Extended duration of brachially inserted intra-aortic balloon pump for myocardial protection in two patients undergoing urgent coronary artery bypass grafting

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Abstract

Intra-aortic balloon pump (IABP) provides myocardial protection for patients who are at risk of myocardial injury during cardiac surgery. The haemodynamic support is crucial in patients with significant and critical coronary artery disease undergoing revascularisation procedures. Traditionally, the femoral arterial access is the preferred route for IABP insertion. This is, however, not always feasible especially in patients with concomitant occlusive peripheral vascular disease. The trans-brachial route can be used as an alternative for percutaneous insertion of the IABP. We report the technique for left trans-brachial insertion of an IABP, and illustrate our experience with two patients requiring urgent coronary artery bypass grafting (CABG) and for whom the IABP duration was over 50 h.

1. Introduction

Conventional insertion of the intra-aortic balloon pump (IABP) via the common femoral artery is relatively contraindicated, in patients with peripheral vascular or severe abdominal aortic atherosclerotic disease. Insertion via the brachial rather than femoral arterial route may prove beneficial.

We describe our technique and experience of IABP insertion via the left brachial artery.

2. Method

The left brachial artery was used for access. It was directly punctured under local anaesthesia with lignocaine (Lidocaine 1%, Antigen Pharmaceuticals, Ireland) and cannulated with a 7Fr sheath (7Fr Flexor Check-Flo Performer Radial Access Introducer Set, William Cook, Bjaerverskov, Denmark) using the Seldinger technique. Intra arterial verapamil (Securon, Abbott Laboratories, UK) and isosorbide dinitrate (Isoket 0.1%, Schwarz Pharma Limited, UK) were given to relieve any potential vasospasm. A 260 cm 0.025" (William Cook, DK 4632 Bjaerverskov, Denmark) exchange guide wire was introduced into the left brachial artery and advanced up to the subclavian artery under fluoroscopic guidance. The acute bend between the descending thoracic aorta and the left subclavian artery makes guiding of the wire down the descending aorta difficult. To facilitate guide wire advancement selectively down the descending aorta, a 6Fr JR4 diagnostic catheter (Cordis Europa, LJ Roden, The Netherlands) was advanced over the guide wire and positioned at the ostium of the left subclavian artery with its tip pointing down the descending aorta as confirmed on fluoroscopy. The guide wire was then advanced selectively down the descending aorta.

The 6Fr JR4 catheter and 7Fr sheath were removed from the brachial artery keeping the guide wire within the descending aorta. Manual pressure was applied for haemostasis during the removal of the sheath and exchange of the IABP over the guide wire.

A 40 cc 7.5Fr intra-aortic balloon pump (Datascope Cardiac Assist, Datascope Corp, New Jersey, USA) was advanced over the guide wire using the ‘sheathless’ technique and positioned in the descending aorta. The ‘proximal’ marker of the balloon was positioned at the level of the 2nd intercostal space (Video 1, Fig. 1)

Left radial artery Doppler ultrasound confirmed satisfactory flow. Pulse oximeter applied to the left middle finger excluded hypoperfusion.

An intravenous heparin bolus (Heparin Sodium, LEO laboratories, UK) of 5000 U was given followed by an infusion to maintain an APTT ratio of 1.8–2.0. Pulse oximetry waveforms and saturations readings were monitored throughout counter-pulsation. The IABP insertion site was regularly checked for any haematoma.

After CABG the IABP was removed. Manual pressure was applied for approximately 20 min for haemostasis.
Video 1. The guide wire is floated to the descending thoracic and abdominal aorta from the left brachial arterial approach, under fluoroscopic guidance. Following dilatation of the arterial puncture site, the IABP is introduced over the guide wire and positioned so that the proximal end of the balloon is at the level of the 2nd intercostal space as judged by the marker on the balloon. Inflation and deflation of the balloon is confirmed fluoroscopically.

Fig. 1. Photograph showing the IABP in the inflated mode (white arrows) at the proximal (P) and distal (D) ends.

