Successful angioplasty of three cases of coronary artery dissections using hydrophilic wires

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Abstract

Three cases of successful angioplasty of high-grade coronary dissections using hydrophilic wires were reported. Our first case had edge dissection after a stent deployed in the left anterior descending artery, after which we found it impossible to track the second stent over the regular wires, and which was successful when we tried with a stiffer hydrophilic wire. The second had spontaneous coronary artery dissections (SCAD), and the third case was a complicated plaque with multiple stenotic and ectatic segments along with dissection and successful angioplasty carried out using the same wires and without additional hardware. These wires also provided adequate support in tracking the required balloons and stents

Key words: spontaneous coronary dissections, hydrophilic wires.

Introduction

Coronary artery dissections are common during percutaneous coronary intervention (PCI) [1]. Although Floppy Guide Wires are recommended as first choice for attempting to cross dissected arteries, we did not find them superior to routine workhorse wires like BMW (Abbot Vascular) or Galeo (Biotronik) in achieving better results [2]. In our experience while trying to cross dissected arteries we have encountered abrupt closure of vessels with no flow.

Case reports

The first case was 60-year-old with chronic stable angina, and his angiogram revealed mid-portion of left anterior descending artery (LAD) 80% stenosis (Figure 1). He was taken up for elective PCI and the lesion was crossed with a regular BMW (Abbot Vascular) wire. We decided to predilate the lesion but encountered difficulty in tracking a 2.0 × 12 mm percutaneous transluminal coronary angioplasty (PTCA) balloon. We placed another BMW (Abbot Vascular) wire, which acted like buddy wire and could cross the lesion, and after adequate predilatation we could successfully deploy a 3.0 × 15 mm Xience V (Abbott Vascular) stent. Because the mid-portion of the stent was not expanded we post dilated with a 3.0 × 10 mm non-compliant Mini Trek Balloon (Abbott Vascular) at high pressure. Check shoot revealed stent edge dissection with gradual reduction of TIMI flow from III to 0. It was impossible to negotiate another balloon or stent through the dissection on the original BMW even though we were sure to be in true lumen because of the tortuosity and extra luminal calcification. Meanwhile, the patient started developing acute anterior infarct on the table and progressive hypotension. He developed ventricular tachycardia, which required electrocardioversion, and subsequently the patient had cardiopulmonary arrest, which required immediate resuscitation and intubation. Urgent cardiothoracic surgeon consultation was sought, but emergency surgery was not possible immediately. We made a desperate attempt to cross the dissection with a Whisper High Torque (HT) Extra Support (ES) wire (Abbott Vascular). After wiring it successfully, predilating the edge of the stent with a 2 ×10 mm PTCA balloon, a 2.75 × 12 mm Xience V (Abbott Vascular) stent was deployed, successfully restoring TIMI III flow (Figure 1). ST elevations in ECG settled down and he recovered completely without any deterioration in left ventricular (LV) function.

The second case was 38-year-old male patient, a young manual labourer, heavy smoker, and ethanolic, who presented with angina class II of 1-year duration.

