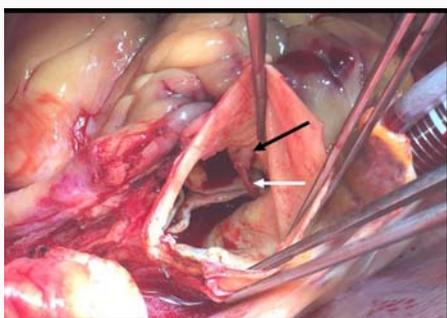
We present the case of a patient that was diagnosed of an acute inferior myocardial infarction. It was only noticed 6 h after his initial diagnosis that he was suffering an acute aortic dissection. We show a unique picture that was taken in the operating room where we can appreciate a total eversion of the right coronary ostia into the aorta lumen due to a complete rupture of the right coronary ostium because of the retrograde dissection of the aortic root.

## Case Presentation

A 64 year old man with no previous medical history was admitted to the emergency department of our hospital due to ongoing chest pain lasting 2 h to 3 h. Patient was referred to the Intensive Care Unit where an EKG showed an ST elevation segment in II, III and aVF leads. With the diagnosis of an inferior wall cardiac infarction standard antifibrinolytic (rPA) plus dual antiplatelet (aspirin + clopidogrel) therapy was administered. The patient continued stable but with ongoing chest pain. The ST elevation persisted despite medical treatment. An emergent coronariography was scheduled.



**Figure 1:** CT scan showing an ascending aortic dissection with no flow in the right coronary artery.



**Figure 2:** Total disruption of the right coronary ostium protruding into the aorta lumen. We can see the complete ostium (black arrow) and the endothelium itself (white arrow).

In the cath lab no coronary lesions were found in the left coronary artery. However, a complete occlusion of the right coronary ostia and an acute ascending aortic dissection was diagnosed.

Patient was referred to the Radiology Department for a cardiac computer tomogram which confirmed an aortic dissection affecting the ascending aorta and the proximal part of the aortic arch, with no flow through the right coronary artery maximum diameter of the ascending aorta was 50 mm (Figure 1). There was no affection of the descending aorta. An aortic calcified valve with severe calcification suggesting severe aortic stenosis was also found.

With the final diagnosis of acute type A aortic dissection the patient was referred to the operating room for emergency surgery. The elapsed time between patient admission and arrival to the operating room was almost 12 h. Transesophageal echocardiogram was performed in the operating room after total anesthesia showing an ascending aorta dissection along with severe aortic valve stenosis. Severe right ventricle dysfunction was also detected with a normal left ventricle function. No other heart valve pathologies were observed. Mild pericardial effusion was described.

Right axillary cannulation using an 8 mm Dacron tube graft was used. A median full sternotomy was performed. Patient was operated under moderate hypothermia (28°C) with antegrade cerebral perfusion. Hypothermic circulatory arrest was a planned procedure to allow distal anastomosis. Surgical dissection of the aorta and supra-aortic trunk vessel was performed. Heart was arrested using Buckberg 4:1 cardioplegia both in an antegrade and retrograde fashion. The dose was repeated every 20 min to 25 min during systemic cooling and rewarming. Left ventricle was vented *via* the right superior pulmonary vein.

Aorta opening was performed using standard techniques. The aorta was transected above the aortic commissure. The presence and the extent of the dissection, in relation to the coronary ostia, were then assessed. Aortic dissection tear was located half centimeter above the sinotubular junction in the right coronary segment. Aortic dissection reached the proximal part of the aortic arch and it was extended proximally into the aortic root. A complete rupture of the right coronary artery was found; the right coronary ostia were everted and protruding inside the aorta lumen. Figure 2 shows the right coronary ostia completely everted into the aorta lumen (Figure 2, black arrow) protruding the endothelium of the proximal right coronary artery itself (Figure 2, white arrow). The aortic root was not dilated. A severe aortic valve stenosis was also found in a trivalve aortic valve.

By means of an open technique, the intimal tear was resected and the dissected layers of aorta were reapproximated with gelatin-resorcin-formalin glue at the site of the distal and proximal anastomosis. An aortic valve replacement was performed implanting a mechanical 23 size St Jude prosthesis. A supra-coronary ascending aorta and hemiarch replacement was performed with a 30 mm diameter Dacron tube. Due to the total destruction of the right coronary ostia no techniques of coronary ostia repair could be performed. Therefore a bypass to the right coronary artery with a vein graft was performed.

When weaning from bypass a severe right ventricle dysfunction with right ventricle dilatation was observed despite the use of very high dose of inotropes. Massive bleeding was also present due to the antifibrinolytic and dual platelet therapy previously given to the patients. Many attempts to wean bypass were performed. Patient died a few hours after surgery.

## Discussion

Survival of acute type A aortic dissection is related to a prompt diagnosis, as survival decreases significantly over time, increasing the risk of death for every hour in the diagnosis delay [1,3,4]. A wrong diagnosis in patients with an acute aortic dissection can entail not only to a delay in referring the patient to the operating room but also to treat the patient with medicaments that can make surgery much more challenging [5].

