NEGOTIATION OF THE BALLOON/STENT IN NON-NEGOTIABLE CORONARY LESIONS

Nemani Lalita, C.Raghu, V.Surya Prakasa Rao, Maddury Jyotsna

Interventional cardiologists are confronted frequently with treatment of lesions with complex anatomy owing to aging population of CAD patients. Delivery of balloon and/or stent to the target lesion could prove challenging despite adequate lesion preparation and improved deliverability of novel stent devices in these complex coronaries. Difficulty in negotiation of balloon or stent to the culprit coronary lesion is encountered under the following circumstances:

1. Vessel tortuosity
2. Calcification,
3. Anomalous origin
4. High-grade stenosis,
5. Presence of previously deployed stents.

Numerous techniques have been reported to help overcome difficult balloon/ stent delivery.

Table 1: Techniques to overcome uncrossable lesions

Simple techniques	Advanced techniques
1. Adequate guide support 2. Guide catheter extensions 3. Use of specialized microcatheters 4. Use of extra-support wires 5. Buddy wire technique 6. Slightly inflating the balloon tip 7. "Grenadoplasty" 8. Performing additional predilation 9. "see-saw balloon-wire cutting technique"	1. Rotational Atherectomy 2. Laser angioplasty 3. Intentional sub-intimal tracking techniques

Nemani Lalita [1],C.Raghu [2],V.Surya Prakasa Rao [3], Maddury Jyotsna [4]
[1] Associate Professor, Department of Cardiology, NIMS, Hyderabad, India
[2] Interventional Cardiologist and Director, Prime Hospitals, Hyderabad
[3] Consultant, Cardiology, Apollo Hospital, Hyderabad
[4] Professor & HOU-IV, Department of Cardiology, NIMS, Hyderabad.
Corresponding author: Nemani Lalita
Email: drlalita775@gmail.com

The technical success of PCI depends on:

1. The ability to deliver the balloon or the device to the lesion.
2. The ability to adequately dilate the vessel or otherwise improve the lumen.

I. Difficulty in the negotiation of the balloon

Balloon uncrossable lesions are lesions that cannot be crossed with the first balloon after successful advancement of the guide wire distal to the lesion. Prevalence will be 0.5% if we look for the entire PCI performed to 7% in a chronic total occlusion.

A. Tortuous coronaries – Proximal vessel tortuosity makes access to the lesion difficult. When there are two bends greater than 60 degrees proximal to the lesion, the amount of tortuosity is considered to be moderate. When there are three or more bends greater than 60 degrees, the tortuosity is excess. In the MAPS Study Group, dilatation failure was more than 1.5 times when tortuosity was severe. According to the Cleveland Clinic, the procedural success rate for PCI in vessels with proximal tortuosity was 72 % compared to 88 % for the remaining lesions.

B. Angled coronaries – Angulated lesions have also been associated with a higher complication incidence. A bend point is considered to be present in any angiographic projection it appears, when the balloon in the position to dilate is located in a portion of the vessel that has a 45 degree or greater angulation at end-diastole. Care has to be taken that the view of the vessel is not fore-shortened. The MAPS Study Group found this type of lesion in 21.6 % of their patients and about a quarter of these (4.8%) had angulations greater than 60 degrees. Ellis et al subsequently reported the success rate for patients with angulated lesions to be 70 % compared to 89 % for those without. As expected, the complication rate was 13% and 3.5% for patients with and without angulated stenosis respectively. A lesion with angulation greater than 60 degrees has an even lower success rate of 53%.

Guiding Catheter Selection: Adequate guide support is an essential step to success in PCI of angulated and tortuous vessels, in fact any complex lesion. "Deep seating" the guide or selective coronary intubation may provide improved support to deliver guide wires, balloons, or stents in a tortuous and angulated vessel. However, this aggressive strategy is associated with an increased risk of vessel injury. If using this technique, a guide with side holes helps to maintain perfusion. Enhanced support can be achieved by using guide catheter extensions or microcatheters.

