

Pulmonary Artery Hemorrhage Following Removal of Pulmonary Artery Catheter

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ABSTRACT

- Although pulmonary artery (PA) injury during PA catheter removal is rare with an incidence of 0.2%, the mortality rate can be as high as 65%.
- This makes it a very serious complication that should be promptly identified and addressed.
- Here we present the case of a PA hemorrhage that was able to be repaired after the patient was placed on cardiopulmonary bypass.

BACKGROUND

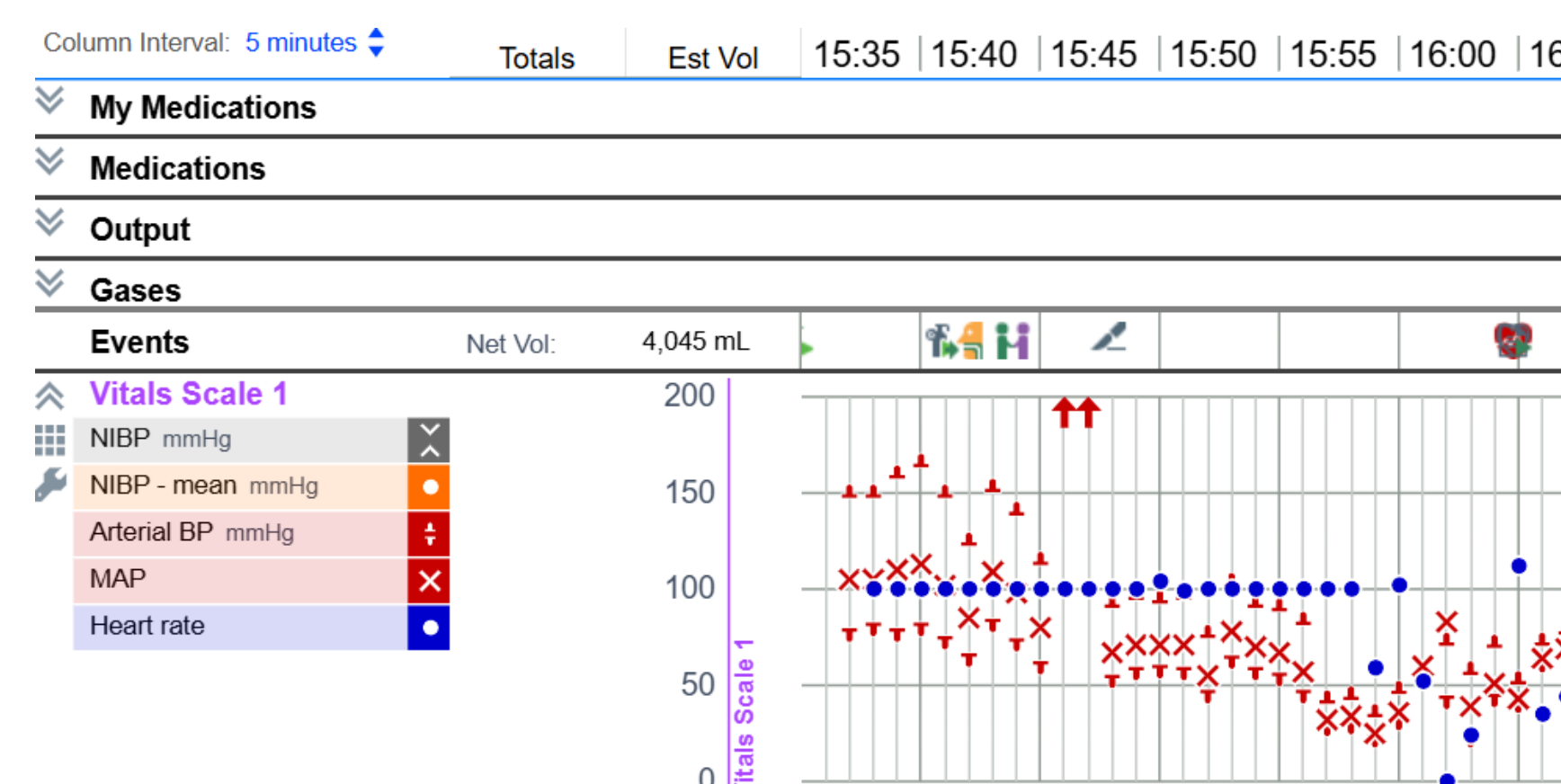
- The development of the pulmonary artery (PA) catheter in 1970 and its subsequent widespread implementation has revolutionized bedside and intraoperative hemodynamic monitoring.
- PA catheterization is a procedure in which a catheter is placed via a central vein and advanced until the tip of the catheter is in the pulmonary artery. This allows for various helpful estimations to the provider, such as cardiac output, right sided filling pressures and vascular resistance.
- Despite controversy in the literature over whether PA catheters improve patient outcomes, they are still widely used in cardiac surgery and in some critical care units.
- The placement, maintenance, and removal of PA catheters carries significant risks. One of these, as mentioned, is a PA hemorrhage during manipulation of the catheter. The high mortality in PA hemorrhages arises from the possible rapid hemodynamic instability and from compromise of the uninjured lung in the setting of bleeding, leading to asphyxiation.

