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Entrapment of hydrophilic coated coronary guidewire tips: Which form of management is best?

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Abstract

Fracture, detachment and entrapment of coronary guidewires is seen infrequently. Different treatment strategies have been performed for such cases in medical literature. Here, we present three different cases of hydrophilic coated coronary guidewire non-metallic tip entrapment. Conservative management was preferred as the main strategy, with a practical approach to fix the guidewire remnant to the coronary bed during intervention. All three patients were asymptomatic following the interventions. Besides case presentation and our treatment, we also briefly review the history and management strategies reported and discussed in the medical literature. (Cardiol J 2010; 17, 1: 104–108)

Key words: hydrophilic guidewire, entrapment, conservative

Introduction

Hydrophilic coated guidewires are widely used in coronary interventions. Although they perform excellently in crossing tight and complex lesions, there is some risk of complications. The biggest potential complication is subintimal movement and dissection and perforation of coronary vessels [1]. Another infrequent complication is fragmentation and entrapment of the guidewires [2]. It can lead to an acute ischemic event due to thromboembolic occlusion. The best management of entrapped guidewires is still unclear. Surgical management, percutaneous extrication of the guidewire, stent implantation over the guidewire remnants and conservative follow-up can be chosen as a treatment [3, 4]. Here we describe different approaches to guidewire entrapments as illustrated in three different cases.

Case reports and our management strategies

In the first case, tortuous and calcific stenosis was obtained in middle circumflex artery (CX) in coronary angiography (Fig. 1). Hydrophilic PT2 guidewire (Boston Scientific Corporation) was preferred because of the tortuous and tight appearance of the lesion. In crossing the lesion, the hydrophilic coated non-metallic tip became detached from the guidewire and entrapped in the calcific lesion. The retained hydrophilic polymer tip was isolated from circulation with angioplasty and stent implantation (Fig. 1). A bare metal stent was implanted due to the unavailability of a synthetic wall stent. The patient is asymptomatic for a year after intervention.

In the second case, middle right coronary artery (RCA) was stented and due to plaque shift to osteum of right ventricular branch, angioplasty was

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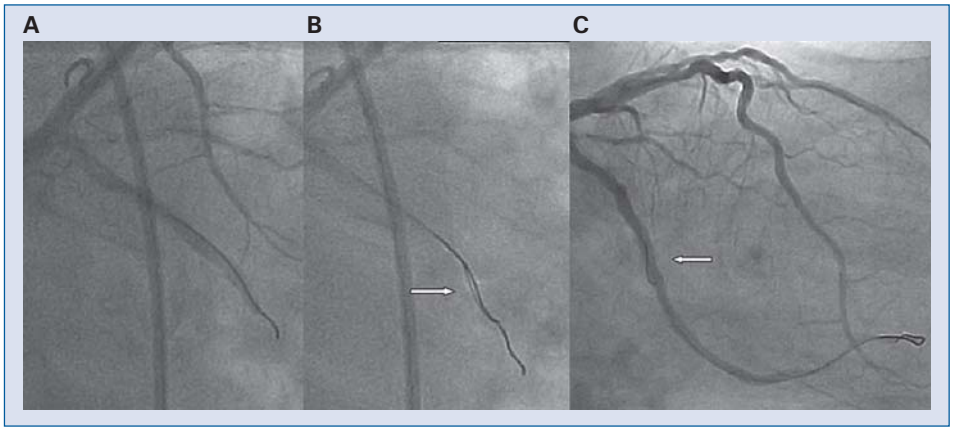

Figure 1. Right anterior caudal projection showing total occlusion of middle circumflex artery (**A**), detachment of PT2 guidewire tip (**B**, guidewire tip remnant indicated with arrow) and fixation of guidewire tip after stent implantation (**C**).