Deep inspiration manoeuvre: A way to facilitate stent delivery in many tortuous, calcified, and acutely angled vessels is to make the patient take a deep breath during the delivery. Deep inspiration displaces the diaphragm and the heart into a more vertical position and causes the coronary tree to straighten slightly, which facilitates balloon and stent delivery. During inspiration, the coronary arteries move caudally. The extent of the caudal motion is probably equal in the left and right coronary arteries. The more anterior vessels—the RCA and LAD—also tend to move posteriorly during inspiration. Accordingly, inspiration can reduce vascular tortuosity, particularly within the proximal segments. However this manoeuvre is not always fetching. Respiration-induced changes in catheter position can also have deleterious effects, as in a case of left main dissection reported by Biel and Krone.

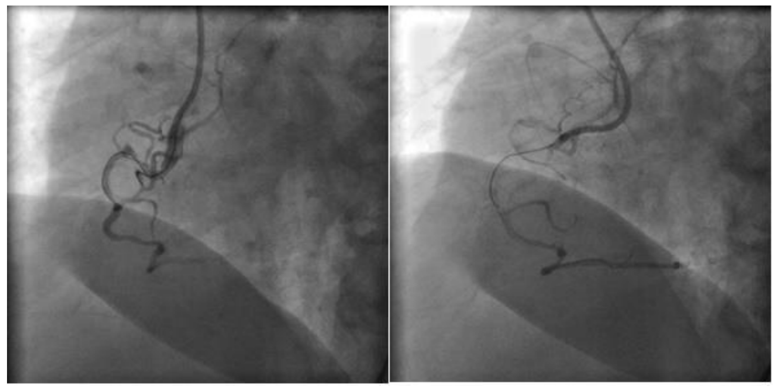
Extra-support wires: A simple strategy is the use of micro-catheter supported hydrophilic guide wire to cross the lesion initially and then subsequently exchange the initial wire with an extra support wire through the micro catheter. Examples of extra-support wires by different manufacturers have been enlisted in Table 2.

Table 2: Extra-support wires

Name of wire	Manufacturer
Grand Slam	Asahi
Choice series Extra-support	Boston scientific
Whisper ES, Balance Heavy Weight	Abbott
Stabilizer plus	Cordis

Rollercoaster angioplasty – Proper guide support and one hydrophilic wire to straighten the proximal tortuous vessel then another wire like ironman guide wire to negotiate the distal vessel then small balloon to track it (Fig 1).

Figure 1: Rollercoaster angioplasty



C.Anomalous origin of the coronaries:
When choosing a guiding catheter, it is important to select the appropriate guiding catheter based upon the vessel location, takeoff, and size so that coaxial alignment and support are maximized. Guide catheter extension system is a useful and reliable alternative to facilitate some difficult angioplasties by providing extra support and back-up. It can be employed as a “bail-out strategy” in challenging cases or can also be used as a first strategy to face anatomical difficulties.

Ramanathan et al. described an anomalous origin of a right coronary artery (RCA) arising from the left coronary cusp, where GL facilitated coaxial engagement and stent delivery after failure of conventional guides to achieve selective cannulation. Similarly, in a case with critical left circumflex artery (LCX) stenosis, which arose from an anomalous LM coronary artery originating from the right sinus of Valsalva, GL was placed in the distal LM for additional support and avoided guide disengagement [19]. In a recent case, GL was success- fully used to enhance backup and increase pushing strength allowing stent deployment in distal LCX arising from a single left coronary artery.

D. Graft PCI: One of the main difficulties in graft PCI is the near impossibility of coaxial engagement of the ostia. GE often provides the only solution to properly engage with adequate support both vein grafts in the ascending aorta or the mammary artery, especially in the presence of an extremely tortuous subclavian. Farooq et al. have highlighted the feasibility of GE devices, including GL, to overcome many of these problems and facilitate trans-radial graft interventions in a series of selected complex cases. Park et al. reported a challenging PCI in which GL allowed stent deployment in left anterior descending (LAD) artery through a tortuous left internal mammary artery (LIMA). Additional backup support for equipment delivery can be achieved by deep intubation of GL in the graft or indeed deep insertion of guide catheter over GL system ("Rail-Roading"). Finally, when faced with a proximal graft lesion, which may prevent deep guide intubation, further backup may be achieved with a 'Swan-Neck' manoeuvre with the guide catheter positioned in the aortic sinus and tip of the GL extended to the vein graft ostium.

