

BROKEN CORONARY GUIDE WIRES IN CORONARY TREE: A SIMPLE, SAFE AND COST EFFECTIVE TECHNIQUE FOR SUCCESSFUL RETRIEVAL;

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Contribution

MNM conceived idea, did literature review and final drafting. SFM reviewed case report. TS,SZ helped in acquiring photographs and related material. All authors contributed significantly to the submitted manuscript.

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ABSTRACT

In complex coronary artery disease percutaneous coronary angioplasty (PCI) is increasingly employed. During the procedure of PCI to open the occluded vessels and to facilitate the balloon and stent deployment a number of different steerable coronary guide wires are used. However, the guide wires are not without hazards: these can perforate or dissect the vessel. Fracture and entrapment of the guide wires itself although uncommon but is also a serious complication. Management of fractured coronary guide wire depends upon the clinical situation of the patient and the position and length of the fractured remnant.

We report two cases of broken coronary guide wire within the coronary tree during PCI. First case was during intervention on a chronic totally occluded artery (CTO) while 2nd case was during P-PCI. Both wires were retrieved, arteries were opened and stented in 1st case while only POBA was done successfully in 2nd case.

Key Words: Balloon Angioplasty, Complications, Coronary Artery Disease, Foreign Body Retrieval; Percutaneous Coronary Intervention, chronic totally occluded artery.

INTRODUCTION

In modern era the frequencies of percutaneous coronary interventions have increased enormously. Many challenging cases, previously thought to be domain of surgery or left untreated are now routinely undertaken by interventional cardiologists.¹ These include chronic totally occluded arteries (CTO's), left main stenting and venous graft stenting. This new trend has caused a variety of novel complications during PCI.²

Breakage and retention of coronary wires, catheters, balloons and stents although rare but all have been documented in medical literature. The management of the patients with retained catheters, coronary guide wires or other hard ware within the coronary artery tree can be difficult. If the fractured components are small these can be left within a CTO with no risk of further complications.³ As any of these intravascular wire fragments are quite thrombogenic, urgent surgical removal, combined with bypass grafting may be needed if percutaneous retrieval becomes unsuccessful or difficult.⁴

Entrapment and fracture of interventional diagnostic or therapeutic devices within the coronary arteries is increasing. Guide wire fracture during PCI is one of serious complications, occurring in approximately 0.1-0.2% of cases.²

CASE REPORT

Case 1: 48 year old female known case of DM, HTN, hyperlipidemia and positive family history of ischemic heart disease complained of stable angina pectoris CCS class III for one month. She had past history of coronary angioplasty and two drug eluting stents (DES) were placed in left anterior descending artery (LAD) and right coronary artery (RCA). Her coronary angiography was performed and showed moderate (50%) stenosis of LAD stent and totally occluded RCA stent at its mid point. Considering her symptoms PCI was planned. A Balance Middleweight BMW (Abbott Vascular) guide wire was taken and placed in RCA. While during the procedure coronary guiding catheter dislodged suddenly and BMW coronary guide wire fractured at distal tip at the proximal end of 15 mm marker. Distal end of wire was entrapped in stent while proximal end was hanging free in aortic bulb (Fig.1A). Patient was shifted to our hospital after about 8 hours with femoral sheath in place.

A 6 French JR4 (Medtronic) guiding catheter was taken for engagement of Right coronary Artery (RCA). A new BMW guide wire was crossed and placed in RV branch of RCA. Miracle 6 (ASAHI) guide wire was opted to cross the CTO lesion of RCA (Fig.1B). After many attempt it crossed the artery but no distal flow visualized. A torque device was connected to both wires and rotated to entangle the retained fragment of broken guide wire between the two wires (Fig.2A). Once the tip of retained fragment started moving, the wires were drawn into the guiding catheter while maintaining the torque (Fig.2B). Both wires along with entangled broken wire were then moved under fluoroscopy within the sheath. A guide wire was passed through sheath to secure the arterial access. First sheath was removed and another femoral sheath of 6 Fr (Cordis) passed. Retained segment was obtained from removed sheath (Fig.2C). CTO of RCA was opened and stented with another DES.

