



Role of Pericardial Baffle as a Preventative Technique in Blood Loss in Patients Undergoing Complex Aortic Surgery

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Abstract

Unmanageable bleeding in certain aortic surgery cases could be life-threatening and carry a very high mortality. In such cases pericardial baffle is a salvaging operation with excellent results.

Keywords: Aortic surgery; Pericardial baffle; Transesophageal echocardiogram

Introduction

We are presenting three cases which reveal pericardial baffle as a phenomenal way to prevent blood loss and consequently have better postoperative discourse. We believe the decision to use the baffle technique should be made relatively early in order to have satisfactory results. Certain complex aortic reconstructive procedures have extremely high bleeding rates which cannot be managed by routine means: Including packing with sponges, topical hemostatic agents, and blood factors such as factor VII used in our cases. One should be prompted to use the pericardial baffle procedure after initial assessment of the complexity of the case and the patient's history.

What are the complex aortic cases? Redo procedures of the aortic valve, combined ascending aorta replacement (using a hemashield graft), certain type-A dissections of the aorta, as well as cases of aortic valve endocarditis are examples of cases in which a physician should be prompted to consider the pericardial baffle procedure.

These complex cases are very lengthy and are associated with long cardiopulmonary bypass time, hypothermic circulatory arrest, and are often associated with catastrophic coagulopathy. In complex aortic reconstruction cases, the cardiopulmonary bypass time is already long and a second pump run to enforce the suture line carries a higher morbidity and mortality rate [1].

Pragmatically, if a discrete bleeding site cannot be found or if suturing is not proving to be sufficient the baffle procedure would be the most logical solution.

Case Presentation

Case 1

A 64 year-old white gentleman who had bicuspid aortic valve stenosis and an ascending aortic aneurysm underwent an aortic valve replacement, with number 25 magna ease, and aneurysm repair with number 32 hemashield dacron tube graft in 2015. The patient did well until March 2018 when presented with acute bioprosthetic endocarditis with two cerebrovascular accidents. The patient had a history of ongoing psoriasis, seborrheic dermatitis and was on Immunosuppressants. The patient also had a heavy drinking history until this admission. The patient received six weeks of IV antibiotics. His Transesophageal Echocardiogram (TEE) revealed his bioprosthetic valve was rocking with severe paravalvular regurgitation.

The patient underwent a redo median sternotomy and cannulation of the right femoral vein and artery to facilitate intrapericardial dissection. The adhesions were very dense and after clamping an aortic tube graft, cardioplegia was given through a retrograde cannula into the coronary sinus. A slit was made through the Dacron tube graft. The valve was practically hanging with a few sutures which were cut and removed. An out-pouching under the left main coronary and a wind sac in the non-coronary sinus towards the left atrium were present. After debridement of aortic annulus, the wind sac was removed and repaired. We chose number 29 freestyle root. This valve was sewed in a subcoronary manner with 4-0 prolene. Along with this, the out-pouching under the left main and wind sac were closed off, followed by the closure of the aortotomy and the removal of the cross clamp.

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After coming off the cardiopulmonary bypass, we gave protamine and since we had continuous bleeding all around the aorta we gave platelets and coagulation factors such as FFP cryoprecipitate and factor VII. Bleeding, however, continued even as we waited long enough. To control bleeding a bovine pericardium was sewed to surrounding tissues using a 4-0 prolene to close off the bleeding around the aorta. A 10 mm hemashield graft was also sewed to an opening on pericardial baffle using a 5-0 prolene and the other end was sewed to right atrium.

The field was dry and we were able to close the chest. The patient was extubated six hours later and after one day at ICU stay was transferred to the cardiac floor. The patient was discharged on fifth postoperative day while his TEE revealed no shunting on discharge.