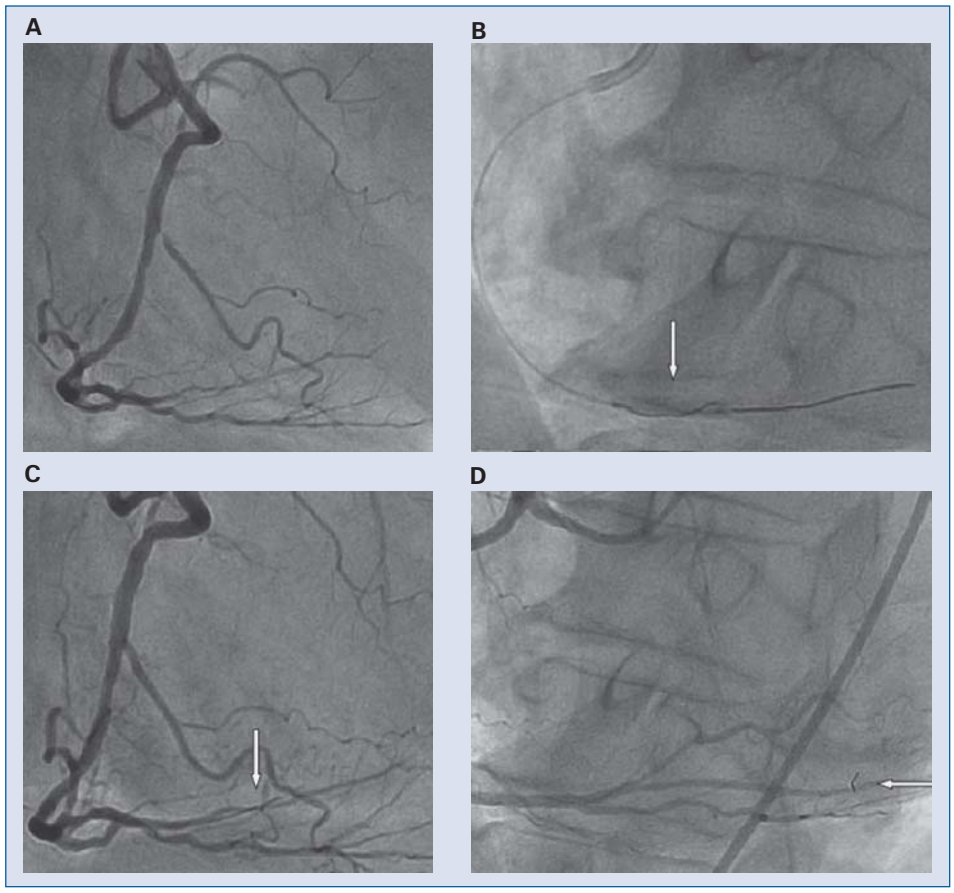

Figure 2. Right anterior oblique projection showing osteal lesion in right ventricular branch of right coronary artery (**A**). Pushing of detached PT2 guidewire tip distally with small balloon catheter (**B**). Lodging into septal branch of distal posterior descending artery and fixation of guidewire remnant (**C**, **D**, entrapped guidewire tip indicated with arrow).

performed to osteal lesion (Fig. 2). During crossing, the hydrophilic coated non-metallic tip of the PT2 guidewire was entrapped after being cut by stent striates. A snare catheter was used to extract the guidewire tip. But, the tip moved down to the distal segment of RCA. Instead of stent implantation over the guidewire, a conservative treatment was preferred. A 1.5 × 15 mm balloon catheter was