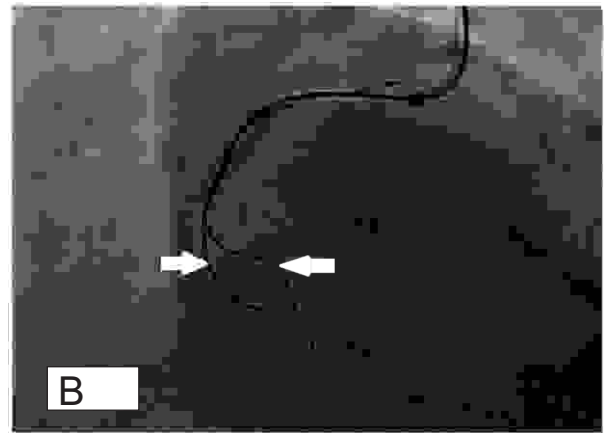
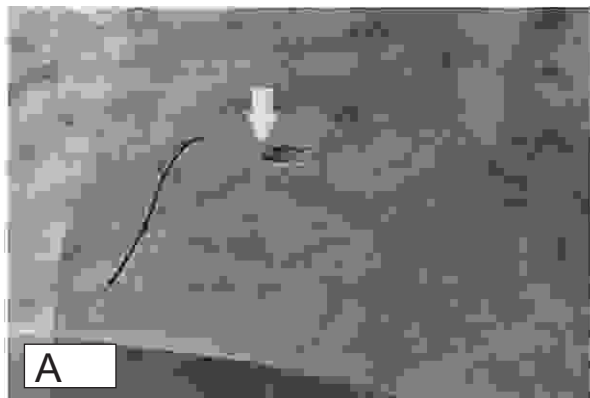
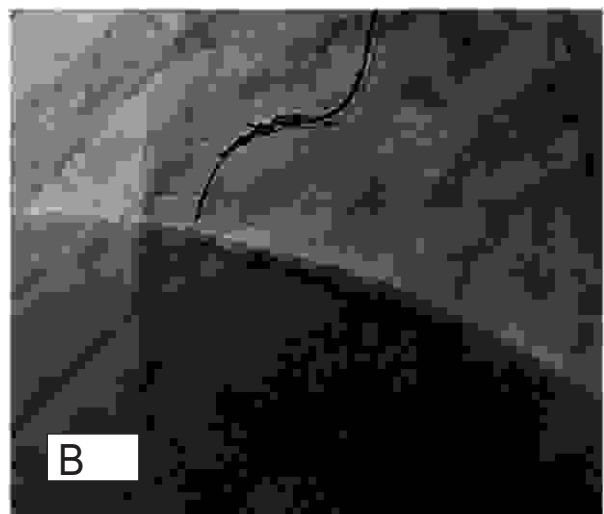
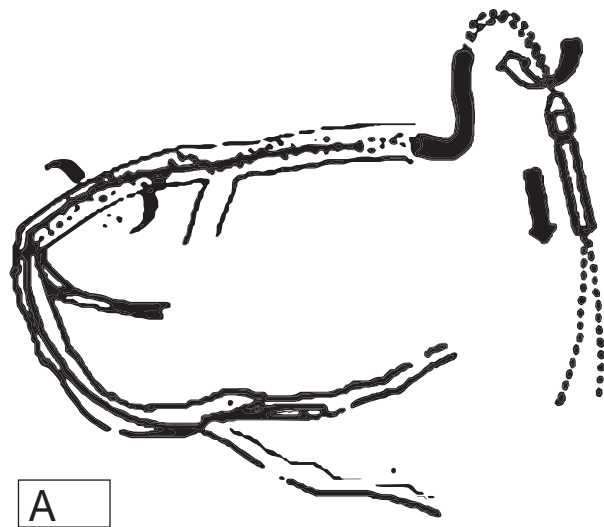


Figure 1: (1A) Showing Entrapped and Broken BMW Coronary Guide Wire Fragment in RCA (red arrow) and (1B) Showing Another New BMW Coronary Guide Wire in RV Branch (blue arrow) and Miracle-6 (white) Coronary Guide Wire in RCA.