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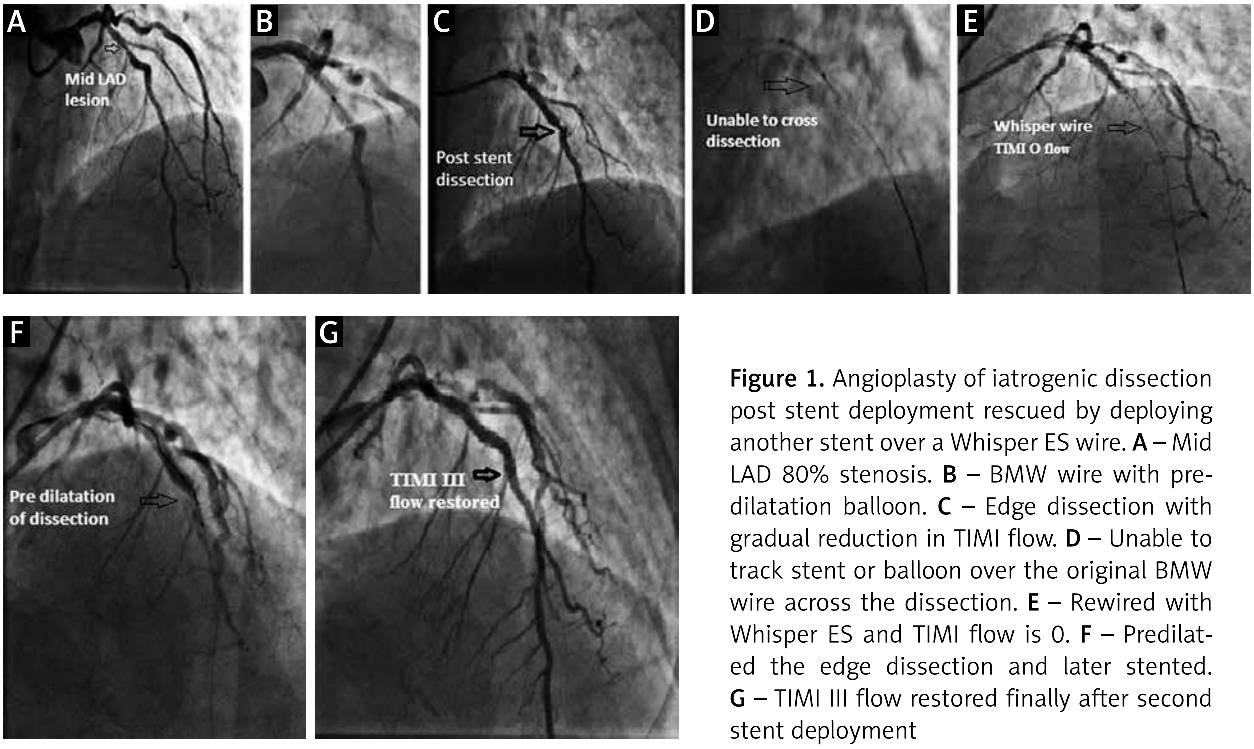

Figure 1. Angioplasty of iatrogenic dissection post stent deployment rescued by deploying another stent over a Whisper ES wire. **A** – Mid LAD 80% stenosis. **B** – BMW wire with pre-dilatation balloon. **C** – Edge dissection with gradual reduction in TIMI flow. **D** – Unable to track stent or balloon over the original BMW wire across the dissection. **E** – Rewired with Whisper ES and TIMI flow is 0. **F** – Predilated the edge dissection and later stented. **G** – TIMI III flow restored finally after second stent deployment

Echocardiogram showed mild LV dysfunction and moderate mitral regurgitation (Jet area was 9.7 cm^2).

Coronary angiogram showed a long segment proximal to the distal left circumflex dissection with subtotal occlusion and TIMI I flow distally (Figure 2). There was dissection of the posterior descending artery with good flow, and a diagonal artery, which was a 2-millimetre sized vessel, also had spontaneous dissection. This was rare case of all three vessels having spontaneous coronary artery dissections (SCAD). We attempted to cross with our regular workhorse wires Galeo (Biotronik) and later Floppy II (Abbot vascular) wires, but we were unable to advance them beyond the initial dissected portion of the circumflex artery. Next we left the initial Galeo (Biotronik)

