Case Reports

Mycotic Ascending Aortic Pseudoaneurysm

Secondary to Pseudomonas Mediastinitis at the Aortic Cannulation Site

Dionisios Vrochides, MD, PhD
William C. Feng, MD, PhD
Arun K. Singh, MD

During the last 5 years, postoperative Pseudomonas mediastinitis has occurred in 2 of the 3,072 patients in our institution who have undergone cardiopulmonary bypass cardiac operations via a sternotomy. To our knowledge, there is no prior report in the English-language literature of postoperative Pseudomonas mediastinitis that originated at the aortic cannulation site, yet that was the site of origin in both of these patients.

The 1st patient developed a mycotic pseudoaneurysm of the ascending aorta at the cannulation site, secondary to the development of Pseudomonas mediastinitis following aortic valve replacement. This sequela was successfully treated by means of aneurysmectomy and closure of the aorta with a bovine pericardial patch, under cardiopulmonary bypass with circulatory arrest. The 2nd patient developed pseudoaneurysm and perforation of the aorta at the cardioplegia needle site, secondary to Pseudomonas mediastinitis following aortic and mitral valve replacement. This patient died. In both patients, the cannulation site and the cardioplegia needle site had been closed with pledgeted sutures. Pseudomonas aeruginosa *was cultured from both sites.*

Once the diagnosis of Pseudomonas mediastinitis is made following heart surgery, the patient should undergo reoperation, if possible, for removal of the foreign bodies (pledgeted sutures). In addition, these patients should be monitored with chest magnetic resonance angiography every 3 months for 7 year, in order to diagnose early development of a mycotic pseudoaneurysm and subsequent complications. ***(Tex Heart Inst J 2003;30:322-4)***

Pseudomonas mediastinitis following open-heart surgery is a rare occurrence.[1] We report our experience with the surgical treatment, outcome, and management of 2 patients who developed postoperative Pseudomonas mediastinitis that originated at the aortic cannulation site.

Key words: *Aneurysm, false; mediastinitis/ prevention & control; Pseudomonas aeruginosa; pseudomonas infections; surgical wound infection/ pathology*

From: *Rhode Island Hospital, Division of Cardiothoracic Surgery, Brown University School of Medicine, Providence, Rhode Island 02903*

Address for reprints:
Arun Singh, MD,
2 Dudley St., Suite 470,
Providence, RI 02903

E-mail: asingh@lifespan.org

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Patient 1

A 70-year-old man with a history of diabetes mellitus type 2, hypertension, and chronic obstructive pulmonary disease presented with congestive heart failure. He was diagnosed with critical aortic stenosis. Cardiac catheterization revealed a gradient across the aortic valve of 65 mmHg, a valve area of 0.8 cm^2, an ejection fraction of 0.60, and normal coronary arteries. Subsequently, he underwent aortic valve replacement with a 23-mm bovine pericardial valve (Carpentier-Edwards Perimount RSR Pericardial Valve Prosthesis 2800, Edwards Life Sciences; Irvine, Calif). He had a benign immediate postoperative course.

However, on the 3rd postoperative day, he developed serous drainage from the sternum, a temperature of 38.4 °C, and an elevated white blood cell count. Wound cultures were positive for *Pseudomonas aeruginosa,* and he was started on intravenous (IV) ciprofloxacin. Three days later, the patient was still febrile. Blood cultures were positive for *P. aeruginosa.* He was taken to the operating room, and the sternal incision was opened. The gross appearance of the wound was normal. The mediastinum was drained, débrided, and closed primarily. Subsequently, the wound healed well, temperatures defervesced, and blood cultures became negative. The patient was discharged from the hospital on IV gentamicin for 6 weeks. At the end of the antibiotic course, his surveillance blood cultures remained negative.

