

Successful Management of Helium Gas Embolism Following Intra-Aortic Balloon Pump Rupture

Sarah L. Scholl P.A.-C, Michael P. Hutchens, M.D., Howard K. Song, M.D.
 Departments of Anesthesiology and Peri-Operative Medicine and Cardiothoracic Surgery
 Oregon Health and Sciences University, Portland, Oregon

Introduction

Intra-aortic balloon pump (IABP) rupture is an uncommon occurrence. Early recognition and intervention can minimize patient complications.

Case

A 67 year old woman was admitted to ICU following multi-vessel coronary artery bypass grafting (CABG) and resection of an aortic valve tumor complicated by failure to separate from cardiopulmonary bypass. An IABP was placed intraoperatively for management of post cardiomy shock (Datascope System 98XT IABP, 8 French 30 ml Arrow Narrow Flex balloon catheter). The early post operative course was complicated by continued cardiogenic shock requiring the IABP and multiple vasoactive agents, and ventilator dependent respiratory failure. The IABP was confirmed in proper position by daily morning chest radiography. Early on post operative day #2, the patient suddenly moved her leg. Blood was noted in the gas line and the gas loss alarm sounded. The IABP was removed immediately. Inspection of the balloon revealed a small tear.

On exam, the patient was unresponsive. The dose of epinephrine was increased to increase blood pressure and cerebral perfusion pressure (CPP) and to compensate for the loss of IABP augmented cardiac output. After 20 minutes, the patient began moving her left side. 40 minutes after the initial event, the patient was increasingly responsive and shaking her head to questions. She was moving her left upper and lower extremities, but right hemiparesis persisted. Two hours after the event, she was able to move all four extremities and was alert and oriented. By four hours after the event, no neurologic deficit could be elicited on exam.

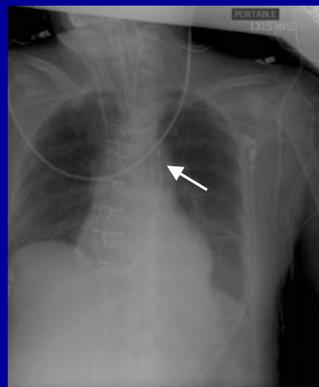


Figure 1: Morning CXR showing proper IABP tip position (arrow).

Discussion

The IABP is a circulatory assist device used to increase myocardial oxygen delivery, cardiac output and coronary blood flow by counterpulsation. Blood is displaced into the proximal aorta by inflation during diastole. Aortic volume and afterload are reduced by rapid deflation during systole (4).

The IABP is used in cardiogenic shock, difficulty to wean from cardiopulmonary bypass, and as prophylaxis for patients with severe left main coronary artery disease or critical aortic stenosis who are pending surgery (2,4).

Helium gas is used as the shuttle gas in the IABP because its low density facilitates balloon cycling. However, its low solubility in blood can prolong ischemia distal to embolized gas bubbles. Helium has been shown to be more lethal than carbon dioxide when embolized (7). Treatment options include hyperbaric oxygen or increasing cerebral perfusion pressure with pressors. Our patient was too ill to transport to a hyperbaric oxygen chamber. We chose to use pressors to increase mean arterial pressure and cerebral perfusion pressure.

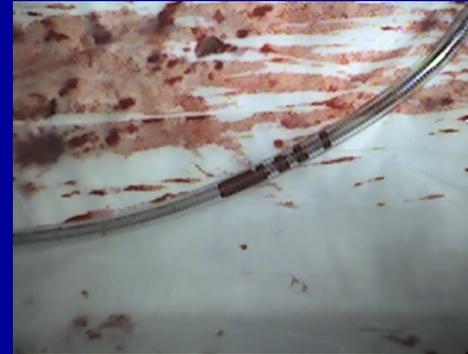


Figure 2: Blood in IABP gas lumen (shown after removal)

Review of the literature revealed several studies with large cohorts of IABP treated patients. The reported complication rate in recent series varies from 3-7% (5,8).

Vascular complications of IABP are well described, including ischemia to the limb distal to the insertion site, arterial dissection or aneurysm, and distal thromboembolism causing ischemic sequelae. The IABP may transiently occlude renal or spinal artery blood flow causing ischemic injury to these areas as well (3). Vessel laceration and/or dissection may occur during insertion. Life threatening retroperitoneal hemorrhage from laceration of the femoral artery has been described (3).

Cerebral vascular accident (CVA) is a rare complication. CVA can result from proximal placement or migration of the IABP, from IABP induced vascular trauma or thromboemboli(2).

Conclusion

Balloon rupture is a very rare event. It is generally attributed to the balloon being placed or cycling against a calcified plaque. Rupture requires immediate removal. Review of other reported cases suggests that patient movement may be a factor as it appears in the case presented here (1, 6).

IABP is a useful tool in managing post operative cardiogenic shock but is not without risks. Our patient experienced the transient effects of a helium gas embolus from a failed balloon. Early recognition, intervention, and management led to a satisfactory outcome from this rare complication

References

1. Fredrickson JW et al. Arterial helium embolism from a ruptured intraaortic balloon. *Ann Thorac Surg.* 1988 Dec; 46 (6): 690-2
2. Little, Cindy. Your guide to the intra-aortic balloon pump. *Nursing.* 2004; 34::321-322.
3. Myers GJ et al. Fracture of the internal lumen of a Datascope Stat-DL balloon resulting in stroke. *Ann Thorac Surg* 1994; 57:1335-7.
4. Oberwalder P: Intra-Aortic Balloon Pump (IABP) Counterpulsation; Theory And Clinical Applications. *The Internet Journal of Thoracic and Cardiovascular Surgery* 1999; Vol2 N2: <http://www.ispub.com/journals/IJTCVS/Vol2N2/iabp.htm> ; Published July 1, 1999; Last Updated July 1, 1999. Accessed January 28, 2008
5. Patel, JJ et. al. Prospective evaluation of complications with percutaneous intraaortic counterpulsation. *Am J Cardiol* 1995; 76:1205.
6. Tretjak, Martin et. al. Cerebral and coronary gas embolism from the inhalation of pressurized helium. *Crit Care Medicine* 2002. 30:1156-7.
7. Wolf JS et al. Gas embolism: helium is more lethal than carbon dioxide. *J Laparoendoscopic Surgery* 1995. 4 :173-177
8. Ferguson JJ et al. The current practice of intra-aortic balloon counterpulsation: results from the Benchmark Registry. *J Am Coll Cardiol.* 2001 Nov 1;38(5):1456-62.