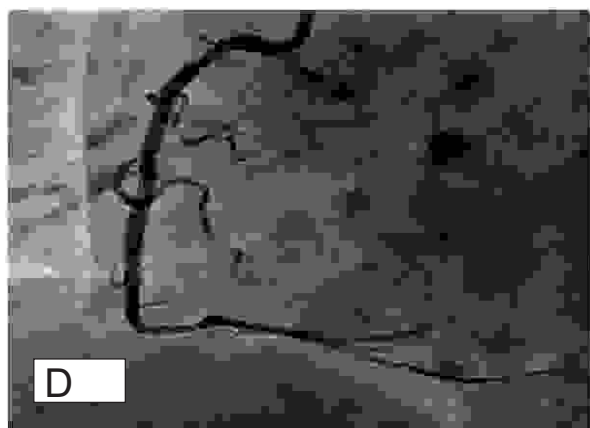
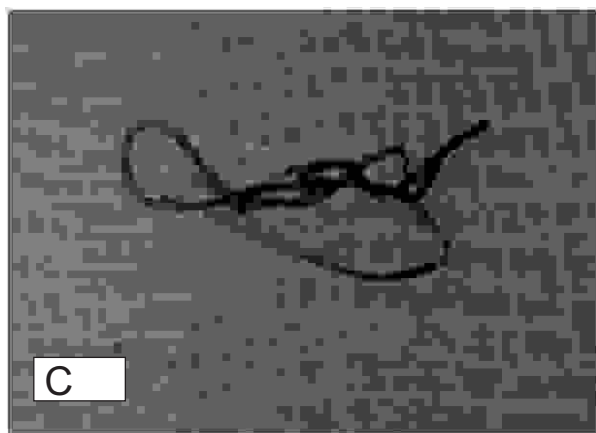


Figure 2: (2A) Diagram Showing Two Coronary Guide Wires Advanced Up to the Distal Part of the Retained Wire Fragment and Rotated to Entangle to Retain the Entrapped Fragment, (2B) Showing Retained Segment Being Entangled by Coronary Wires and Withdrawn (2C) Showing the Successfully Retrieved Guide Wire Fragment and (2D) Showing Final Result After Successful Stenting.

Case 2: Second case was of a 55 years old female, diabetic and hypertensive, landed in Emergency department with cardiogenic shock. ECG showed acute inferior wall myocardial infarction and RV infarct. Patient was shifted to cath lab for primary PCI. Diagnostic angiogram showed totally occluded RCA (Fig.3.A). A BMW guide wire was taken and culprit lesion was crossed successfully but the distal tip of the guide wire was entrapped in a small branch of Right Posterior Left Ventricular artery (R-PLV) (Fig.3.B).

