Stent Balloon Entrapment At Left Main Stem; A Low Resource Setting Approach

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Key words

Entrapment, angioplasty balloon, percutaneous coronary intervention, balloon dilation

ABSTRACT

A 60 year old, male patient underwent an elective percutaneous coronary angioplasty and stenting of mid circumflex coronary artery lesion at the origin of second obtuse marginal artery. The bare metal stent deployed in a partially inflated state due to a tight calcific area with subsequent stent balloon entrapment inside the stent by the calcified plaque. It was entrapped entering the left main stem in the partially withdrawn state. With impending surgical retrieval progressive supra burst pressure dilatation attempted to dilate the entrapped segment, final supra burst pressure with successful retrieval. This case highlight the steps to attempt in a low resource setting and final supra burst dilatation of a same stent balloon to overcome an entrapped vessel segment before surgical retrieval options.

INTRODUCTION

With the recent advancement in the field of interventional cardiology both coronary and non coronary interventions are in the rise due to its popularity in minimal access nature and reduced need for in-hospital stay. The catastrophic complications of these procedures like acute in stent thrombosis, coronary perforations, severe dissection with abrupt closure, etc are not uncommon.[1,2] We report a rare situation in which an unruptured coronary angioplasty balloon in spite of full deflation getting impacted in a partially dilated stent at a tight area of calcified stenosis in Left Main Stem(LMS) during the percutaneous coronary stenting procedure for single vessel coronary artery disease.

CASE REPORT

A 60 year-old, diabetic and hypertensive patient presented with a history of exertional angina (CCS II) for one year duration. His 2D echo was normal with an ejection fraction of >60%. His exercise tolerance test was strongly positive at stage I (Bruce protocol). Coronary angiography revealed a short segment of 95% calcific stenosis of the Mid Left Circumflex coronary artery (LCx) with osteal involvement of second Obtuse Marginal branch(OM2) (medina 1,1,1 type B1 lesion) (Figure 1). The left anterior descending

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and the right coronary arteries had minor disease. With a Euro score of 0.94% for Coronary Artery Bypass Graft Surgery (CABG) and Syntax score of 27 for Percutaneous Coronary Intervention (PCI) elective PCI was planned.

XB3 extra back up (EBU) guiding catheter was used for engagment and LCX lesion was crossed with 0.014”/0.36mm (190cm) BMW guide wire. OM2 was crossed by 0.014”/0.36mm (190cm) BMW guide wire..

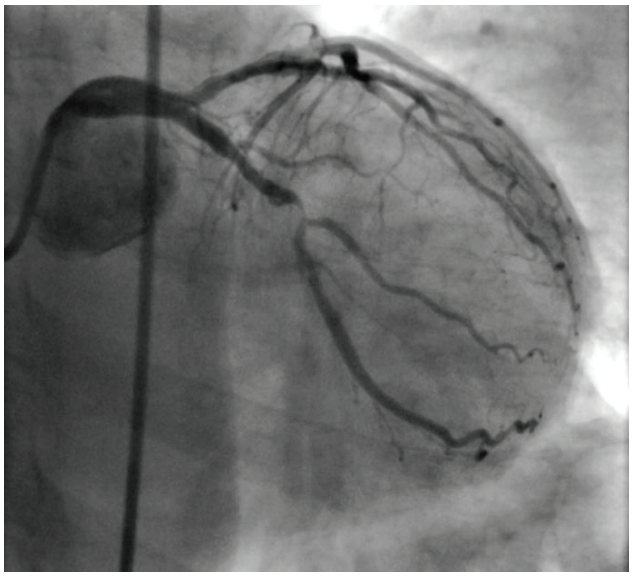

Figure 1 –Angiographic image showing mid LCX critical stenosis involving OM2 side branch (medina 1,1,1) with tortuousity (Type B1 lesion) in RAO – Caudal view (Engaged by XB3 catheter)