The patient did well for 3 months. Then he presented again with shortness of breath, shaking chills, and an elevated white blood cell count. The sternal incision was clean, dry, and healthy. Chest radiography showed clear lung fields. Repeat blood cultures were again positive for *P. aeruginosa.* He was started on IV ceftazidime, tobramycin, and vancomycin. Over the next 24 hours, the temperatures defervesced, and blood cultures became negative. A transesophageal echocardiogram, which was done to rule out endocarditis, showed no vegetations and a normal, functioning aortic valve. A full body computed tomographic (CT) scan showed an anterior mediastinal mass. The subsequent chest magnetic resonance angiogram (MRA) revealed a 3-cm, mycotic pseudoaneurysm of the ascending aorta.

The patient underwent reoperation with the use of cardiopulmonary bypass and hypothermic circulatory arrest. The mycotic pseudoaneurysm of the ascending aorta arose from the initial aortic cannulation site, which was originally closed with 3-0 pledgeted, polyester-polytetrafluoroethylene (PTFE) sutures. The aortic wall surrounding the pseudoaneurysm looked infected. The pseudoaneurysm and the infected aortic wall were excised to healthy margins. The aortic wall defect was closed with a bovine pericardial patch (Edwards Life Sciences; Irvine, Calif), and with the use of 4-0 polypropylene sutures. The patient's postoperative course was benign. Subsequent blood cultures were all negative. Cultures of the sac and of the aortic wall near the pledgeted sutures were positive for *P. aeruginosa.* The histologic report on the aortic wall indicated that there had been a loss of elastic tissue. The patient was discharged from the hospital on IV ceftazidime and tobramycin for 6 weeks.

Thirty-eight months after the last operation, the patient continues to enjoy good health, without any evidence of recurrent infections.

Patient 2

A 68-year-old woman with a history of rheumatic heart disease and hypertension presented with decreased exercise tolerance and shortness of breath. Cardiac catheterization revealed severe aortic and mitral stenosis, pulmonary hypertension, an ejection fraction of 0.50, and normal coronary arteries. Subsequently, she underwent aortic and mitral valve replacement using bovine pericardial valves (respectively: 21-mm Carpentier-Edwards Perimount RSR Pericardial Valve Prosthesis 2800; and 29-mm Carpentier-Edwards Perimount RSR Pericardial Valve Prosthesis 6900). She was extubated during the 4th postoperative hour, her cardiac index was constantly greater than 3 L/min/m^2, and she was moved out of the intensive care unit (ICU) on the 1st postoperative day.

However, on the 2nd postoperative day, she rapidly became confused, agitated, hypoxemic, and hypotensive, with low urine output, but still afebrile. She developed lactic acidosis and a positive diffuse intravascular coagulation (DIC) screen, with a normal white blood cell count. Serum amylase and lipase levels were normal. She was moved back to the ICU and was re-intubated. Dopamine, norepinephrine, and inamrinone were required in order to maintain adequate cardiac function and blood pressure. A transesophageal echocardiogram revealed no evidence of aortic dissection or pericardial effusion, no vegetation, normally functioning aortic and mitral valves, and an ejection fraction of 0.35. An abdominal CT scan with contrast agent showed normal visceral perfusion with no evidence of bowel ischemia. The patient was started on IV gentamicin and vancomycin.

On the 3rd postoperative day, the patient became febrile, continued to require large doses of inotropic agents, and remained acidotic with thrombocytopenia and a positive DIC screen. She also developed acute tubular necrosis, with rising creatinine levels. The results of blood cultures (which had been sent to the laboratory on the 2nd postoperative day) were positive for *P. aeruginosa.* At this point, the sternal wound was partially opened at the bedside and was found to be foul smelling and necrotic. The Gram stain was positive for gram-negative rods. She was immediately taken to the operating room, and the entire sternal wound was opened. She had extensive tissue necrosis that extended to both breasts, to the subcutaneous tissue of the chest wall and the upper abdomen, and to the mediastinal fat. Radical debridement and lavage were performed. The mediastinum was drained with chest tubes. The sternal bone looked healthy and was closed primarily. Subcutaneous tissues were left open. Wound cultures and blood cultures were all positive for *P aeruginosa.*