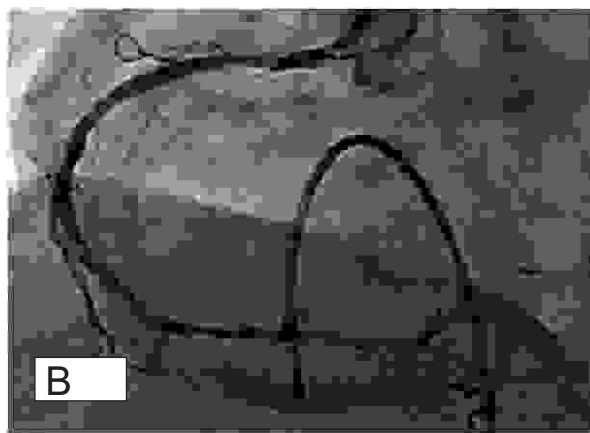
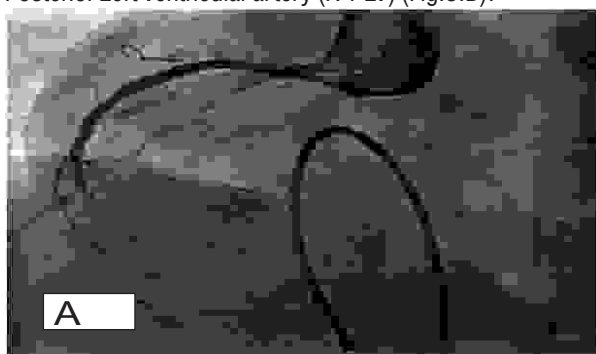
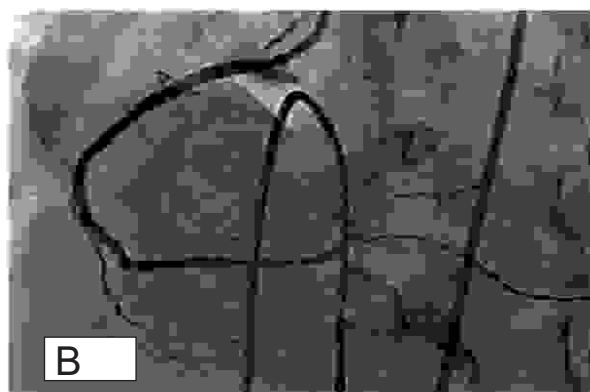
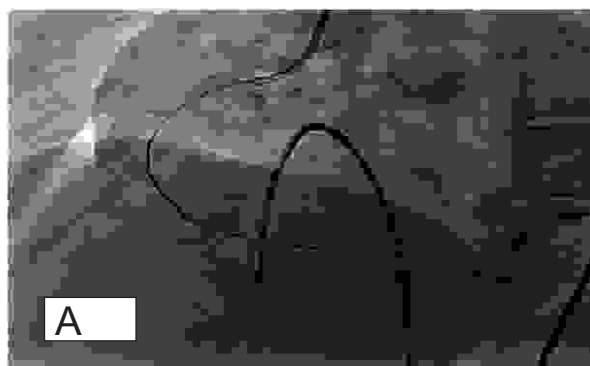


Figure 3: (3A) Diagnostic Angiogram of RCA. (3B) Showing BMW Entrapped in a Branch of R-PLV .

Upon attempts to pull the wire to redirect the tip in the main vessel the shaft of the wire was coming out but the distal tip was not moving. Upon further attempts the wire broke in its distal part while proximal part came out of the guiding catheter. We took two more BMW guide wires and parked the distal tips in R-PLV and Right posterior descending artery (R-PDA).A torque device was connected to both wires and rotated to entangle the retained fragment of broken wire between the two wires. As the entrapped wire segment started moving both the BMW wires were pulled out (Fig.4.A) while rotating the torque device with the entrapped segment out of the guiding catheter successfully (Fig.4.A,C & D). RCA was then managed with POBA only (Fig.4.B).



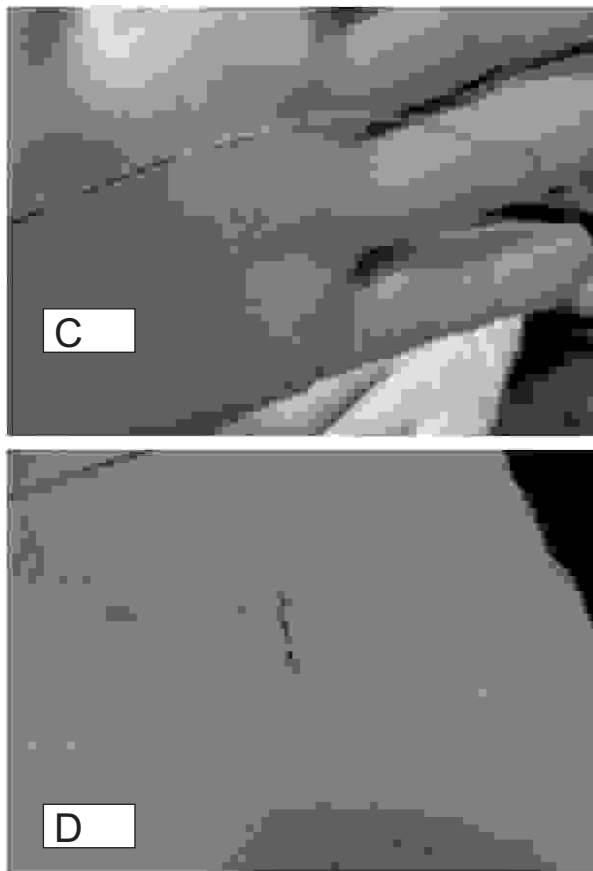


Figure 4: (4A & B) Showing Both BMW Guide Wires and the Entrapped Broken Segment being Pulled Out and the Final Result after Removal and POBA to RCA While (4C & 4D) Showing Images of the Entrapped Wire Retrieved Successfully.