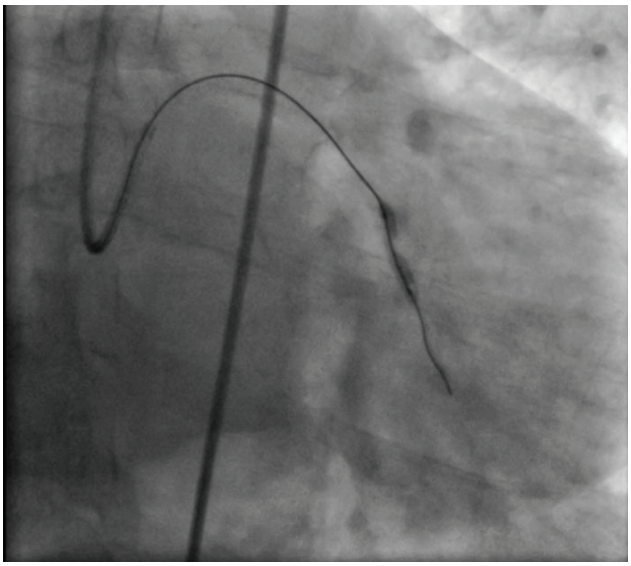

Figure 2–Angiographic image showing LCX lesion pre dilated with a 1.5×15mm compliant balloon at 9atm with eccentric very tight stenosis.

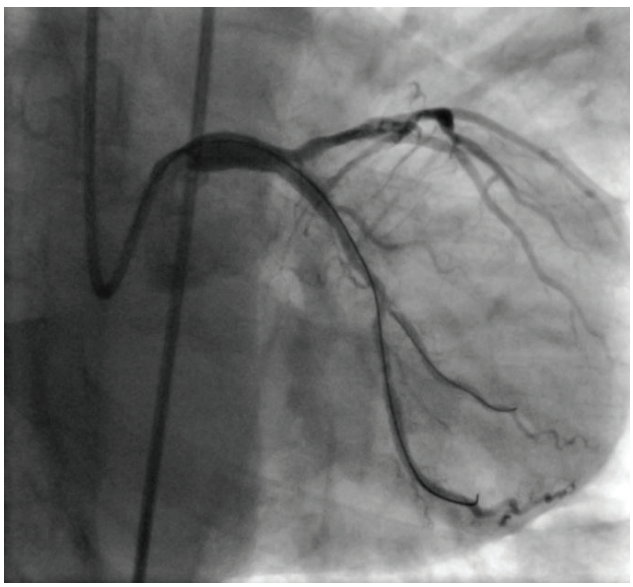

Figure 3 – Angiographic image showing LCX lesion at second pre dilation with 2.5×15mm compliant balloon at 10atm with 25 % recoil

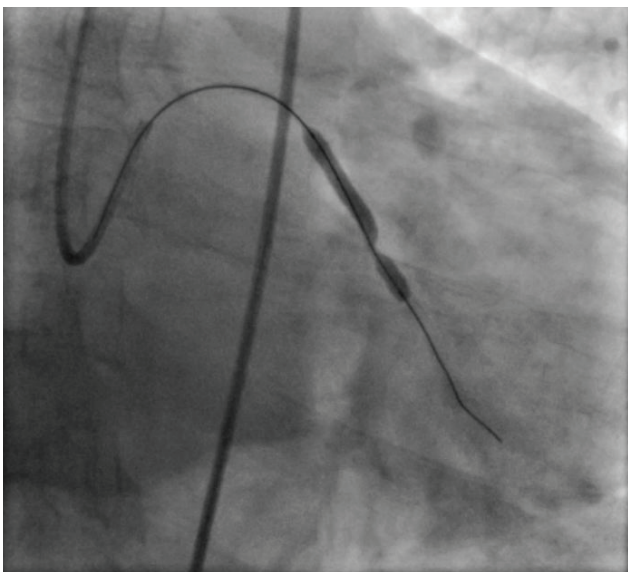

Figure 4–Angiographic image showing the inflated stent balloon up to its critical burst pressure at 14 atm leaving distal part of the stent still under inflated.