CASE DESCRIPTION

- A 67-year-old female status post heart transplant for dilated nonischemic cardiomyopathy had a PA catheter placed intraoperatively.
- On postoperative day 7, the critical care team attempted to remove the PA catheter. However, resistance was met with multiple removal attempts. A chest X-ray was obtained to see if any abnormalities could be seen but was unrevealing. When the catheter was finally removed, there was a noted defect on the catheter distally.
- Significant sanguineous chest tube output was noted. The patient was promptly transferred to the operating room for a suspected PA hemorrhage while being actively transfused. The patient was hemodynamically stable during transfer and alert and oriented. On arrival to the OR, the chest tube output was noted to be 600 mL.
- The patient was intubated with a single lumen endotracheal tube with use of a video glidescope. A clip in triple lumen catheter was placed in the existing right internal jugular introducer site.
- During mediastinal exploration, bleeding was noted from the pulmonary artery posterior to the aorta, at the site of the pulmonary artery anastomosis. The patient became more hemodynamically unstable, requiring initiation of vasopressin and norepinephrine while being actively transfused.
- Given inadequate exposure and profuse bleeding, it was not possible to initially stitch the defect and the decision was made to heparinize and place the patient on cardiopulmonary bypass with an aortic arterial and right atrial venous cannulation.
- The PA tear was repaired with pledgeted stitches, and the patient was weaned off cardiopulmonary bypass with minimal inotropic support.
- Throughout the case, given blood loss and ensuing coagulopathy, patient required 5 units of packed red blood cells, 2 units of cryoprecipitate, and 3 units of platelets. In addition, she received 758 mL of Cell Saver and 601 mL of autologous whole blood.
- Transesophageal echocardiogram showed appropriate left ventricular function with mild right ventricular dysfunction.
- On return to the critical care unit, inotropes were weaned off and she was transferred to the progressive care unit 6 days later. She had a prolonged hospital course for several months in the setting of acute on chronic kidney injury, chronic gastrointestinal bleeding, delirium, and multiple other complications. However, she did not have any further episodes of pulmonary artery hemorrhage.

FIGURE 1

Timeline of hemodynamics from induction to transition to cardiopulmonary bypass. Time from induction of anesthesia to cardiopulmonary bypass was 24 minutes. Patient became more hemodynamically unstable upon chest opening following skin incision.



DISCUSSION

- Here we present a case of PA hemorrhage following PA catheter removal, a rare but life-threatening complication of PA catheter use.
- There is increased risk of PA hemorrhage with PA catheters with increased age, female sex, pulmonary hypertension, hypothermia, and anticoagulation therapy. Our patient's age, sex, and maintenance of the PA catheter postoperatively could have all contributed to her hemorrhage. In addition, given that the defect on mediastinal exploration was found to be at the site of the pulmonary artery anastomosis, this more friable vasculature was likely more susceptible to trauma from the catheter.
- In order to manage a PA hemorrhage, it is of utmost importance to identify it, restrict blood flow to the affected pulmonary vasculature, and repair the defect promptly. The presentation can range anywhere from mild hemoptysis to severe hemorrhage with hemodynamic collapse. The site of injury is most commonly along the right pulmonary artery and its lobar branches, but injury to the left side can also occur. Isolation of the affected lung with a double lumen tube or bronchial blocker can be life-saving when intratracheal hemorrhage is suspected and the affected lung can be identified. However, identification of the injured lung can prove to be difficult with massive hemorrhage despite the use of suctioning and bronchoscopy. In our case, given the site of injury was unknown at the time of induction and the goal was to initiate cardiopulmonary bypass as quickly as possible, the decision was to proceed with a single lumen tube.
- In patients with suspected PA hemorrhage, patient hemodynamics and imaging such as chest x-ray and CT can help determine whether conservative or aggressive management should be performed. Surgical management is recommended in hemodynamically unstable patients, recurrent hemorrhages, and in suspected pulmonary artery pseudoaneurysms that pose a higher risk of rupture.
- Strategies to mitigate the risk of PA hemorrhage with PA catheters include placing these monitors in selective patients while considering their risk factors, minimizing manipulation, and placing the catheter tip properly in the pulmonary artery. In our patient, prior to catheter removal, further exploration beyond a chest x-ray could have been performed with CT to determine the site of the PA catheter and whether any abnormality could be seen.

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