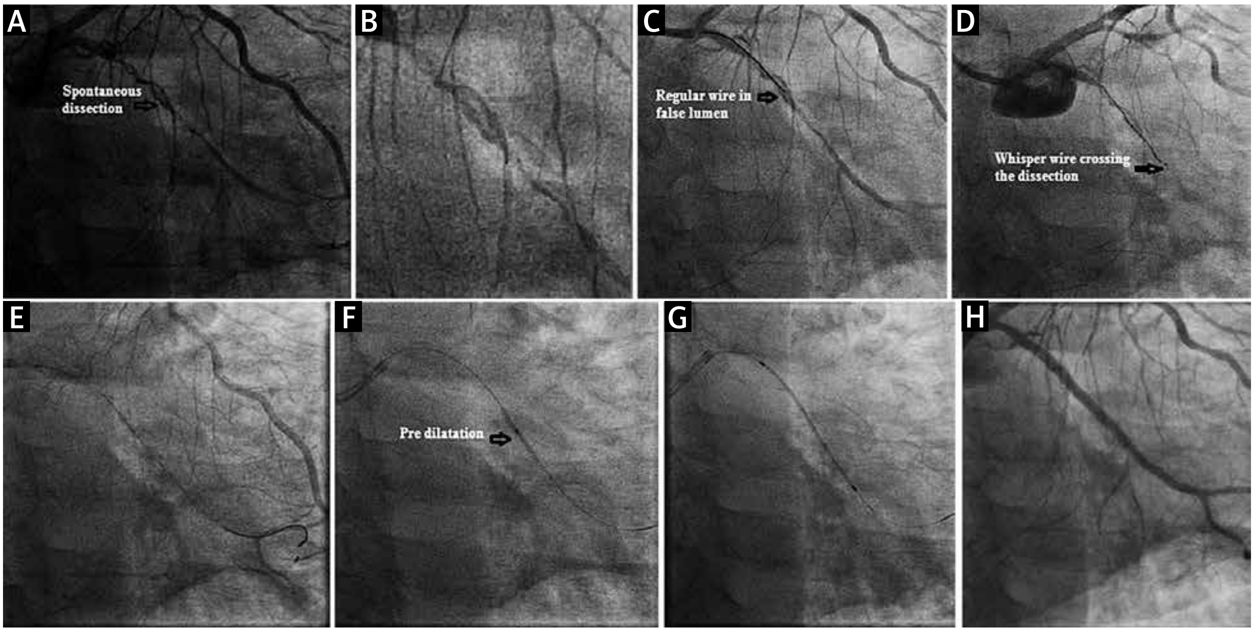

Figure 2. Angioplasty of SCAD of circumflex artery. **A** – Left circumflex having long segment spiral dissection with critical stenosis and TIMI II flow distally. **B** – Magnified view of coronary dissection. **C** – Unable to cross lesion with regular workhorse wires. **D**, **E** – Crossing the lesion with a Whisper wire. **F** – Predilatation of dissection. **G**, **H** – Successful stent deployment and TIMI III flow achieved

wire at the point where it was not advancing further and used a whisper wire to cross the dissection. This method is sometimes called the parallel wire technique [3]. By carefully manipulating the wire tip the entire dissected artery was crossed. The wire position in the true lumen was confirmed by its free two-and-fro movement and also its ease of tracking in the distal side branches of the main artery. We predilated it and successfully stented the dissected segment using a 2.5 × 38 mm Xience Prime (Abbott Vascular) stent, establishing TIMI III flow (Figure 2).

The third case is 65-year-old male with diabetes mellitus, hypothyroidism, and carcinoma of the larynx, who underwent total laryngectomy with tracheostomy and post radiotherapy. He had angina on exertion, and coronary angiogram (CAG) revealed triple vessel disease with long segment complicated plaque with multiple tight stenotic and ectatic segments along with underlying linear dissection in proximal LAD (Figure 3). Because of the nature of his coronary anatomy he was offered coronary artery bypass grafting (CABG), and during surgical work-up he was found to have mid part of subclavian artery stenosis. In view of all these comorbidities, the surgeons refused the patient for CABG. We then planned to carry out high risk PCI to LAD. We again chose a Whisper wire (Abbott Vascular) from the beginning, and after considerable difficulty we were able to cross the whole lesion successfully. We choose the plane superior aspect of the dissected artery, which facilitated easy entry with least resistance to wire advancement. We predilated the dissected artery with a 2.5 × 15 mm Maverick balloon (Boston Scientific) at 8–10 atm, and subsequently the whole lesion was stented with a 2.75 × 38 mm Promuis Element (Boston Scientific), achieving excellent results at the end of PTCA (Figure 3).

In the second and third cases intravascular ultrasound (IVUS) was not used to confirm the dissections as it was obvious by angiographic images, and because the IVUS catheter was not available at the time of performing PCI.

