Case report

A rare case of aortocoronary dissection following percutaneous transluminal coronary angioplasty: successful treatment using off-pump coronary artery bypass grafting

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Abstract
Retrograde dissection of the aorta is a rare but potentially life threatening complication of percutaneous coronary intervention. We describe a case of retrograde aortic dissection, which occurred during attempted percutaneous transluminal coronary angioplasty (PTCA) of chronically occluded left anterior descending artery (LAD). Emergency coronary artery bypass grafting (CABG) was performed to revascularise LAD distal to the site of entry tear with pedicled left internal mammary artery (LIMA). This was achieved off-pump. Ascending aorta was not replaced as the dissection was localised.

1. Introduction
Aortic dissection is a rare complication of percutaneous coronary intervention [1–7]. Most of the reported cases occur following interventions of the right coronary artery (RCA) [1–4,7] and very rarely, following interventions of the left coronary circulation [1,5,6]. This complication is potentially life threatening and can lead to acute myocardial infarction or a sudden cardiac arrest. The options for treatment are dictated by patient stability, nature of dissection of the coronary vessel, ability to restore the coronary circulation by further interventions and finally, extent of aortic dissection [1,7]. Surgical intervention is with high risk, especially in unstable patients [1,4]. Use of off-pump coronary artery bypass grafting (CABG) made it possible for us to simplify surgical management of this condition in the shortest possible time.

2. Case report
A 74-year-old diabetic lady with a known history of ischaemic heart disease and predominantly left anterior descending artery (LAD) disease underwent percutaneous transluminal coronary angioplasty (PTCA) in August 2002 on an elective basis. Angiography had demonstrated a right dominant circulation with proximal irregularity, a 90% proximal LAD lesion and minimal disease in the non-dominant circumflex circulation. A Voda 3 guide wire was passed distal to the LAD lesion so as to deploy a stent. A dye hold up was seen in the proximal LAD with a dissection flap seen in the proximal LAD and left main stem. There was no evidence of antegrade dissection in LAD. Patient started complaining of severe chest pain with ischaemic changes in ECG in the anterolateral leads. Two new PT wires were passed, one in to circumflex and other in to LAD to preserve the blood flow through the true lumen. This improved patients ECG and hemodynamics and urgent surgical opinion was sought.
Screening of the ascending aorta did not reveal progression of the aortic dissection in to the arch. It remained localised to the anterolateral portion of the ascending aorta. The surgical options were to either replace...
the ascending aorta and revascularise the LAD or just to revascularize LAD conserving the aortic dissection.

Median sternotomy was performed. The ascending aorta showed localised haematoma on the anterolateral aspect of the aorta. Rest of the aorta felt normal. Mid and distal LAD appeared normal with no evidence of antegrade dissection. In view of these findings, it was decided to perform LAD revascularisation only and treat the ascending aortic haematoma conservatively. Left internal mammary artery (LIMA) was harvested and Octopus 2# was used to perform off-pump graft to LAD, thus avoiding cardiopulmonary bypass (CPB) and necessity of clamping the aorta. After opening the LAD in the mid segment, the guide wire was withdrawn and a 2mm intraluminal shunt was inserted to control bleeding during the procedure.

Patient recovered well and remained stable with no electrocardiogram (ECG) changes. Cardiac enzymes, which were marginally elevated, normalised within 1 week. ECG and computed tomography (CT) scan performed 1 week after the operation did not reveal regional wall motion abnormalities and progression of the dissection, respectively. Patient remains well till date.

3. Discussion

Gruntzig, revolutionised the management of coronary artery disease with first successful PTCA [8]. Interventional cardiologist are using this technique in increasingly difficult cases, thus increasing chances of complications such as coronary dissection, coronary perforation, acute coronary syndrome and dysrrhythmias [9].

Retrograde dissection of the aorta is a rare complication following PTCA and related procedures [1–7] and has been reported only thrice during procedures on the left coronary circulation [1,5,6]. Coronary dissection complicating PTCA is common with the use of rigid wires and has also been attributed to forceful manipulation of guide wires and vigorous injection of the contrast [1,7].

Two mechanisms for propagation of the dissection flap have been put forward, which further contrast injection into the already existing dissection and shearing forces during systole and diastole [1,7]. Several pre-existing factors might play an important role in the propagation of the dissection: (a) the presence of calcification in the aortic root and at the dissection site, which reflects loss of elastic properties of the vessel; (b) it is common in older patients i.e. >60 years old and those with hypertension, reflecting on the process of cystic medial degeneration of the media of aorta and the coronary sinuses; (c) it is common in patients with recent infarct, reflecting possibility of inflamed vessel wall onto which PTCA is being attempted and (d) use of intra aortic balloon pump (IABP) may accelerate antegrade and retrograde extension of dissection [1,7].

Review of literature revealed only 25 cases of this complication of which only three occurred during procedures on the left coronary artery (LCA) [1]. It remains uncertain as to why RCA is more easily dissected than LCA. The tunica media of LCA has more spiral smooth muscle cells which are arranged in concentric layers with abundant elastic fibres making LCA more resistant to retrograde dissection [1].

Retrograde dissection is easily diagnosed during the procedure, which reveals dissection flap in the coronary artery (Fig. 1) and persistent dye localised to the portion of ascending aorta (Fig. 2). Any further forceful injection of the dye should be avoided. Extent of dissection into the aorta and the state of coronary circulation needs to be reviewed with regards to flow distal to the dissection, flow in to rest of the coronary circulation, ECG changes, symptoms and hemodynamic stability.

Management depends on status of the distal coronary circulation and extent of aortic dissection. When possible dissection can be dealt with deployment of stents distal to the dissection and near the ostium, thus sealing off the entry port [1,5,6]. Aortic dissection when localised may be followed up with ECG and CT scan if coronary blood flow has been corrected by stenting [1,7]. However, if the above procedure fails or cannot be attempted without high risk of further compromising of the coronary circulation as in our case, surgery is the only option [1,4]. Surgery is also preferred when aortic dissection is extensive and needs correction [1]. Emergency surgery is always with a high risk and more so if the patient is unstable. Risk is increased further because one may need to perform either root replacement or replacement of ascending aorta with CABG, which are by no means a simple procedures in an emergency situation [1]. Even if it is decided to conserve the dissected aorta, technical problems like inability to clamp the aorta without damaging it during CABG complicate the nature of the operation [1,2,5].

We circumvented this dilemma by utilising beating heart technique to perform LIMA to LAD anastamosis, thus avoiding need of cannulation and clamping of the dissected aorta. Restoration of circulation distal to the dissection entry

![Fig. 1. Coronary angiography demonstrates site of entry tear (solid arrow) in LAD and proximal extension towards aorta (hollow arrow).](image-url)
point helped in achieving excellent blood flow through the true lumen of the LAD thus occluding the false lumen. This also restored coronary circulation rapidly in a critical situation. If there is antegrade progression of dissection in the LAD, off-pump grafting may become technically difficult or impossible.

Off-pump-CABG has become a standard procedure for coronary revascularisation and with experience, even complex cases could be done with safety [10]. Multiple grafts can be done by utilising T or Y graft techniques, thus avoiding clamping of aorta all together [10].

In conclusion, we describe a rare case of retrograde aortic dissection during PTCA to the LAD. We also describe for the first time, the use of off-pump method of revascularisation to manage this difficult problem thus circumventing need of an extensive procedure in an emergency situation.

References