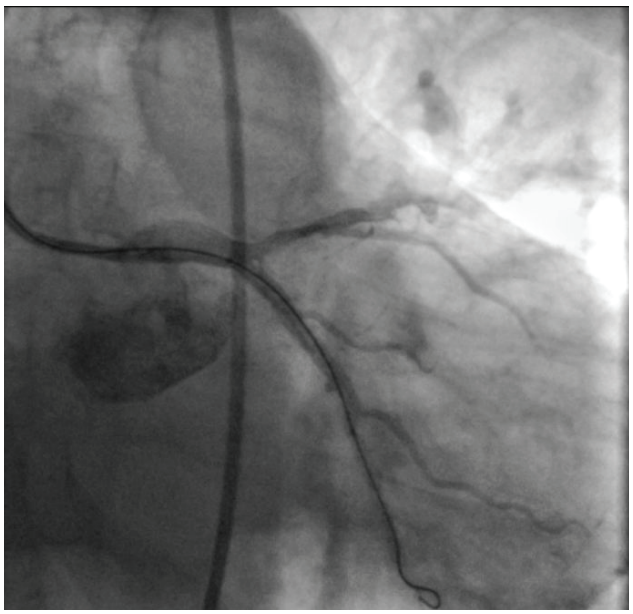

Figure 5 –Angiographic image showing partially withdrawn angiographic balloon: proximal portion at left main stem obstructing the blood flow with distal balloon entrapped by the lesion.

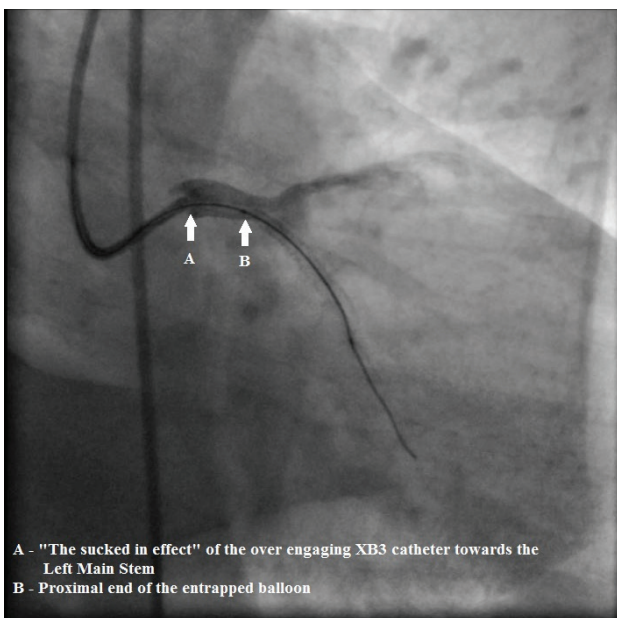

Figure 6 –Angiographic image showing over engagement of XB3 catheter dangerously towards entrapped, proximal portion of the stent balloon; "the Sucked in effect".

LCx lesion was pre dilated with a 1.5×15mm compliant balloon at 9atm followed by 50% immediate recoil (Figure 2). We neither have the intravascular ultra sound (IVUS) nor optical coherent (OCT) facility in our center for accurate assessment of the calcific plaque or rotational atherectomy access to overcome it. Due to the anticipatory risk of under inflation a mildly over sized stent was selected to give room for over inflation if balloon gets stuck inside or stent gets under inflated. Second pre dilation was done with 2.5×15mm compliant balloon at 10atm followed by 25 % recoil (Figure 3). A cobalt chromium bare metal (BMS) stent sized 3×33 mm was deployed at 10atm of which the marked nominal pressure was 6atm for its deployment, positioning at the mid LCx covering the culprit stenosis. An area of under deployment was noted at the distal part of the stent where pre dilatation recoil also had occurred suggestive of a very tight area of stenosis.

