

Management of Intra-Aortic Balloon Pump Rupture and Entrapment

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Abstract

While the intra-aortic balloon pump (IABP) itself has many useful and life-saving indications, it has a high complication rate, up to 30% in some studies. This report discusses the surgical removal and subsequent vascular repair in a patient with a ruptured and subsequently entrapped IABP and reviews the literature on the presentation and management of this rare but major complication.

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Key Words

Intra-aortic balloon pump • Entrapment • Aorta

Introduction

The intra-aortic balloon pump (IABP) provides mechanical hemodynamic support and improves coronary perfusion, making it a valuable tool for cardiac surgeons in the postoperative setting [1]. However, it is also associated with a high complication rate of up to 30%, with patients experiencing fever, thrombocytopenia, limb ischemia, bleeding, and entrapment [2]. IABP entrapment is a rare but major complication with a described incidence of less than 2% [3-5]. In this report, we present the case of a patient with a ruptured and entrapped IABP that required emergent removal and subsequent repair of the iliofemoral arteries and review the literature on the presentation and management of IABP rupture and entrapment.

Case Presentation

An 82-year-old female presented to the Royal Melbourne Hospital with symptomatic severe aortic calcific stenosis (aortic valve area 0.5 cm²), moderate-to-severe tricuspid regurgitation, and severe pulmonary hypertension. She underwent an elective bioprosthetic aortic valve replacement and tricuspid valve repair with an annuloplasty ring. The operation was successful and uncomplicated. Two days after the procedure, the patient's cardiac index dropped, and she required increasing doses of inotropes. She was subsequently returned to surgery for suspected cardiac tamponade, but this was not found on re-exploration, and an IABP was inserted for hemodynamic support. One day after placement, the IABP was advanced a further 4 cm, and a correct position was confirmed on chest X-ray. It was noted two days post insertion that the IABP had poor augmentation and therefore the IABP was advanced another 5 cm restoring good augmentation. Blood was noticed in the tubing the next day, and no more deviation in balloon inflation/waveform was noted. An attempt to remove the IABP in the intensive care unit (ICU) was unsuccessful as resistance was felt, and the IABP was thought to have lodged into the right common femoral artery. The patient developed an ischemic right limb, which necessitated urgent surgical removal of the IABP via an extra-peritoneal approach to the right iliac vessels after failed removal through an oblique groin incision



and cut into the common femoral artery. The IABP had ruptured and thrombosed (Figure 1), causing entrapment and dissection of the right external iliac artery, which was repaired by an interposition expanded polytetrafluoroethylene graft (Figure 2). The patient’s recovery following revision surgery was uneventful. Her cardiogenic shock resolved, and after a prolonged stay in ICU for line sepsis and acute kidney injury, the patient was discharged to cardiac rehabilitation and is currently still alive.



Figure 1. Extracted intra-aortic balloon pump with a thrombus in the balloon tip.

Discussion

The use of an IABP has a significant complication rate of 20–30%, with fever and thrombocytopenia being the most common [2]. The main major complications are acute limb ischemia, bleeding, aortoiliac injury, aortic dissection, and thromboembolic phenomena, with entrapment considered a rare complication [2]. Large cohort studies and registries have reported that the incidence of IABP rupture and entrapment ranges within 1–1.7% [3-5].

IABP rupture is probably caused by rubbing of an abrasive aortic plaque against the smooth surface of the balloon. Tears in the balloon have also been attributed to design and manufacturing issues. Entrapment is subsequently caused by the development of a bulky thrombus load inside the ruptured balloon.

Early identification of balloon rupture is pivotal in preventing IABP entrapment postrupture. However, rupture may be hard to detect because often the leakage alarm fails due to tamponade of the ruptured balloon with thrombus, mimicking a functioning

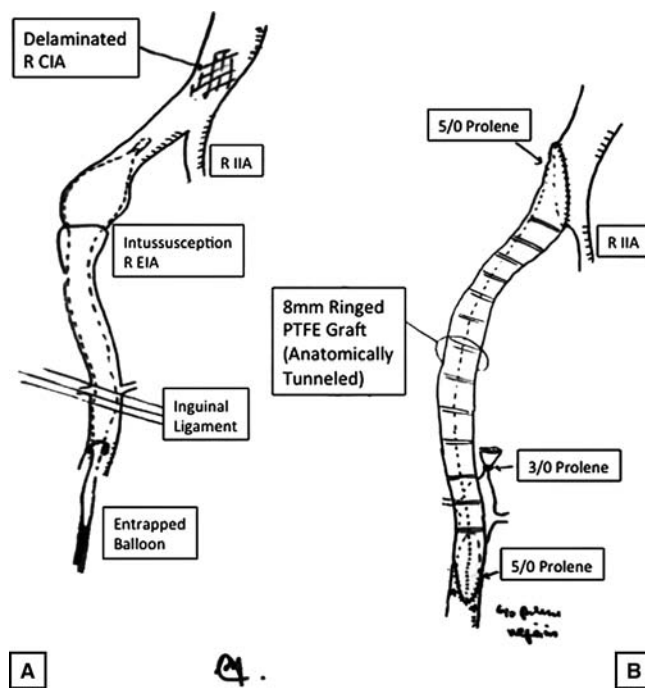


Figure 2. Schematic drawing of intraoperative findings. Entrapped balloon pump in right external iliac artery with delaminated common iliac artery (Panel A). Final repair with iliofemoral bypass interposition graft (Panel B).

balloon [1]. In a cohort study of 2,803 patients, alarms for gas leakage were insensitive for rupture and were only effective in 29% of patients. Device error indicators, loss of augmentation, frequent IABP filling, and blood in the safety chamber or tubing are warning signs of rupture. Blood inside the catheter shaft was the indicator that raised the suspicion of IABP rupture in 80% of patients [4]. Clinically, the presence of limb ischemia and ineffective hemodynamic support should always raise the suspicion of rupture.

Only a handful of case reports have been published on the management of IABP rupture and entrapment in the iliac system. Naturally, the goal of management should be safe removal of the IABP. However, there have been documented cases of forceful extraction resulting in unintentional damage to the external iliac and common femoral arteries [6, 7]. Complications arising from such methods have resulted in acute limb ischemia, the need for bypass surgery, and even death [6].

Both percutaneous and open approaches have been described for the safe removal of the ruptured IABP. Local delivery of streptokinase, urokinase, heparin, or tissue plasminogen activator into the gas-driven lumen of the balloon catheter has dissolved the clot within the IABP lumen, enabling a normal percutaneous extraction of the balloon catheter without surgery [6, 8]. However, an open surgical

approach has been the extraction modality of choice in recent times [6, 8, 9]. Open inguinal access to the femoral and/or iliac vessels is the mainstay approach for removal of the entrapped IABP due to the ease of access and possibility for safe extraction under direct vision, although successful trans- and retroperitoneal approaches have also been described [7, 10]. As in our case, IABP rupture and entrapment often causes substantial damage to the iliofemoral arteries, necessitating vascular repair by endarterectomy, patch closure, or even bypass graft and resulting in significant morbidity for the patient.

In conclusion, balloon rupture and entrapment is a rare complication in patients treated with an IABP, and it is often difficult to detect. Management should be aimed at early rupture detection with a low threshold to remove the IABP before entrapment can occur. In case of IABP entrapment, either percutaneous removal in conjunction with local or systemic thrombolysis or surgical extraction should be performed, followed by repair of the damaged iliofemoral arteries.

Conflict of Interest

The authors have no conflict of interest relevant to this publication.

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