Postoperatively, the patient was placed on IV ciprofloxacin, gentamicin, and meropenem. The mediastinum was continuously irrigated with weak, povidone iodine solution for 4 days.[2] Daily debridement of the chest and abdominal wall, together with local wound care (sulfamylon dressings with tobramycin beads), was performed for 10 days. Slowly, the patients pulmonary, cardiac, and renal function improved, and gradually the doses of inotropic and diuretic agents were reduced. The sternal wound started to granulate. Laboratory values were all normal, and repeat blood cultures were negative.

On the 17th day after the initial operation, chest wound reconstruction was performed with use of bilateral pectoral muscle and right rectus muscle flaps. The patient was extubated, had a benign postoperative course and normal chest radiographs, and was doing quite well.

On the 31st postoperative day, the patient suddenly developed respiratory distress and required intubation, and she became hypotensive and unresponsive to resuscitation. Repeat chest radiography revealed a wide mediastinum and a large left hemothorax. Placement of a left chest tube immediately yielded 500 cc of fresh blood, and the patient died.

The autopsy showed a large hematoma of the anterior mediastinum and a left hemothorax. There was a 6-mm necrotic perforation of the ascending aorta at the cardioplegia needle site. This was originally closed with 3-0 pledgeted, polyester-PTFE sutures. The aortic and mitral valves looked normal. Postmortem cultures of the mediastinum and the valves were negative. In contrast, postmortem cultures of the aortic perforation and cardioplegia needle sites were positive for *P. aeruginosa.* Histologic examination of the aortic wall showed necrotic tissue infiltrated with polycytes, with loss of elastic tissue.

Discussion

Infectious mediastinitis after median sternotomy is a rare but highly morbid complication.[3] *Pseudomonas aeruginosa* is responsible for 0 to 37% of these deep sternal wound infections.[4] Rarely, clusters of cases of postoperative Pseudomonas mediastinitis have been traced to specific surgeons or scrub nurses, who were shedders of the bacteria.[5] However, to our knowledge, there is no report in the English-language literature of postoperative Pseudomonas mediastinitis that originated at the aortic cannulation site. The treatment of any type of postoperative mediastinitis always involves the removal of all foreign materials.[6]

During the last 5 years, 3,072 cardiopulmonary bypass cardiac operations have been performed at our institution, via a sternotomy. The rate of mediastinitis at our institution following this type of operation was 1.1%, a number that is within the 1% to 6% range reported in other studies.[7] Of the 33 cases of mediastinitis that were observed on our service, 2 (6.1%) were caused by *P. aeruginosa.*

In both of our patients, the morbidity and death was due to disruption in the aortic wall, which led to the formation of pseudoaneurysms and subsequent rupture. The histologic examination of the aorta revealed a loss of elastic tissue of the infected aortic wall. At the same time, Pseudomonas was cultured from the aortic cannulation and cardioplegic sites. This observation is in concert with previous experimental studies, which attribute vascular elastic-tissue loss to the properties of an enzyme (elastase) excreted by *P. aeruginosa.*[8] In both of our patients, braided, pledgeted sutures acted as a nidus for bacteria, which were continuously releasing the enzyme elastase that eventually destroyed the aortic wall.

On the basis of others' observations and our own experience, we propose that whenever, after open-heart surgery, the diagnosis of Pseudomonas mediastinitis is confirmed, the patient should be returned to the operating room. All foreign bodies (that is, pledgeted sutures in the aortic wall) should be replaced with biological patches and monofilament sutures, if possible. In addition, we recommend that patients with this diagnosis be monitored with chest magnetic resonance angiography every 3 months for 1 year, in order to diagnose early the development of a mycotic pseudoaneurysm.

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