Aortic thrombosis as a complication of intraaortic balloon

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Abstract

Intra-aortic balloon counterpulsation is often used in critically ill patients with cardiac disease. Commonly accepted indications for its use include cardiogenic shock and mechanical complications of acute myocardial infarction (e.g. ventricular septal defect). The potential benefits of counterpulsation must be weighed against its possible severe thrombotic and hemorrhagic complications. Here we describe a 72-year old female with interventricular septum rupture complicating the course of acute myocardial infarction, in whom the intra-aortic balloon was used to stabilize the circulation prior to the surgery. Despite anticoagulation she developed a thrombus in the abdominal aorta. The risk – benefit ratio and possible ways to predict the complications are discussed.

Key words: infarction, shock, thrombosis, tomography, intraaortic balloon.

Introduction

Intra-aortic balloon counterpulsation (IABP) is the most frequently used mechanical circulatory support. According to ACC/AHA guidelines the principal indications for IABP include: cardiogenic shock, support for high-risk catheterization and angioplasty, mechanical complications of acute myocardial infarction (e.g. ventricular septum rupture –VSD or acute mitral regurgitation), pre-operative support for high-risk cardiac surgery, refractory post-MI angina, weaning from cardiopulmonary by-pass, refractory left ventricular failure, refractory ventricular arrhythmias, intra-operative support during surgery [1]. Contraindications to IABP include severe peripheral vascular disease as well as aortic regurgitation, dissection or aortic aneurysm [1]. The potential benefits of IABP must surpass the risk of its possible complications (bleeding, systemic thromboembolism, limb ischemia and aortic rupture) [2, 3].

Case report

In this paper we describe a 72 year old female with previous history of arterial hypertension and peripheral artery disease (PAD) who was admitted with inferior wall ST-elevation myocardial infarction (STEMI) 48 h after onset of symptoms. On admission she complained of severe shortness of breath and epigastric pain. Electrocardiography (ECG) has shown sinus rhythm with Q waves and approximate 1 mm ST segment elevation in leads II, III and aVF. Acetylosalicylic acid and clopidogrel were started in loading dose (300 mg) and in following days 75 mg was given. On auscultation there was a loud systolic murmur over the precordial area.

Echocardiography revealed rupture in the infero-basal region of the septum. Coronary angiography showed multivessel disease including occluded right coronary artery (RCA). The patient was consulted by cardiovascular surgeon and was scheduled for coronary artery bypass graft (CABG) and septum repair after a stabilization with intra-aortic balloon pump (IABP). The main reasons for delaying the operation were: presentation late after onset of STEMI symptoms and uncommon localization of acquired ventricular septum defect (VSD) making the operation much more difficult. Intraaortic balloon pump was placed by right femoral access and a low dose (40 mg/day) subcutaneous enoxaparin was started. The patient was stabilized by counterpulsation and remained stable with systemic pressures 100-110/45-55 mm Hg, central venous pressure of approximately 10 mm Hg and pulmonary to systemic flow ratio (Qp/Qs) of 1.3. The direct measurements of the blood pressure in the aorta were performed continuously using the access through the balloon catheter. Pulmonary flow, cardiac output and pulmonary to systemic flow ratio were calculated using echocardiography. The morphology of the peripheral blood presented similar number of platelets in repeated investigations, hence gave no indication of heparin induced thrombocytopaenia (HIT). Nine days after the admission the patient complained of severe right leg pain associated with cyanosis. The IABP was removed, full dose anticoagulation with enoxaparin (1 mg/kg body weight every 12 h subcutaneously) was started, resulting in elimination of symptoms. The patient could not be operated on at that time due to technical reasons. Within 3 h the IABP had to be implanted again because of hemodynamic instability. This time the access site was the left femoral artery. The patient was stabilized and katecholamine infusions were weaned off. On the next day severe pain of both lower extremities and lower abdomen occurred, accompanied by cyanosis of this area. The patient was put on high dose anticoagulation with unfractionated heparin (80 IU/kg bolus plus 18 IU/kg/h of continuous intravenous infusion), IABP was removed and computed tomography (msCT) of abdominal aorta was performed. msCT with contrast enhancement revealed presence of thrombus just below the orifices of renal arteries (white arrows Figure 1). Three dimensional reconstruction confirmed this finding (Figure 2). The patient was scheduled for an operation but without IABP support the haemodynamic status deteriorated rapidly and she died only 3 h later.