E. **Uncrossable chronic total occlusion:** chronic total coronary occlusions (CTO) are encountered in 15 to 20 % patients referred for coronary angiography. The success of CTO revascularization can be attributed to the vast array of hardware that has now become available and also to the vastly enhanced operator expertise. It is however realistic to state that despite the tremendous increase in the rate of successful CTO revascularization, there then comes a subset of CTO where revascularization attempts fail. The reason for such failures given that other variables remain constant is the inability to cross the CTO lesion.

I. This can be due to a failure to cross the lesion with a guide wire (despite guide wire escalation).
II. The second cause of failure commonly is the failure to cross the lesion with a balloon (i.e. Uncrossable CTO lesion). This can occur despite the successful placement of a wire in the distal true lumen. Instances where the balloon passed could not be dilated also constitute the array of CTO PCI failure. The balloon Uncrossable lesions contribute in 2 to 10 % of CTO PCI failure cases.

Guide support: It is quite essential that a guiding catheter that provides good support is employed for dealing with Uncrossable CTO lesions. Failure to cross a lesion with a low profile balloon is most often due to severe calcification at the occlusion site or a significant tortuosity or as is most often the case a combination of both of these. There are two essential methodologies that address the issue of "Uncrossable Lesions" and attempt to offer solutions for a successful outcome. The first of these looks at improving guide catheter support. Guide catheters with large size- extra backup, Amplatz and other specially designed guide catheters provide maximum support. The use of long sheaths, armour guide catheter technique, mother and child technique (5 in 6 or 7 Fr heart rail Terumo catheter) , Guide liner (vascular solutions) , buddy wire technique and balloon anchoring techniques including distal anchoring wire technique further provide the strong back up support that is desired when tackling such lesions . 3-4-5The change of guide catheter to better one and by deep seating it also results in optimization of support. During reverse controlled antegrade and retrograde subintimal tracking (CART) the advancement of the GL from the antegrade guide catheter can offer a visible and accessible target for the retrograde wire. "GuideLiner reverse CART" is an elegant modification of reverse CART shortening the dis- tance between the site of re-entry of the retrograde guidewire and the antegrade guiding catheter

The lesions which are Uncrossable in spite of obtaining good guide backup support are truly uncrossable lesions. These are mostly densely calcific lesions, a cardiologist's nightmare. Various techniques have been described to treat it. The lesions are attempted with low profile over the wire balloon, corsair micro catheter, Tornus micro catheter (Asahi Intec), rotational atherectomy, excimer laser atherectomy and also with the use of Tornus microcatheter with side branch balloon anchoring technique.

Balloon support: Simpler techniques are attempted first, such as using a new, small (1.2–1.5 mm) balloon that can sometimes be ruptured intentionally to modify the plaque [balloon-assisted microdissection or grenadoplasty]. It was suggested that the distal third of the balloon be positioned in the lesion. If the balloon ruptures, less material would be trapped within the lesion and therefore facilitating withdrawal. Use of specialized balloons such as cutting balloon and angiosculpt can modify the plaque and can assist in passage of balloon or stent. Advanced techniques such as rotablator may be needed in 30% . In the absence of rotablator one can serially upsize the balloon upto even a size larger than the intended stent size choice as it can enlarge the lumen to allow smooth passage of stent.

1. *Difficulty in passing balloon through CTO segment after crossing the lesion with wire* - After successful wire crossing of a CTO, the next major technical challenge is balloon dilatation of the lesion, which is unsuccessful in up to 9% of cases. Approaches to overcome the limitations include selecting larger guide catheters with more support, deep intubation of the guide catheter, inflation of an angioplasty balloon in a proximal SB to stabilize the guide catheter, and use of debulking devices (Table 3). Even when guide liner not able to give support to pass the balloon engaging the lesion site with Tornus-pro catheter and to exchange with rotablation wire and doing rotablation may be helpful. Simple manoeuvres such as inflating at high pressures a low profile smallest diameter balloon even when the nose cone of the balloon has "dipped" into the lesion shall facilitate further balloon advancement.

2. *The balloon anchoring technique* was initially described by Fujita in 2003 as inflation of a balloon in the side branch of a target coronary vessel to facilitate equipment delivery to a target lesion. Anchoring the balloon in the side branch from the lesion may not give the support for pushing the balloon. Then better is distal anchoring balloon in the main vessel. Distal anchoring is a variation of this technique in which a balloon is inflated distal to or at the target lesion to enhance support for equipment delivery.