Discussion

Coronary artery dissections can be either iatrogenic or spontaneous. Up to 30% of all conventional balloon angioplasties result in angiographically significant coronary artery dissection [4]. Spontaneous coronary artery dissection is an unusual cause of acute myocardial ischaemia that in almost 50% of cases is followed by sudden death [5]. The incidence of SCAD is estimated between 0.1% and 0.28% of all acute coronary syndrome (ACS) or sudden deaths evaluated by angiography or by anatomical examination, respectively [5]. The first case of SCAD was described in 1931 [6], and until now approximately 500 cases have been documented in literature [7].

There is a predominance of SCAD in young women, but both of our patients with SCAD are males. Seventy percent of SCAD occurs in women, of which approximately 30% occurs in the peripartum period [8]. The left anterior descending artery is the most frequent location of

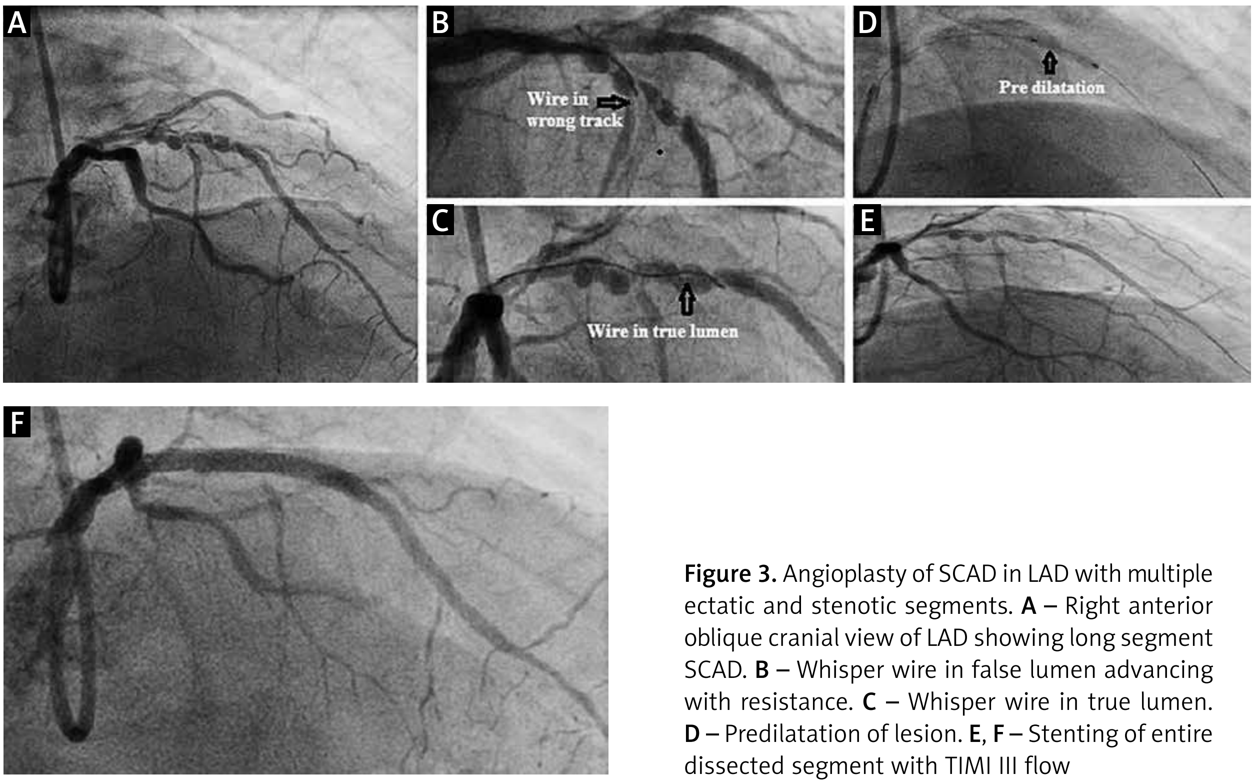

Figure 3. Angioplasty of SCAD in LAD with multiple ectatic and stenotic segments. **A** – Right anterior oblique cranial view of LAD showing long segment SCAD. **B** – Whisper wire in false lumen advancing with resistance. **C** – Whisper wire in true lumen. **D** – Predilatation of lesion. **E**, **F** – Stenting of entire dissected segment with TIMI III flow

dissection. In angiographic and autopsy series, the LAD accounts for over 60% of coronary dissections [9].

