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Prophylactic Intra-Aortic Balloon Pump is Useful to Facilitate Percutaneous Coronary Interventions: Images from Rescue Cases

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ABSTRACT

Images are presented of coronary reperfusion that occurred shortly after insertion of an intra-aortic balloon pump for counter-pulsation in 3 patients with acute myocardial infarction refractory to thrombolytic therapy and hemodynamic derangement. It is shown that prophylactic intra-aortic balloon pump use may facilitate percutaneous coronary intervention during acute myocardial infarction and it is useful to provide a visual assessment of myocardial flow restoring.

INTRODUCTION

The intra-aortic balloon pump (IABP) is a useful invasive device to support hemodynamics in patients with myocardial function impairment and it is indicated in a wide list of clinical situations still in expansion since its conception in the late 1960s [Stone 2003; Santa-Cruz 2006]. Scintigraphic [Müller 1973] and coronary flow velocity [Kern 1993] studies have shown that inflation of IABP during diastole increases coronary blood flow as a consequence of risen aortic and coronary pressures. On the other hand, during acute myocardial infarction (AMI) it is possible to use IABP as an adjunct to thrombolytic therapy, primary percutaneous coronary intervention (PCI), and rescue PCI [Stone 2003; Mishra 2006]. In the healing phase of AMI and following reperfusion, IABP can temporarily improve cardiovascular hemodynamics [Braunwald 1982; van't Hof 1999] and may decrease the incidence of artery re-occlusion by maintaining adequate coronary flow [Brodie 1999].

In a registry of 1490 patients with AMI treated by primary PCI between 1984 and 1997, 105 patients (less than 10%) had an IABP inserted prior to PCI and 108 had insertion delayed after the completion of the procedure [Brodie 1999]. Despite the fact that the former group of patients had a higher prevalence of cardiogenic shock and multi-vessel disease, they had a higher rate of procedural success and less adverse events to the extent that IABP use before PCI was an independent predictor of freedom from catheterization laboratory events (odds ratio 0.48 with 95% confidence intervals 0.29 to 0.79) [Brodie 1999]. The potential usefulness of prophylactic or elective (odds ratio 0.11 with 95% confidence intervals 0.21 to 0.60) versus provisional IABP to prevent intra-procedural major adverse cardiac and cerebral events in high-risk PCI was more recently advocated among 133 consecutive patients with ejection fraction less than or equal to 30%, of whom 61 (46%) underwent PCI since February 1998 [Briguori 2003].

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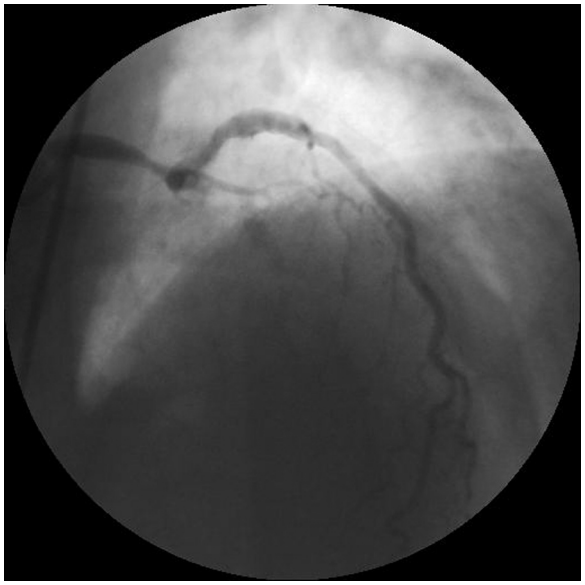

Figure 1. Case 1: Left coronary angiography in antero-posterior view with cranial angulation shows proximal occlusion of left anterior descending coronary artery.