A modified version of the distal anchor technique was used to cross a balloon-Uncrossable CTO by performing distal balloon inflation on a wire passed into the subintimal space. The distal balloon anchoring in the subintima is also reported to provide back up support for this lesions. The counter movement of wire and balloon should be done during application of anchor balloon techniques.

3.*Multi wire plaque* crushing technique is one of among all which had also proven effectively. The multi-wire plaque crushing technique is to insert 1-2 wires along with the original wire located in the true lumen of CTO after balloon failure for plaque crushing and then to withdraw the crushing wires to get an enlarged lumen inside the occlusion segment, thus facilitating the passing of the low profile balloon.

4. *The seesaw balloon-wire* cutting technique is one of the effective and safe technique to facilitate balloon crossing during CTO interventions. The main process of this technique was to insert two guide wires (guide wire A and guide wire B) into the distal true lumen of CTOs and then to advance two short and low-profile balloons (balloon A and balloon B) over the two guide wires, respectively. Balloon A was first advanced over guide wire A as distally as possible, and then was inflated with high pressure (≥18 Atm) to press guide wire B, producing a cutting power to crush the proximal fibrous cap of the CTO. Subsequently, balloon A was withdrawn slightly, and balloon B was advanced as distally as possible and then was inflated to press guide wire A, producing a similar cutting effect to crush the proximal fibrous cap on the other side. The two balloons were progressed alternatively until one of them was able to cross through the occluded segment.

5. *The Grenadoplasty* is also yet another useful technique for Uncrossable lesion CTO PCI. In Grenadoplasty small (usually 1.20 – 1.50 mm) balloon is advanced as for as possible into the lesion and inflated at high pressure until it ruptures. The balloon rupture can modify the plaque resulting in successful penetration of another balloon.

6. Another simple technique is to "rewrap" the balloon by inflating the balloon within the guide catheter at low pressure.

7. Advanced treatment strategies for balloon uncrossable lesions include laser and rotational atherectomy. Laser is particularly well suited for treating such lesions as it can be used over any standard 0.014 inch guidewire, but has limited availability. Laser is proven to reach high success rates in balloon resistant coronary lesions in the LEONARDO (early outcome of high energy Laser [Excimer] facilitated coronary angioplasty ON hard and complex calcified and balloon-resistant coronary lesions) study.

8. If all else fails, subintimal strategies can be used for balloon uncrossable lesions, by advancing a knuckled guidewire or a Cross Boss catheter through the subintimal space across the occlusion, followed by (a) modification of the lesion by subintimal balloon inflation (b) distal anchoring by inflating a balloon distal to the occlusion that facilitates intimal balloon crossing; or (c) by re-entry into the distal true lumen followed by stenting of the subintimal space.

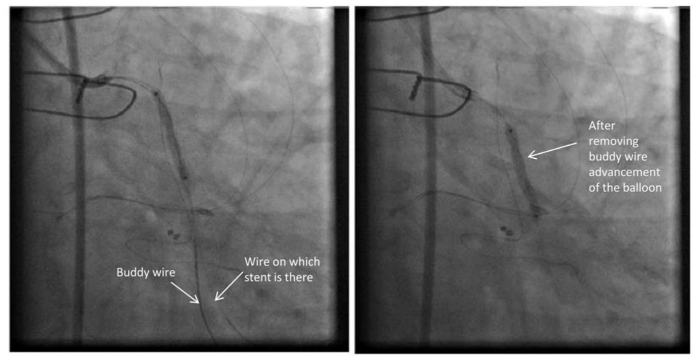
Given the high prevalence and significant impact of balloon uncrossable lesions in reducing procedural success, having a clear understanding and local availability of equipment and techniques to treat balloon uncrossable lesions is critical.

Balloons: The newer balloons have become smaller to aid in crossing the tighter lesions, more pushable to negotiate tortuous vessels and simplify crossing tight coronary lesions, and stronger to permit use of higher pressures. Savas et al used long balloons for PTCA in 69 lesions with angulation greater than 45 degrees. The success rate was 88 %.