The management of SCAD is not clear because these cases are uncommon and a lot of variations exist in coronary anatomy. Sometimes a conservative approach is better if they are asymptomatic [10], as stenting can produce long segment "metal jacket" arteries because the dissected artery segments are usually quite long. Shamloo *et al.* concluded that about 20% of SCAD cases were diagnosed post-mortem and the rest by coronary angiogram; isolated single vessel involvement was the most frequent lesion, and early intervention strategy (either stent if feasible or bypass graft surgery) had a superior outcome when compared to conservative management [11].

Hydrophilic wires, when used for routine PCI cases, can become subintimal and produce dissections. As such they are avoided when they are likely to produce dissection during PCI [12]. We have found that initially, in an emergency situation, in a case of iatrogenic dissection, and later in 2 cases of complicated dissected coronaries, hydrophilic wires with extra support, i.e. Whisper ES (Abbott Vascular), were very helpful and successfully solved the crisis situation. In the first case the reason why the second stent could not advance was because it was not expanded fully at the distal end or there was an acute bend in the vessel beyond the stent. We could have used a microcatheter or wire balloon to exchange the original BMW wire with a stiffer wire, which would have given adequate support for the subsequent passage of stents or balloons. Sometimes changing the guide to one that gives more backup support would have solved the problem, but we were in a real crisis situation and something had to be done fast to avoid on-table arrest of the patient. The easiest method, we thought, was to use a buddy wire, which would give adequate support to cross the stent and dissection. But the second BMW wire was unable to cross the dissection, which became an acute total occlusion within minutes, at which point the Whisper wire came to our rescue. The hydrophilic coating gives better torquability and penetration during wire manipulation, especially when there are high grade dissections (NHLBI Grade > C). The Whisper ES (Abbott Vascular) wire also provided adequate support for tracking balloons/stents when the lesions were tortuous and significantly stenotic. Tactile feedback during wire advancement plays an important role in crossing occlusive and high-grade dissected arteries. Any feeling of increasing resistance or a "squeezing feeling" or "grating" sensation of wire movement is an indication of going into a false track, at which point the direction of advancement should be changed. The hydrophilic wire glides along the flow of blood in the path of least resistance, and if very delicate forward pushing and gentle rotatory movements are given while negotiating the dissected artery, it tends to seek the true lumen. Entering into the true lumen of dissected arteries without producing complications (abrupt closure, perforations) is the most important step, and if required we can use IVUS [13] or optical coherence tomography (OCT) [14] to decide the correct strategy of management. In all our cases IVUS was not used to confirm the true lumen and demonstrate the dissected plane due to technical reasons of non-availability of a working IVUS catheter at the time of PTCA. The IVUS increases the yield of detecting angiographically silent dissected areas, where the angiogram appears normal but there is underlying spontaneous dissection [15]. The role of IVUS in detecting angiographically obvious filling defects, which indicates coronary dissections, is unclear. Even if we cross the dissected arteries and enter the true lumen distally, it is difficult to track balloons and stents across the dissected arteries if there is significant stenosis or if vessels are tortuous with calcium as in our cases. If the guide wire re-enters the true lumen after initially entering the false lumen, exchanging with stiffer wire using a microcatheter or Venture catheter and later with a Guideliner, "stingray balloon" yields better results [16]. Luckily, the Whisper – ES (Abbottt Vascular) wire provided adequate support, in our cases, to track the balloons and stents across the dissected arteries.

Conclusions

Choosing hydrophilic wires during initial attempts to cross complicated artery coronary dissections has led to better success rates without use of extra hardware, completing the procedures in a simplified manner.

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