Case report
Successful surgery for perforation of the thoracic aorta caused by the tip of an intra-aortic balloon pump

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Abstract

We describe a case of perforation of the thoracic aorta caused by the tip of an intra-aortic balloon pump. The perforation was confirmed by computed tomography (CT) scan and immediate surgical repair was successful. Vascular injury due to the insertion of an intra-aortic balloon pump is quite common but is predominantly confined to limb ischemia or injury to the femoral or iliac artery. Iatrogenic aortic perforation leading to significant bleeding is much less common and usually fatal. © 1997 Elsevier Science B.V.

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1. Introduction

Intra-aortic balloon pumping (IABP) is the most widely used form of mechanical circulatory support. IABP-related complications are very common with reported incidence rates of approx 25%, ranging from 4 to 45% [1,4,5,8]. The majority of complications consists of leg ischemia due to thrombosis or embolism, other complications include peripheral artery dissection, bleeding, wound infection or balloon rupture. Aortic injury is reported at a rate of 0–4% [1,4,5,8] and is usually confined to the abdominal aorta. We describe the case of a local dissection and perforation of the proximal thoracic aorta caused by the tip of an IABP.

2. Case report

In March 1995, a 69-year-old man received mitral valve replacement and a single-vein coronary bypass to the left anterior descending (LAD) artery for severe degenerative mitral regurgitation and isolated LAD stenosis. Aortic cross-clamping lasted for 79 min, cold cardioplegia was repeatedly applied through the aortic root. Weaning from bypass was not possible due to severe postischemic myocardial dysfunction. An IABP (Datascope 9.5 Fr. PERCOR STAT-DL) was inserted percutaneously through the left femoral artery without any difficulty and advanced to the position previously determined by measuring from the point of insertion to the angle of Louis. IABP pressure support was successful and subsequent weaning from bypass was uneventful. A chest X-ray taken immediately after insertion of the IABP (Fig. 1, top) showed the tip of the IABP was touching the upper contour of the aortic arch. The position of the IABP was not changed. Myocardial
contractility recovered well and the IABP could be removed 24 h after surgery. A second chest X-ray taken shortly before removal showed a slight increase in mediastinal widening and the tip of the IABP could be seen to lie outside the cranial contour of the aortic arch (Fig. 1, bottom). The patient developed sudden severe chest pain 18 h after IABP removal. A chest X-ray (Fig. 2, top) showed a massive increase in mediastinal widening and a large pleural effusion on the left. Aortic dissection was suspected and an emergency CT scan was performed. It showed an extravasation of contrast medium at the level of the left subclavian artery with a large mediastinal hematoma and hematothorax (Fig. 2, bottom). An emergency left thoracotomy was performed.

There was more than 2 l of blood in the pleural space and a large mediastinal hematoma. A perforation of the posterior wall of the aortic wall at the branching off of the left subclavian artery was found. After securing the aorta and the subclavian artery, the defect was repaired with direct sutures and reinforced using armed sutures. The subsequent course was uneventful and the patient was discharged in good condition on the 11th postoperative day. He is still well 1 year after the event.

3. Discussion

Aortic injury is a rare complication of IABP and is reported at a rate of 0–4% [1,4,5,8]. An autopsy study [2] suggests a higher incidence; presumably many cases do not lead to significant bleeding and remain asymptomatic. If symptomatic or followed by perforation, aortic injury is a very serious complication and often fatal [1,3–8]. In our patient, aortic perforation led to significant bleeding into the mediastinum and pleural space and conservative treatment would presumably have been fatal. Our case thus shows that immediate surgery for aortic perforation due to the IABP can be successful.

Aortic damage at the point of branching off of the subclavian artery due to the tip of the IABP has only been reported in one case [7], where the authors suggest that the perforation was caused by the patient sitting up. In the majority of cases where a detailed description of the aortic injury is given, it occurred at the time of insertion and was due to the IABP dissecting the wall of the atherosclerotic femoral or iliac artery near the site of introduction, the tear then continuing up into the abdominal aorta [2,3,6,10]. Our patient was only in the supine position and the chest X-ray taken after insertion showed no sign of aortic perforation (Fig. 1, top). Our case thus serves as a reminder that aortic damage due to an IABP can also occur in the proximal thoracic aorta and that it can occur during use and not only at the time of insertion. In fact, the dissection only became symptomatic 18 h after removal of the IABP. It is worth keeping in mind that dramatic complications of IABP use can occur at a time when the patient may have left the intensive care unit and not be under close observation.

We had introduced the IABP after measuring the distance between the puncture site and the angle of Louis. The chest X-ray taken after IABP insertion (Fig. 1, top) showed its tip clearly lying above the left subclavian artery touching the aortic arch, but no signs of perforation were visible. Since IABP function was good, the balloon position was left unchanged even though it is generally recommended to place the IABP tip below the left subclavian artery. In retrospect, the catheter should immediately have been withdrawn by approximately 3 cm. The second chest X-ray taken shortly before removal of the IABP showed that the tip

Fig. 1. Top: Chest X-ray taken 15 min after IABP insertion. The tip of the IABP touches the aortic arch. No suggestion of perforation. Bottom: Chest X-ray taken shortly before removal of the IABP. There is mediastinal widening and the tip of the IABP can be seen to have perforated the aorta (arrows).
Fig. 2. Top: Chest X-ray taken 18 h after removal of the IABP when the patient developed severe back pain. The mediastinal widening has greatly increased, there is a tracheal shift to the right and a large left-sided pleural effusion. Bottom: CT scan taken immediately afterwards. There is a large mediastinal hematoma with an extravasation of contrast-medium at the left-dorsal aspect of the proximal descending aorta immediately distal to the left subclavian artery. The large hematothorax can also be seen.

had perforated the wall of the aorta but there was no significant effusion or mediastinal widening (Fig. 1, bottom). Only at a time when the patient had become symptomatic did the chest X-ray show clear signs of mediastinal bleeding (Fig. 2, top). Our case reinforces the importance of meticulously checking the correct position of the IABP by chest radiography even if the pump is working properly. Alternately, correct placement can be confirmed by transesophageal echocardiography (TEE) [3,9].

In summary, we present a rare complication of the IABP: perforation of the descending thoracic aorta caused by the tip of an IABP inadvertently advanced beyond the left subclavian artery. The diagnosis was promptly confirmed by CT and the tear successfully repaired. Our case reinforces the importance of carefully checking the position of the IABP by X-ray and shows that perforation, even accompanied by significant bleeding, can be successfully treated surgically.
References