1. **Difficulty in passing compliant balloon to the lesion site, after stenting for post dilatation –** Buddy wire and deep guide intubation may be helpful. A new method for further advancement of balloon beyond the stented segment, when negotiation of the stent itself was difficult and bare minimum position for implantation with help of buddy wire. After stent deployment, do not remove the dilated stent balloon, but remove the jailed buddy wire slowly (Fig 2). This will facilitate the balloon advancement more distally in the vessel. At this time precaution is taken for guide deep engagement also.

2. **Difficulty in passing semi-compliant balloon to the side branch lesion site, in bifurcation lesion -** During bifurcation angioplasty, using bioresorbable scaffold in small vessels, there could be difficulty in negotiating the balloon in the side branch through the scaffold struts. Adequate repeat dilatation with NC balloon at high pressure may facilitate there-crossing of the balloon through the scaffold struts.
3. **Difficulty in passing semi-compliant balloons for kissing after main vessel stenting -** Interventions requiring final kissing balloon inflation are feasible with the use of 6-in-7 (and, where necessary, 7-in-8) GL . If coronary guidewires have been placed in the main vessel and side branch, GL must to be inserted over both coronary guide wires . Inserting a new guidewire can be difficult and if a guidewire is needed while the GL is already in situ, meticulous attention has to be paid to ensure the guidewire passes through the lumen of the GL tubing rather than outside by direct visualization on fluoroscopy.

Fig 2: Advancement of the stent balloon distally after removing the buddy wire.



4. **Presence of previous stent:** Under expansion of the previous stent predisposes to stent restenosis and at same site the balloon may not negotiate. “Focused” and “forced angioplasty” procedure may be helpful. This is by passing a buddy wire and inflated the small balloon to very high pressures, which yields the lesion as maximum pressure on the lesion is created at the narrowest portion. Presence of proximal tight lesion also prevent the balloon to reach the target lesion site. Balloon dilatation of the proximal lesion will facilitate the distal lesion negotiation.

II. Difficulty in the negotiation of the stent

Negotiation encompasses both deliverability and trackability. Deliverability means ability to deliver stent to target lesion. Determinants are longitudinal flexibility, crossing profile, trackability, nesting (security of stent attachment to delivery system whish again dependent on stent design and profile.). Trackability means ease of movement over guide wire. Determinant are profile, shaft coating, stiffness, distal tapering in difficult lesions if direct stenting is attempted then potential stent embolization if stent will not cross target lesion. Predilatation is preferred in complex anatomy (calcification, angulation, ostial, or total occlusion).

Optimal Guide support is a pre-requisite. Enhanced support can be achieved by using guide catheter extensions or anchoring techniques. Those techniques can be used simultaneously with a lesion modifying technique further enhancing the likelihood for success. A list of the devices and techniques has been mentioned in Table 4.

Table 3: Techniques to overcoming uncrossable CTO

Guide Catheter Support	Guide Wire	Lesion modification
7, 8 Fr Guides: Amplatz, extra backup guides	Anchor wire	Tornus or corsair micro catheter
Long arterial sheaths	Buddy wire	Excimer laser: ablative and acoustic energy
Armour guide technique	Anchor balloon: side branch, distal target vessel or Subintimal at or below lesion site	Rotational atherectomy
Deep engagement		Seesaw balloon-wire cutting technique
Mother and child technique		Grenadoplasty
Guide liner		Multi wire plaque crushing technique
If antegrade approach fails	Fielder FC	Retrograde approach

Table 4. Enhancing the guide catheter support

Devices	Techniques
1. Guide-extension system 2. Micro-catheters	1. Side branch anchoring 2. Distal balloon anchoring 3. Proximal balloon anchoring

Guide catheter extension system: A useful and reliable alternative to facilitate some difficult angioplasties by providing extra support and back-up. It can be employed as a “bail-out strategy” in challenging cases or can also be used as a first strategy to face anatomical difficulties. There are four guide-catheter extensions available in market:

1. GuideLiner catheter (Vascular Solutions Inc., Minneapolis, MN, USA)- available in 4 sizes: 5.5, 6, 7, and 8 Fr.
2. Guidezilla (Boston Scientific, Natick, MA, US) - only available in a 6-Fr size
3. Heartrail (Terumo Corp., Tokyo, Japan)- available in 5, 6, and, 7-Fr sizes
4. Guidion (IMDS, Roden, Netherlands)- available in 5, 6, 7, and 8-Fr sizes