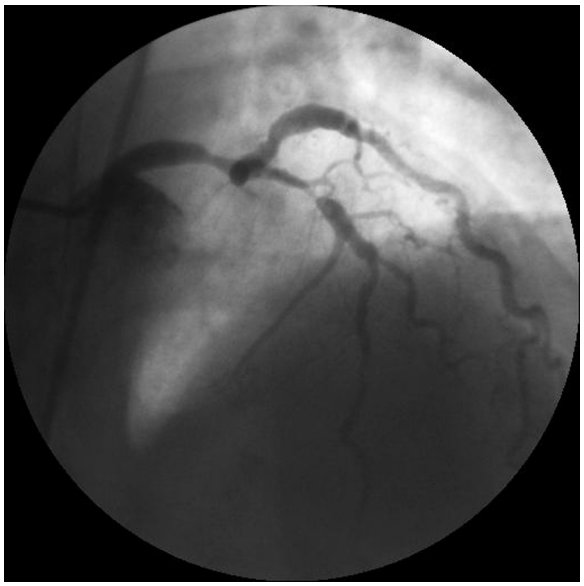

Figure 2. Case 1, post–intra-aortic balloon pump (IABP) placement: Same view as Figure 1. Left anterior descending coronary artery is completely opacified. Remarkably, a critical proximal stenosis is seen at the site of complete occlusion present immediately before IABP use.

PATIENT POPULATION AND CASE REPORTS

From January 2004 to December 2006 at Sant'Anna Hospital, Catanzaro, 2187 PCI were performed: 756 (36%) because of an acute coronary syndrome, including AMI, non–Q-wave AMI, and unstable angina. Prophylactic IABP was inserted in 127 of the latter patients (17%), 37 of whom were high-risk patients without initial ventricular impairment and 90 had ventricular impairment at admittance. Primary PCI was performed in 17 patients whereas 73 patients underwent rescue PCI. We report on 3 rescue cases in which prophylactic IABP was instrumental to facilitate PCI. Images are presented to illustrate the usefulness of this device.

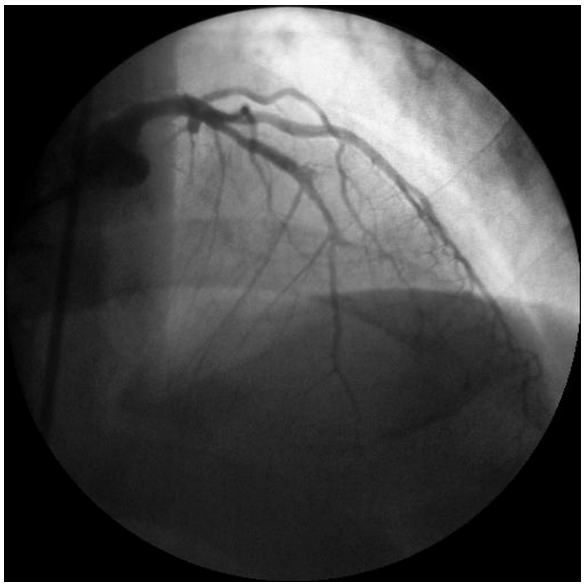

Figure 3. Case 2: Left coronary angiography in antero-posterior view with cranial angulation shows proximal occlusion of left anterior descending coronary artery.

Figure 4. Case 2, post–intra-aortic balloon pump (IABP) placement: Same view as Figure 3. Left anterior descending coronary artery is opacified and an ulcerated plaque may now be observed where total occlusion was present in the images obtained before IAPB use. Remarkably, a long dissection of mid left anterior coronary artery may now be clearly seen.

Case 1

A 45-year-old male with anterior AMI was referred to our department after unsuccessful systemic thrombolysis. Two hours after the onset of chest pain, the patient received systemic Tecneplase and was admitted to the catheterization laboratory after another 2 hours. Diagnostic angiograms showed a single vessel disease (Figure 1) with total proximal occlusion of the left anterior descending (LAD) coronary artery. As the clinical conditions were quickly worsening, an IABP was inserted prior to starting a rescue PCI. The left coronary artery was therefore cannulated with an extra back-up guiding, and a check angiogram was performed that showed LAD recannalization with TIMI-3 flow and a tight stenosis at the previous occlusion site (Figure 2). PCI was then easily carried out and a 3 × 20 bare metallic stent was inserted with a good angiographic result (not shown). IABP was removed 24 hours later and the patient was discharged 5 days later.