DISCUSSION

Retention of the hardware including guide wire components in the coronary arteries has been reported to complicate coronary angioplasty.^{2,3} During PCI excessive bending while torque produces a high tensile load to the guide wire, especially when applies to the junction point between the very flexible distal 3 cm tip and the shaft of the guide wire and it can result in guide wire fracture.⁵

Literature search revealed a total of 67 patients in 48 reports with guide wire entrapment and a number of different management approaches which involving percutaneous and surgical retrieval of entrapped fragments and conservative therapy for some cases were applied. Of the arteries, guide wire entrapment was reported in the right coronary artery (RCA) in 22 cases, in left anterior descending artery (LAD) in 25 cases, in left circumflex artery (LCX) in 19 cases and in ramus intermedius artery (RI) in 2 cases. In 29 cases (43.3%) surgical extraction was performed and percutaneous intervention was used in 28 cases (41.8%), while in 10 cases (14.9%) were managed conservatively.^{3,6} Interestingly floppy wires were used in

most of these cases. Different percutaneous techniques were used for retrieval of the entrapped guide wire fragments including snare loop in 9 cases, stenting against the vessel wall in 7 cases, double or triple wire technique in 3 cases, use of biptome in 1 case, tornus micro-catheter in 1 case, and deep-guide catheter wedging with balloon inflation 6 cases.^{3,7-11}

Fragmented and retained piece of guide wire can be a source of thrombosis and acute occlusion that can result in catastrophic events.⁹ As mentioned earlier different management strategies have been documented and proposed in literatures. Surgery, conservative left alone, fixing the guide wire fragment to coronary vessel wall, and snare removal.¹²⁻¹⁴ All these documented management strategies are with varying rate of success. We used balloon inflation to mobilize and free the entrapped segment of the guide wire. Small and underinflated balloon catheters can also be used for mobilization and dragging of guide wire fragments into the lumen of a side branch.¹⁵ Our initial strategy was to cross the CTO and then try retrieval. In severe stenotic lesions when stenting of the guide wire segment becomes unsuccessful because of failure to cross the stenotic lesion with stent, a specific balloon Tornus catheter which is < 1 mm size, can be used to cross the stenotic segment and extract the entrapped guide wire when guide wire tips have not detached totally.¹⁰

There are many cause of wire fracture such as wire wedging into distal or winding vessels, excessive 360 degree rotation in one direction only, wire cutting by rotational or directional coronary atherectomy catheter and structural failure.¹⁶ We assume that guide wire fracture occurred due to separation of the distal core and stainless proximal shaft due to the trapping of the distal tip into thick fibrous cap of CTO in first case while excessive 360 degree rotation in one direction resulting in uncoiling of the floppy distal tip was the cause in second case. Risk of the endothelial damage is high with attempts to retrieve the entrapped wire in an already diseased vessel. So whenever possible, removal of the guide wire / catheter and grafting of the distal coronary artery is advised.¹⁷

The possible mechanics involved in rupture of the guide wires are several. During the procedure of PCI it is recommended to advance the wire across the stenotic lesion and park it far distally to facilitate the hardware movement across the stenosis. The guide wire is rotated with torque device during advancement to negotiate the branches and the correct course. But this rotational maneuver should never exceed 180 degrees. If the tip of the guide wire is not free, this excessive rotation, , leads to lateral stress caused by torque and unraveling of the platinum coil and will precipitates rupture.¹⁸

CONCLUSION

Fracture of coronary guide wire due to entrapment is a rare complication of PCI. Different techniques including surgery have been described for retrieval of broken guide wire segments. We think retrieval of the fractured segment with double wires is relatively a simple, safe and cost effective technique and be tried first before any complex procedure.

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