Case 2

A 78 year-old gentleman, who was taking steroids, presented acute onset chest pain and was diagnosed with type-A aortic dissection. He underwent heparinization, right femoral arterial cannulation, median sternotomy, and right atrial cannulation. He was placed on cardiopulmonary bypass and later cooled down. A vent cannula was inserted through the right superior pulmonary vein and a cross clamp was then applied. Cardioplegia was given retrogradely and the ascending aorta was removed. We noticed the aortic valve was calcified and the tissue was extremely poor; therefore to have a better control of bleeding the decision was made to use a full root replacement using 21 mm freestyle porcine root. This resulted in our re-implantation of the coronaries. Since the dissection was extended to the arche, the patient was cooled to 20 degrees centigrade and circulatory arrest was achieved. We performed a hemiarch replacement and a graft was sutured to the descending aorta with head vessels anastomosed to the arche graft. Circulation was returned back to normal and re-warming was restarted. Finally the arche graft was anastomosed to a freestyle root and after de-airing the cross clamp was removed. Bleeding, however, did not subside with protamine and numerous blood product transfusions. The decision to do the baffle procedure was made and a 4-0 prolene was used to close off transverse sinus. This contained the area around the aorta and connected the baffle to atrium in the same manner observed in the first case. The baffle procedure dried up the area and the patient's postoperative course was seemingly uneventful.

His CT angiogram revealed small patent shunting, however the patient felt well, did not wish to have any intervention, and left the hospital on seventh postoperative day.

Case 3

A 45 year-old gentleman with a history of chronic renal disease, thirty years of smoking, and morbid obesity arrived to the emergency room due to six hours after his onset chest pain. A CT scan revealed a type A dissection of the aorta extending into abdominal aorta and he appeared to be anuric and hypotensive. Immediately taken to the operating room on vasopressors, we administered heparin and went for crash cannulation. Median sternotomy was completed while cannulation of the right femoral artery achieved. Upon entering the pericardium, clots and blood gushed out and blood pressure rose which suggested tamponade. Cardiopulmonary bypass started, cooling was initiated, and the left ventricular vent was inserted. An aortic cross clamp was applied and retrograde cardioplegia was given. A composite graft was given as was a re-implantation of the coronaries. The extent of the dissection had practically denuded the

adventitia from the coronary arteries, but our judgment deemed it sufficient enough to have coronary buttons re-implanted. A distal section of the hemashield graft was anastomosed to the beginning of the arche after it was fortified by applying bioglue and we noticed the patient's weak tissue. After the cross clamp was removed we had to clamp the aorta a few times to place repairing sutures. The right coronary attachment fell apart due to the poor tissue quality, thus necessitating a right coronary ligation and bypass of the right coronary artery with reversed saphenous vein. At this point we had six hours of cardiopulmonary bypass time and after coming off and giving all blood products the patient still had remarkable bleeding. Blood pressure was maintained yet the decision to reduce bleeding was not made soon enough; the baffle procedure dried up the field, but the patient did not do well due to profound shock and acidosis. Ultimately the family made the patient DNR and the patient succumbed to death.

Discussion

The creation of pericardial baffle to right atrium was first described by Cabrol et al. [2]. Since then, many modifications have been described by Salerno et al. [3], Elefteriades et al. [4], Hoover et al. [5] and Blum et al. [6].

In re-do cases with acute dissection of ascending aorta, the rate of serious bleeding is high, therefore some surgeons use Cabrol fistula more commonly for these kinds of cases, Estrera et al. [7].

What has been noted, relatively consistently, is that pericardial baffle changes an uncontrolled bleeding field immediately into a dry one. Surprisingly, the complications of the baffle procedure are rare or negligible and in most of cases the fistulas clot off.