Case 2

A 51-year old male with anterior AMI was referred to our department after an unsuccessful thrombolysis complicated

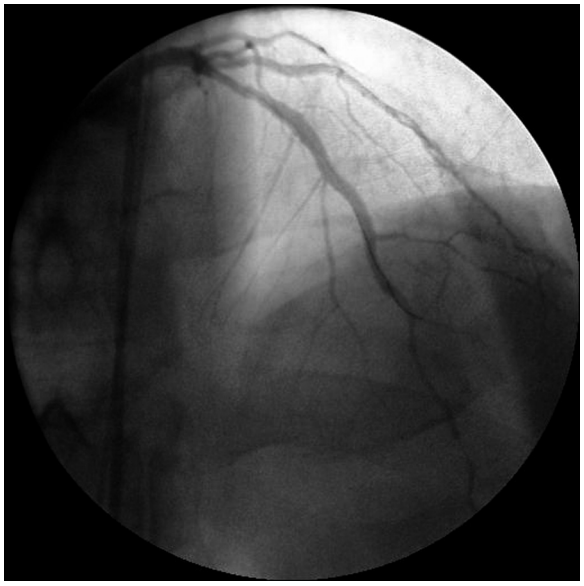

Figure 5. Case 2, last step: Same view as Figure 3. The left descending coronary artery is seen following the implantation of 3 bare metallic stents. Note that the distal one was the last to be implanted because an intimal flap was still present.

Figure 7. Case 3, post–intra-aortic balloon pump (IABP) placement: Same view as Figure 6. The mid and distal portion of the vessel are now opacified and a critical stenosis, where thrombosis is present, is visualized at the level of mid right coronary artery at the site of complete occlusion before IABP use.

by cardiogenic shock. Diagnostic angiograms showed total occlusion of the middle LAD (Figure 3). Before starting a rescue PCI, an IABP was inserted. The left coronary artery was cannulated by means of a 6F extra back-up guiding catheter, and check angiogram showed an isolated long and unusual dissection involving LAD until its distal portion (Figure 4).

Figure 6. Case 3: Right coronary artery in left oblique view. The vessel presents with ectasias and it is occluded at its mid level.

The lumen was then reconstructed by inserting 3 bare metallic stents with a good angiographic result (Figure 5). The IABP was removed 48 hours later, and after 6 days the patient was discharged.

Case 3

A 61-year-old male with inferior AMI involving the right ventricle, complicated by cardiogenic shock, was referred to our department 3 hours after unsuccessful thrombolysis. Diagnostic angiograms showed a 3-vessel disease with total occlusion of the middle segment of the right coronary artery (Figure 6). An IABP was inserted prior to starting a rescue PCI. The left coronary artery was then cannulated with a Judkins right guiding catheter, and control angiograms showed recannalization of the right coronary artery with a TIMI-3 flow and a tight stenosis at the occlusion site (Figure 7). The patient was then referred to heart surgery and underwent a successful intervention.

DISCUSSION

This report presents interesting examples of the usefulness of IABP during AMI and provides a visual assessment of myocardial flow restoring. Thus, besides the functional myocardial improvement [Mishra 2006], it is clearly shown that IABP may also be useful to facilitate PCI, thus helping to improve effectiveness. These cases may thus support the concept that a more favourable outcome is obtained in patients undergoing high-risk PCI if elective use of IABP is considered instead of post-procedural, which is a suggestion coming from observational reports [Brodie 1999; Briguori 2003;

Stone 2003]. A more recent study investigated clinical outcomes of 68 consecutive patients who underwent high-risk PCI with prophylactic IABP support as compared with those of 46 patients who required rescue IABP [Mishra 2006]. At 6 months, the mortality and major adverse cardiac event rates were lower in the prophylactic IABP group (8% versus 29%, $P < .01$, and 12% versus 32%, $P = .02$, respectively) and the incidence of vascular complications was low and comparable except for more major bleeding (15% versus 3%, $P = .03$) in the rescue IABP group. Thus, a more liberal use of a prophylactic IABP should be considered [Mishra 2006].

Few randomized trials investigated the effects of IABP in the setting of AMI and PCI and most were problematic with significant treatment arm crossover (25%); however, the consistent finding across these trials is that IABP use in high-risk AMI patients as an adjunct to cardiac catheterization and PCI is associated with decreased ischemic events and a low incidence of vascular and hemorrhagic complications [Ohman 1994; van't Hof 1999; Santa-Cruz 2006]. Awaiting for future adequately powered controlled trials, the experience reported here may help illustrate a further advantage of prophylactic IABP, which is the facilitation of PCI. Indeed, visualization of post-stenotic run-off following IABP may help in selecting the best procedure to effectively perform PCI. Moreover, visualization of the coronary vessel distal to total occlusion as the consequence of IABP use may be advantageous to surgical procedures.

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