Guideliner catheter: The GL is a coaxial “mother and child” GE system, which has been developed for deep vessel engagement and device delivery; providing active guide support by its long flexible tubular end, which can be deeply advanced into the target vessel. Unlike deep intubation of a guiding catheter, the GL has no primary curve and its soft distal tip promises a low dissection risk compared to deep seating of regular guides. The first generation GL received FDA approval and CE marking in 2009 and was designed as a single lumen rapid exchange catheter with a flexible 20-cm tip connected by a metal collar to a 115-cm stainless steel shaft. The second-generation V2 system has a 5 cm longer flexible tubular end and an all polymer collar for increased flexibility; in the more recent V3 the 25 cm rapid exchange section is maintained but with an additional “half-pipe” to assist device alignment when passing through the collar transition and to limit the incidence of stent collar interactions.

Twente GuideLiner Registry- 70 lesions were treated through a “5-in-6” GuideLiner catheter. Among them, 97% were type B2/C (according to the American Heart Association [AHA] / American College of Cardiology [ACC] classification), 53% distal, and 23% showed heavy calcifications. The indications of the use of this “mother and child” device were as follows: to increase back-up and facilitate delivery (59%), achievement of coaxial alignment of the guide catheter (28%), and selective contrast injections (13%). The success rate reached in the latter study was as high as 93%, confirming other previous reports.

The use of the GuideLiner proved generally safe; however, some complications have been documented. Balloon damage at the site of metallic collar was reported by Murphy et al. Seto and Kern described stent deformity upon attempted movement through the proximal GuideLiner collar. Minor complications such as air-embolism (De Man et al), stent dislodgement and pressure damping especially with "6-in-7" Fr GuideLiner engagement (Luna et al) have been described. The new design of GuideLiner V3 aimed to prevent stent damage and dislodgement.

Recommendations for the optimal use of this device are:

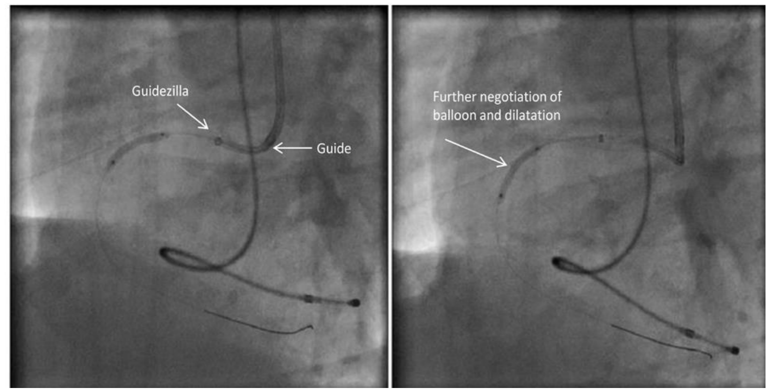
a. Vent the system in order to diminish the risk of air embolism.
b. The Guide Liner should be inserted using a guide catheter over a first guide wire, in such a way that the tip protrudes a maximum of 10 cm.
c. The connection to the flexible segment should be made in the straight portion of the guide catheter in order to facilitate the passage of devices along it.
d. The operator should be sure that the proximal segment of the target coronary vessel is suitable for intubation. Indeed, if the lesion extends to the proximal part or if there is a sharp angulation, the extension system is not recommended.

The model "5-in-6" Fr, allows the passage of regular balloon catheters, contemporary optical coherence tomography catheters, and stents up to a nominal diameter of 3.5 mm. However, it does not permit the use of larger devices such as thrombectomy catheters, self-expanding stents, some intravascular ultrasound probes, and simultaneous kissing balloon inflations.

Guidezilla: It is a 5-in-6 F (1.67 mm – 2 mm) guide extension catheter that offers steadfast backup support, exceptional pushability, unsurpassed kink resistance, and the stiff-yet-flexible extension to finesse across complex lesions. It is designed to conquer the complexities of non-compliant and tortuous vasculature (Fig 3).

i. The stainless steel hypo tube shaft provides exceptional pushability and kink resistance.
ii. A hydrophilic coating on the outer-diameter reduces friction and enhances deliverability through complex and tortuous anatomy.
iii. 1x1 Braid provides extra back-up support without over straightening the artery.
iv. 0.057"(1.45 mm) Inner-diameter allows more real estate to deliver interventional devices.
v. 0.066" (1.68 mm) Outer-diameter reduces guide catheter interference

Figure 3. Guidezilla for PCI of tortuous RCA



Guidion: Guidion has a more flexible atraumatic distal end; the most recent version promises to have better pushability.