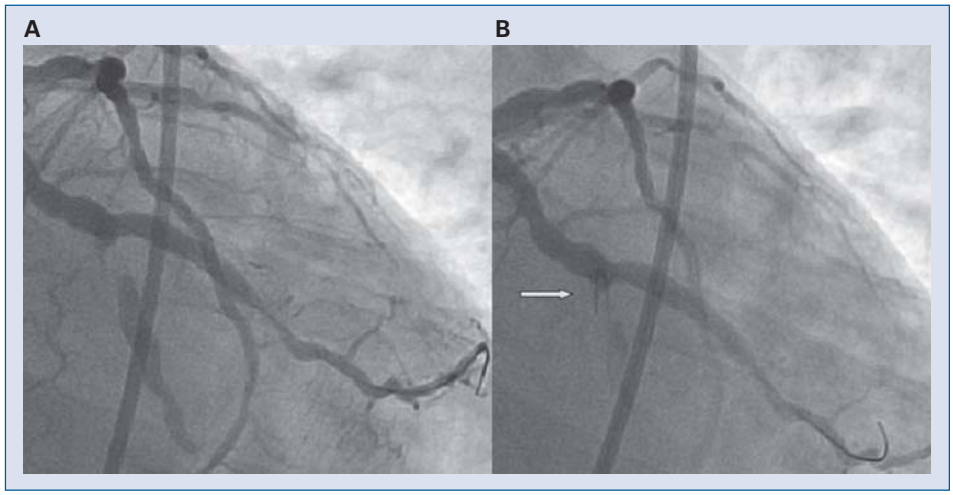

Figure 3. Anterior caudal projection revealing subtotal calcific lesion in middle circumflex artery (**A**) and fixation of PT2 guidewire tip into lesion after balloon angioplasty (**B**, guidewire remnant indicated with arrow).

inflated at low pressure (6 atm) over the guidewire fragment. The guidewire tip was lightly adhered to the balloon surface and by pushing the balloon forwards, the remnants of the guidewire were pushed to a small septal branch of the distal posterior descending artery (Fig. 2). There was no disruption to coronary blood flow. The patient is asymptomatic six months later.

In the third case: the target lesion was tortuous and calcific and occluded the middle CX subtotally (Fig. 3). PT2 guidewire was also used in this case and the non-metallic polymer tip was entrapped during crossover. It was tightly lodged into the calcific lesion and could not be mobilized and retracted with a balloon catheter. Stent implantation was impossible due to the failure of the stent to cross over the lesion. Then angioplasty was performed over guidewire tips and guidewire fixation was strengthened (Fig. 3). Distal coronary flow did not change and the patient was asymptomatic at three month follow-up. In all three presented cases, detachment of the guidewire tip occurred suddenly without any feeling of traction on guidewire mobility by the operator. So, operators should beware of such a complication when treating complex coronary lesions.

Discussion

The breaking and entrapment of guidewire is a rare complication of percutaneous coronary intervention. It can lead to severe clinical outcomes due to thrombosis and occlusion of coronary vessel and systemic embolism risk [5, 6]. Risk factors for guidewire entrapment are set out in Table 1. The management can be interventional, surgical or conservative, depending on the clinical situation of the patient and the position of the guidewire remnants [7]. Management strategies are summarized in Table 2.

Table 1. Clinical conditions that increased guidewire entrapment risk.

Conditions with higher guidewire entrapment risk
Use of firm tipped guidewire
Sharp curving of guidewire tip
Use of rotablator
Extensive maneuvers with balloon or stent catheter
Use of stiff thrombectomy catheter
Use of multiple guidewires
Stenting of bifurcation lesions
Tortuous and calcified lesion
Chronic total occlusion
Intervention of stent restenosis
Coronary intervention through stent striates
Extensive atherosclerosis of full-length coronary vessel
Kinky segmented and irregular shaped coronary vessel
Prolonged percutaneous coronary intervention session

The history of coronary guidewire entrapments goes back more than 20 years. The first cases of guidewire entrapment were reported in the late 1980s at the start of the coronary angioplasty era [6]. Urgent surgery was preferred in the initial cases

Table 2. Treatment choices of guidewire entrapment.

Management strategies of guidewire entrapment
Conservative follow-up
Interventional techniques:
Extraction with snare catheter
Stenting over guidewire
Balloon angioplasty over guidewire
Mobilization and fixing into small side branch
Surgery:
Removal of guidewire
Accompanied endarterectomy and/or graft anastomosis