Discussion

The possibility to introduce the IABP percutaneously with an introducer sheath significantly expanded the number of indications when IABP is used, covering the wide range of cardiologic emergencies [4]. This therapy, however, sometimes entails complications like: major limb ischemia, severe bleeding and balloon leak. Fergusson *et al*. analyzed large registry of aortic counterpulsation (16.909 IABP patients enrolled in the database). They found that the incidence of balloon-related complications in this cohort was low. Only 2.6% of all patients experienced at least one major complication (severe bleeding, major limb ischemia, balloon leak). Limb ischemia occurred in 2.9% cases, but major limb ischemia (resulting in surgical intervention, arterial repair or amputation) was reported in only 0.9% of patients [5]. Thrombotic complications are the most common side effects of IABP, especially in older patients with previous

Figure 1. Frontal (right panel) and sagittal (left panel) reconstructions of contrast enhanced abdominal computed tomography. Thrombus in abdominal aorta is marked by white arrows

history of PAD who require prolonged (more than 7 days) of IABP support. In the large, prospective study, Cohen *et al*. [4] identified following risk factors of major IABP complications: peripheral artery disease (PAD), female sex and body surface area. Although our patient had no history of claudication, she was already diagnosed with PAD and the CT scan revealed severe calcifications in the both iliac arteries and in the abdominal aorta. We did not try to investigate further the extent of peripheral vascular disease prior to the IABP insertion, but maybe the assessment of lower limb arteries in patients with planned long term IABP support should be considered and included into decision-making process. Given the presence of PAD, advanced age, female sex and hypertension, the presented patient should have been considered a person at high risk of complications during the IABP support [4]. The risk of thrombotic events should be taken into account when planning a long term IABP therapy.

In our patient a low dose of low molecular weight heparin was used. This is a recommended preventive measure against pulmonary embolism and deep vein thrombosis. Current guidelines for IABP use do not include precise suggestion for anticoagulation as prevention of thrombotic complications. One recent randomized study including 153 patients on IABP support has shown that heparin does not decrease the rate of thrombotic events, particularly no difference in the incidence of limb ischemia was found, but significantly increases the frequency of bleeding [6]. The vascular complications are decreasing due to the recently developed less thrombogenic IABP catheters, better care, and replacing the catheters before any ischemic complications occur. Simultaneously to the development of more sophisticated technologies, a higher percentage of diabetic and PAD patients are being operated with the support of the recent advances in interventional cardiology [7]. Therefore, there is a need for further randomized studies in this field.

The clinical efficacy of IABP for short-term support has been frequently reported, however, only a few reports have documented the long-term use of IABP [8, 9]. Freed *et al.* described 24 patients with prolonged IABP support of 20 days or more and found that complications were more frequent in prolonged-support patients than in those assisted for less than 20 days, and that the survival rate of prolonged-support patients was 63% [8]. Manord *et al*. studied patients in whom IABP was used longer than 72 h and reported that this therapy was feasible and associated with acceptable complications rate [9].

The described patient suffered from lower limb ischemia, followed by a formation of thrombus in aorta. This might have occurred due to severely impaired flow in femoral and iliac arteries because of prolonged IABP use.

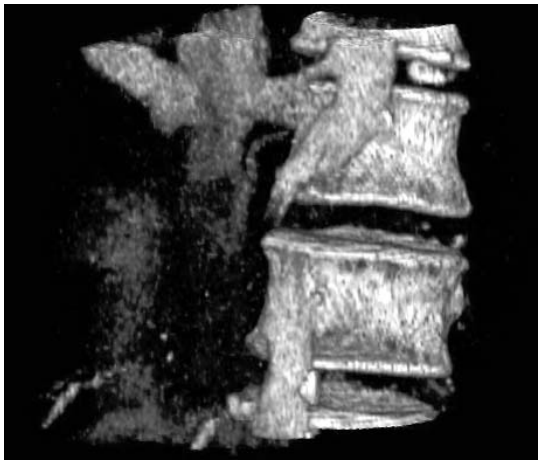

Figure 2. Three-dimensional reconstruction of contrast enhanced computed tomography of abdominal aorta. An apparent disruption of aortic continuity is caused by thrombus not enhanced by contrast

This case presents a very complex problem of decision making in the timing of operation of sub-acute VSD and decision how thrombotic complications of IABP support should be handled. The widespread use of IABP necessitates guidelines for the prevention of the thrombotic and the hemorrhagic complications of this treatment. Mechanical complications of myocardial infarction always require close collaboration of cardiologist, anesthesiologist and cardiac surgeon.

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