Patients suffering a malperfusion coronary syndrome due to an aortic dissection have worse outcomes than those patients with no affection of the coronary ostia [6-9]. A myocardial infarction was diagnosed in our patient, with no suspicion of an aortic dissection, and he was decided to be treated with antifibrinolytics and dual anti-platelet therapy. The administration of thrombolytic therapy can have disastrous consequences in patients with an acute aortic dissection causing an unmanageable bleeding scenario [5,10]. In our patient the medical administered treatment before surgery came with a very bleeding surgical issue during the whole surgery, with a hemostatic disorder very difficult to manage.

As the patient did not clinically improve after the antifibrinolytic therapy he was referred to the cath lab and then, once he was properly diagnosed, to the Radiology Department. Although angiography was the former gold standard diagnostic test for the diagnosis of aortic dissection, angiography is currently only used when patient is suffering a heart attack and the diagnosis of aortic dissection is no certain [1,3]. A total of more than 12 h were passed between patient admission into the hospital until he was referred to the operating room. During that time patient was suffering a right ventricle infarction due to a non

diagnosed right coronary rupture, which it was finally discovered in the surgical field. The consequence was a severe right ventricle dysfunction that was present from the very first moment in surgery. It is well known that the risk of patients undergoing cardiac surgery in an acute myocardial infarction is dramatically increasing [5].

The management of patients with a myocardial ischemia or infarction due to an aortic dissection is really challenging. The use of antithrombotic therapy can imply an excess of bleeding during surgery and postoperatively. On the other hand patients undergoing surgery with a severe ventricle dysfunction have a real worsen outcomes. This is why some groups consider emergency percutaneous intervention in the setting of an acute aortic dissection. Uchida et al. [10] suggest that patients with an acute aortic dissection and coronary malperfusion may benefit from a percutaneous intervention to avoid undergoing surgery with an ongoing myocardial dysfunction or severe myocardial dysfunction. Authors suggest that this management may be worthy even if this means to have a more bleeding risk. This is a very controversial topic. Aortic dissection surgeries are quite challenging and they can be very long, with long bypass and cross-clamp times [9]. Also, hypothermia itself increases the risk of bleeding. An excess of bleeding may impair the use of supporting devices that can be helpful for weaning from bypass. Extracorporeal membrane oxygenation devices have been proved to be useful in similar cases as our patient [11]. We decided not to use an extracorporeal membrane oxygenation device in our patient mainly for two reasons: First, the excess of bleeding that we were having in the surgical field. We do not think bleeding could have been controlled in the Intensive Care Unit with an extracorporeal membrane oxygenation device. Secondly, after more than 12 h of right ventricle myocardial infarction, the changes of recovering right ventricle function were really low.

We are aware that total coronary ostium rupture is an extremely rare condition which is very difficult to think of and that it cannot be easily diagnosed using standard CT definition. Total coronary artery disruption due to a type A aortic dissection is an uncommon event and it is associated with a very high mortality. According to European guidelines [1], when a coronary artery is dissected during ascending aortic dissection, either a coronary ostia repair or bypass should be attempted. Neri et al. described three main types of coronary lesion due to proximal dissection in 24 patients [7]. Type A lesion is defined as an aortic dissection with a false lumen that involves the coronary ostium causing malperfusion. A type B lesion is defined as the presence of the false lumen that extends into the actual body of the coronary artery causing luminal compression and subsequently malperfusion. Type C was described as a circumferential detachment with an inner cylinder intussusception. In the Neri group experience type C lesion occurred in 38% (9 out of 24) of their patients. However it is not described in their series a total right coronary artery disruption in any case. In a more recently published paper Kreibich et al. [8] describes their experience in a similar population sample. They recommend coronary artery bypass in all type C lesions or in patients with underlying coronary artery disease. Kawahito et al. published their experience in a series of 12 patients and recommended CABG repair in all of them [9]. Despite Neri group recommendation of doing an ostial repair whenever possible, an ostial repair it can be really demanding in type C lesions. The more simple technique of doing a bypass graft with a saphenous vein it is less time consuming and much easier to perform.

In none of these patients the authors describe the complete eversion of the right coronary ostia into the aorta lumen [7-9]. In

our patient performing a bypass to the right coronary artery was not very helpful, probably because of the elapsed time between patient admission to the emergency department and surgical time, which led to an irreversible right ventricle dysfunction.

Maybe a total and complete disruption of coronary ostia is one step further in coronary lesion due to proximal aortic dissection. Doing an ostial repair in our patient would have been almost by sure a failure. More cases need to be reported but we might consider than a total ostia rupture with coronary eversion could be classified as a type D lesion.

Although the idea of the RCA being occluded during a type A aorta dissection is not unique the picture of the RCA ostia eversion is indeed new.

## Conclusion

Complete rupture of the coronary ostia is a rare event in an acute aortic ascending dissection. Malperfusion coronary syndromes in aortic dissection are a very serious disease with a high associated mortality.

We have presented a complete rupture of the right coronary artery. The right coronary ostia were everted and protruding inside the aorta lumen. We could also observe protruding the endothelium of the proximal right coronary artery itself. This suggests one step further in coronary lesion due to proximal dissection. We recommend a bypass graft in these cases as an ostial repair may be extremely challenging.

Prompt diagnosis is crucial in these patients. Physicians must always keep in mind the possible association between ischemic syndromes and aortic dissection.

## Authors' Contributions

Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; drafting the work or revising it critically for important intellectual content; final approval of the version to be published.

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