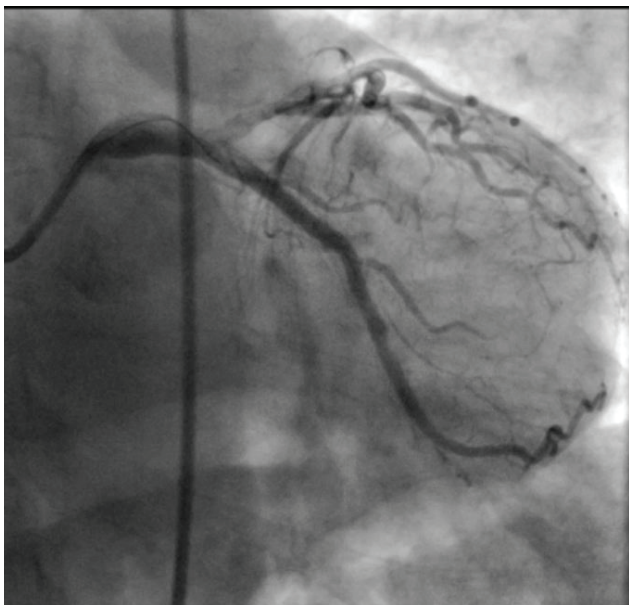

Figure 7–Angiographic image showing good angiographic results with retrieval of the balloon following graded supra burst pressure dilation at 28 atm.

Since stent remained under inflated even after the specified burst pressure dilatation at 14atm (Figure 4), post dilatation by a high pressure non-compliant balloon was planned. At this point we realize that, even though the stent balloon was fully deflated radiologically it was entrapped and could be only partially withdrawn at LMS and could not be further retrieved.

As the proximal portion of the stent balloon entered in to the LMS with partial withdrawal (Figure 5). Patient experienced episodes of chest pain with fluctuating blood pressure. The initial short wiggle, push and rotatory movements to withdraw the angiographic balloon were all unsuccessful and abandoned as it leads the XB3 catheter to over engage with sucked in effect (Figure 6) increasing the risk of vessel perforation at LMS. Actually this caused pulling of the engaging catheter towards the entrapped object rather than withdrawal of the balloon. To overcome this emergency situation we planned to push the balloon after maximum deflation to keep it away from the left main stem first to avoid catastrophic LMS mechanical obstruction and then thrombus formation or a dissection. This was only partially successful due to tight entrapment of the balloon.

To facilitate the withdrawal of the stent balloon, progressive dilution of the contrast material with saline was attempted which was not successful. Then a second parallel intermediate guide wire was negotiated through the lumen of the stent and secured distal to tight lesion. It was attempted to glide a non-compliant balloon through this guide wire but could not be maneuvered beyond the critically entrapped area. Puncturing entrapped balloon with hard end of either 0.014" or 0.018" wire was not attempted due to major risk of vessel perforation at or near left main stem and further it seems unlikely to relieve the tightly caught balloon segment by the speculated calcific plaque.

At this point we were left with either to proceed for an urgent surgical intervention of coronary arteriotomy and end arterectomy of the calcified lesion or to inflate the balloon over its burst pressure to facilitate retrieval. As the final rescue maneuver inflation of the entrapped normal pressure balloon beyond its burst pressure (14 atm) was attempted under strict emergency and surgical back up before proceeding in to the surgical intervention. At a massive supra burst pressure of 28 atm the calcified lesion gave away leaving the stent non ruptured balloon intact. Routine high pressure non compliant balloon post dilatation done, at nominal pressures (10 atm) for optimum stent deployment. Final vessel was dilated in to its original size well covering the tightest area by the BMS (Figure 7). Post retrieval state of the stent balloon was analyzed both fully deflated and inflated at nominal, burst and the supra burst pressure in vitro where we could not detect any major distortions. Cause for entrapment was attributed to the complexity of the calcific lesion and also to the maneuverability of the balloon partially. Brief heparin anticoagulation was given, observed for post procedure complications and discharged after 24 hours uneventfully.