Identifying patients, who are undergoing aortic reconstruction, that are higher at risk for excessive bleeding is imperative [8]. The basic technique for the creation of baffle begins with the sewing of an autologous or bovine pericardium to native pericardium around the aorta. In doing so, it is advised to close the transverse sinus at the onset. This should be done by re-approximation of the right pulmonary artery to the dome of left atrium, before aortic reconstruction is commenced: Seeing as this would be difficult to do post reconstruction. In our cases, baffle was not intended at the start, but it was done at the end in hopes to salvage the patients. The purpose of the baffle creation is to let the clot seal most of the bleeding sites and shunt the shed blood back into circulation: thus, diminishing blood transfusion and consequently decreasing bacterial endocarditis [9], prolonged ventilation, morbidity and mortality [10]. We believe the baffle procedure is a creative tool for autotransfusion, prevention of blood loss, and other consequences that follow.

Short and long term side effects of this procedure are early clotting of the shunt as well as persistent shunting. In the majority of the cases shunts will clot. The cases in which persistent shunting remains asymptomatic it is rare to need any intervention or reoperation. In our cases, however, only one had persistent and an asymptomatic shunt.

In Mancini [11], 1999 series, 260 patients had prophylactic pericardial baffle, three cases had persistent flow, and only two of the three cases needed reoperation. Hoover et al. [5] reported nine cases of shunt creation without any death; of those, two had patent shunt and one needed reoperation. In our cases, we closed off the structures neighboring the aorta by suturing bovine pericardium over these

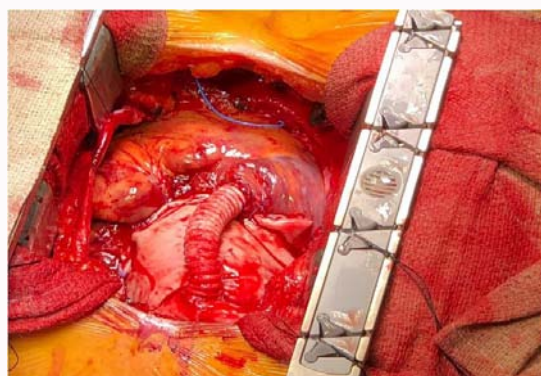


Figure 1: The structures neighboring the aorta by suturing bovine pericardium and connecting the closed-off space to right atrium.

structures and connecting the closed-off space to right atrium (Figure 1). This technique is what has been described by Posacuglu et al. [1].

In seven cases who underwent type A aortic dissection repair, Posacuglu et al. used autologous or bovine pericardium. In Posacuglu's series, there was no patent shunt on discharge TEE or CT scan. Complications of this procedure are early thrombosis, bleeding, and persistent patent shunt. Right heart failure is an unsubstantial concern and there are no reported cases of reoperation for that reason. In Toole's [8] series there were six patients with persistent fistulas but only one needed re-intervention.

Mortality in this subset of patients is very high but baffle procedure reduce that. Toole et al. [8] reported their observed mortality to be 4% in the baffle group compared to 6% in the group that underwent aortic surgery. This observation suggests that via use of the baffle technic one could equalize the mortality between the higher risk group and lesser risk group. In Toole's series, they were able to close the chest in 74% of the patients. In baffle group, prolonged ventilation had a higher rate while incidence of postoperative renal failure, stroke, and reoperation for bleeding and mediastinitis was similar. In a subset of very high risk aortic reconstruction, mortality could be in range of 22% to 57%.

It is our observation, however, that the baffle procedure has saved two of our presented cases. There are two cases which we believe would have done very poorly without baffle procedure. In our third case who did not survive, we should have decided earlier to do the baffle to prevent blood loss and ultimately avert the loss of the patient. Baffle not only decreases mortality, but also cuts down on morbidity. It is our belief that baffle diverges from possible devastating postoperative outcomes and allows for a more successful outcome.

Conclusion

Unmanageable bleeding in complex aortic surgery is not uncommon. Serious bleeding does not respond to ordinary measures and ultimately carries a very high mortality and morbidity. A periaortic pericardial baffle in such cases is lifesaving, and lessens mortality and morbidity rates to more normal levels. It is very prudent to predict the severity of the post-cardiopulmonary bypass bleeding at the onset of the operation and to consider pericardial baffle as a preventative technique.

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