[8, 9]. Until 2000, several guidewire entrapments were reported consecutively. In the reported cases, surgery was seen as the basic therapy [8, 9]. A few physicians preferred leaving the guidewire fragment within the coronary bed, especially in patients with a high risk for surgery [10]. They followed up such patients with systemic anticoagulation. But, coronary segment that contained guidewire remnant was showed up progressive stenosis in following angiography [11]. Despite the development of more flexible and high quality guidewires, the incidence of this complication has not decreased. With technological improvements in the guidewire, physicians began to intervene in more complex coronary lesions. So, the risk of guidewire entrapment remained at the same level, or perhaps even increased. Since 2000, new interventional techniques have been introduced to the arena of interventional cardiology. Retrieval of entrapped guidewire has been carried out via a special snare catheter, using a balloon as a wedge for extracting guidewire fragments. Fixing the guidewire to the coronary bed with stents has been performed and reported [5, 12]. Despite this newly introduced interventional technique, surgery constitutes a backup and urgent treatment modality [13, 14]. Also, surgery has been an easier means of treatment for a cardiologist with limited interventional experience.

In fact, surgery should be the last solution for such a patient. Moreover, surgical techniques vary according to the operator because of the absence of clear guidance and differing types of guidewire. Isolated removal of guidewire and accompanied endartectomy or graft anastomosis has been reported in medical literature. In some cases, it is imposible to remove guidewire entrapped in a small, thin side branch. In such cases, the surgeon would do best to leave the guidewire remnant within the coronary bed and follow up conservatively [4, 15].

In our experience, leaving the guidewire remnants within the small side branch of coronary artery seems logical. This maneuver can be preferred, especially for non-metallic and hydrophilic guidewire tips and if the entrapped fragment is small in diameter. Such fragments are less thrombogenic compared with metallic peers and mobilizing and drawing the guidewire to a side branch is relatively easy due toits slippery properties. Small and underinflated balloon catheters can be used for mobilization and dragging guidewire fragments into the lumen of a side branch. Another technique is isolating the guidewire remnants from circulation with stent procedure. Entrapped guidewire usually pendulates over stenotic segment's surface and this property facilitates the fixing of the guidewire fragment with stent. With a second guidewire usage, stenotic lesion and entrapped guidewire can be stented successfully.

In medical literature, different type of stents, such as graft stents, drug eluting stents or bare metal stents have been used [16]. We think that graft walled stents are not obligatory unless in the case of perforation or extensive dissection of the affected coronary vessel. We preferred bare metal stents in our case and the patient has been followed up without ischemic symptoms for a year. In excessive calcific and chronic total occlusion lesions, a stent procedure could be unsuccessful because of failure to cross the stenotic segment with stent. In such a case, a specific balloon catheter (Tornus or < 1 mm sized nano balloon catheter) can be used to cross the occluded segment and extract the entrapped guidewire when guidewire tips have not detached totally [17]. In the case of totally detached guidewire within the calcific lesion, lodging fragments into the lesion by means of balloon dilatation can be tried as a last resort when stent crossing has failed. Extracting guidewire with a snare catheter can be used in proximal segment entrapment. The success rate of the snare method is lower, especially in tortuous segmented coronary vessels and in the presence of mobile guidewire remnants.

Cardiologists should consider surgery if interventional techniques are unsuccesful, in the presence of larger and longer entrapped fragments, or if entrapment is within the left main coronary artery and accompanied by multivessel disease.

Conclusions

Fracture and entrapment of hydrophilic coated guidewire tips can occur easily in calcified and

tortuous complex lesions. So, the operator should beware, especially when treating complex lesions with hydrophilic guidewires. In entrapment cases, the surgical approach should be the last treatment considered.

Interventional techniques and/or conservative management should be preferred. If entrapped guidewire remnants are non-metallic, fragmented and localized in distal part of vessels or chronically occluded vessels, they can be followed up conservatively. Entrapped guidewires which adhere to stenotic lesions and are fixed in the surface of lesions should be stented. A bare metal stent can be used safely, but on the other hand, graft walled stents are not obligatory other than in cases of serious complication in the vessel wall. Pushing the entrapped guidewire distally and fixing it into a small side-branch can be made with a slightly inflated small balloon catheter. Although our early follow-up period of patients has been excellent, we need to check late follow-up results also to get clearer information on treatment. The management approaches that we have discussed are limited to case reports in medical literature and physicians' own experiences. Although we suggest interventional and conservative therapy as a first-line therapy besides surgery; clear-cut guidelines should be published to inform operators how to do it.

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