3. Case report 1

A 65-year-old diabetic with peripheral vascular disease was referred for urgent in-patient CABG. Coronary angiography via the right radial artery revealed severe left main and distal right coronary artery stenoses. He had undergone bilateral ilio-femoral artery stenting 12 months previously for claudication. Femoral arterial pulses were impalpable. Duplex ultrasound study of the neck vessels showed no occlusive disease involving the carotid or vertebral arteries. He developed severe angina at rest with dynamic ST segment changes despite optimal anti-anginal treatment. Urgent stabilisation with IABP insertion prior to coronary artery bypass grafting was felt to be mandatory. IABP was inserted through the left brachial artery as described above and he was stabilised for 20 h prior to surgery. He underwent CABG and his postoperative course was uneventful. The IABP was inflated for a total period of 53 h. There were no neurovascular complications.

4. Case report 2

A 76-year-old man was referred for urgent coronary angiography because of unstable angina. Angiography via the right femoral artery and tortuous iliac arteries, showed severe left main stem and proximal right coronary artery stenoses. He developed rest pain following angiography requiring stabilisation with IABP prior to urgent CABG. Attempted IABP insertion via the right femoral artery was unsuccessful because of the tortuous iliac vessels. It was not possible to advance the IABP beyond the distal abdominal aorta. Further attempts via the left femoral artery were also unsuccessful. He underwent IABP insertion via the left brachial artery and was stabilised for 24 h prior to off-pump coronary artery bypass grafting (OPCAB). The IABP was inflated for a total period of 76 h. His postoperative recovery was uneventful.

5. Discussion

High-risk patients undergoing coronary artery bypass surgery have improved outcomes with IABP haemodynamic assistance [1]. This is particularly crucial during the perioperative period as it reduces critical cardiac ischaemia during the induction phase of anaesthesia and the graft harvesting time [2]. Counter-pulsation therapy delivered by the IABP also assists in weaning patients from cardiopulmonary bypass and maintaining haemodynamic stability when manipulating the heart during OPCAB. Patients with critical coronary artery disease and concomitant peripheral vascular disease may be unsuitable for IABP support via the femoral artery. It is therefore necessary in such cases to find an alternative route. Cases of transaxillary [3] and transaortic [4] insertion of IABP have been reported but they have all required general anaesthesia. This is therefore unsuitable for haemodynamically unstable patients. Series of short-term IABP support via the brachial artery (inflation times ranging from 18 to 39 h) in the perioperative period using 7.5 F IABP have been recently reported [5]. These patients had significant aorto-peripheral vascular disease and were unsuitable for elective transfemoral IABP insertion prior to cardiac surgery. Our two cases illustrate the feasibility of prolonged inflation times (53 and 76 h) in patients requiring prompt stabilisation prior to urgent CABG. In our two cases we used the left brachial route. Despite being technically more challenging, the left side was chosen as it avoids all the cerebral vessels (apart from the left vertebral artery) and reduces the risks of cerebral embol-
isation. Furthermore, it allows the surgeon to operate from the right side of the patient.

Adequate and sustained haemodynamic support was achieved in these high-risk patients without significant complications, thus reducing peri-operative risk.

The femoral artery remains the route of choice. Transbrachial route should be considered as an alternative for patients with coexisting peripheral vascular disease. The main limitation has been due to the small diameter of the brachial artery. Report from the first transbrachial insertion of an 8Fr IABP [6] did result in left-hand hypo-perfusion necessitating early withdrawal of the IABP.

The availability of smaller 7.5Fr IABP catheters facilitates safe transbrachial insertion as described.

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References


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Patients with existing impaired cardiac function are considered to be high-risk candidates for cardiac surgery. Anesthetic agents and the procedure itself can place increased myocardial oxygen demands on the already impaired heart. Use of intra-aortic balloon pump (IABP) provides haemodynamic stability by assisting in balancing myocardial oxygen supply and demand, preoperatively, intraoperatively, and during the critical post operative period when the demands on the heart are particularly high. Traditionally, the femoral artery access is used for IABP insertion. The submitted report [1], which is devoted to the technique for left trans-brachial insertion of an IABP in patients with concomitant occlusive peripheral vascular disease, seems very interesting because in such cases we should keep that method in our mind. But by applying that technique there is a high risk of the development of neurological complications. So that maybe it would be safer to use left trans-subclavian insertion of an IABP.

Reference