DISCUSSION

In the current era of improved stent technologies although angioplasty guide wires, catheters and balloons are extremely reliable; there is an increasing incidence of hardware failure due to broken fragments of angioplasty equipment being left behind in the coronary vasculature.[3,4] Severely calcified lesions and diffuse distal lesions prevent the withdrawal of the broken fragments or sometimes the whole device may entrap inside mainly when a device undergoes severe operating stress such as rotating a guide wire in a single direction while the tip is held fixed in a total occlusion and with inflation of balloon catheter past its operating pressure range in an attempt to dilate a resistant stenosis.[5] A very tight speculated calcified plaque can catch the devices like balloons even at nominal pressure inflation as in our case scenario. On rare occasions, desperate manipulations may lead to detachment of a part of the guide wire or dilatation catheter with fragments remaining in the coronary artery.3This may also include dislodgement of the stent from its mounted balloon or failure of the stent delivery balloon to inflate or deflate properly. Entrapment

or embolization of angioplasty balloons or guide wires in a proximal and patent coronary artery results in acute coronary thrombosis with acute myocardial infarction making the immediate removal of the broken hard-ware imperative.[6] Entrapment in or near LMS further increases the risk of grievous hemodynamic effects. Even though balloon rupture technique either by puncturing or over inflating is used as a technique to facilitate retrieval of an impacted balloon, it is known to cause fatal distal embolization of the ruptured tip of the balloon. The balloon tip Impalement on a calcified plaque with failure to pull back the entire catheter is also documented in literature.8 Furthermore "sucked in effect" was visually illusive and falsely reassuring about apparent nature of the easy balloon withdrawal which the operator should be vigilant of. Innovative methods have been used to retrieve hard-ware lost in these vessels.[3,7] The recent advancements in various devices for retrieval of impacted catheter removal include baskets, bioptomes and intertwined guide wires. Reports of emergency surgery for broken or stuck parts of angioplasty hard-ware have also been described.[1,2,8] During surgery the broken guide wire, catheter or balloon is retrieved from the coronary arteriotomy site. In case of stuck but unbroken device, the visible part can be excised at the coronary arteriotomy site and the remaining part can be pulled out from the femoral sheath. Emergency surgery for hard-ware retrieval differs from elective CABG in certain aspects where prior to the angioplasty procedure, the patients routinely receive Aspirin, Clopidogrel, Heparin as well as Glycopeptide IIb-IIIa inhibitors, increasing the possibility of major bleeding during an emergency CABG, when compared to elective CABG where the patient undergo it in a anti platelet effect free window of time.[9,10]

CONCLUSION

Non surgical retrieval of an entrapped angioplasty balloon involving the left main stem is a nerve wrecking challenge which carries risk of multiple complications where the practicing interventionist should be vigilant of. Different techniques have its pros and cons. This case describes the graded steps available to overcome a stent balloon entrapment before proceeding in to emergency surgical retrieval in low resource emergency situations where the IVUS, OCT and Rotational atherectomy is not a feasible alternative to overcome the challenge of balloon entrapment. This case highlights the success of a careful graded supra burst pressure over inflation as a rescue approach to retrieve the entrapped stent balloon even at a heavily calcific coronary stenotic area in a low resourceful emergency situation saving an impending emergency surgery. This would be a quite rewarding experience especially at low resource settings to save the patient from catastrophic vascular complications and form a major unprepared emergency surgery. This further emphasizes the sucked in effect of the engaging catheter towards LMS on attempting to pull on an entrapped angiographic object at or near LMS which should carefully anticipate on handling such events to avoid further catastrophic complications.

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