Potential indications for guide-extension use

i. Devices delivery in presence of vessel angulation and tortuosity
ii. Devices delivery in presence of diffuse coronary calcifications
iii. Facilitation of catheter engagement and intervention in anomalous coronary arteries and grafts
iv. Supporting the initial wiring or to assist advancement of balloon or micro-catheter during chronic total occlusion interventions as well as to facilitate re-entry of the retrograde guidewire.

Other maneouvers to enhance guide-catheters support: 6F Long Brite Tip® guiding catheters can be used for deep intubation of the coronary artery, enabling more support in the case of poor stent accessibility. The 5-in-6, a 6F guiding catheter was strengthened by inserting a 5F guiding catheter through it. Because the 5F catheter was longer and softer, its tip protruded beyond the 6F catheter, and it could be safely advanced into the tortuous coronary artery. An aspiration catheter was used as a sheath during a difficult stent delivery when alternative techniques, including the buddy wire and anchoring, were unsuccessful.5 When initial stent delivery failed, Singh and colleagues successfully used a phospholipid-emulsion stent lubricant, Rotaglide® System Lubricant (Boston

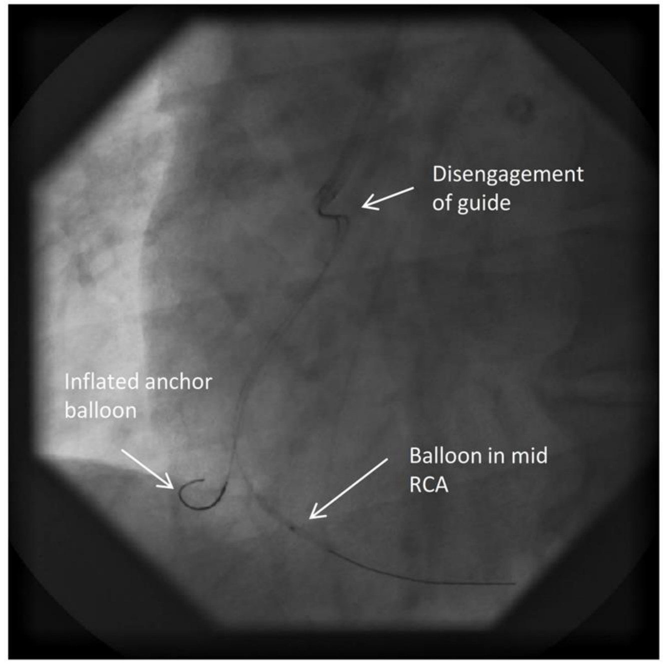
Scientific Corporation; Natick, Mass). If IVUS is negociatable then we can find the reasons for failure of passage of the stent like calcific nodule protrusion.

Guidewire Selection and Technique

a. Switching to a Stiffer Wire after Crossing with the Flexible Wire
The difficulty in placement of stents in tortuous coronary arteries is mostly overcome by the use of a stiff wire either alone or adjacent to the stent delivery system to "straighten" the coronary vessel. The lesion should be first crossed with a flexible workhorse wire and then exchange it for a stiffer wire. This can be accomplished in an over-the-wire (OTW) system or intracoronary catheter such as an Ultrafuse or Transit catheter, microcatheter or other telescopic guiding systems. Special wires such as Wiggle wire can be used to facilitate the passage of a balloon or stent in tortuous segment by optimizing the coaxial push.

b. Buddy Wire" Technique
In some circumstances, the addition of a second guidewire across the stenosis, commonly referred to as a "buddy wire," will aid in the delivery of the device. The second wire often straightens the vessel and allows for easier delivery of the stent. If a buddy wire is used, a wire of different stiffness and lubricity from the original wire is usually chosen. Care should be taken to remove the buddy wire before deploying the stent. Wire entrapment and microembolization of wire coating are minor issues where in over the wire system (OTW) may offer an advantage.

c. Anchoring balloon technique
Placement of a balloon inflated at low pressures in a proximal side branch can help deflect the guidewire into the main or desired vessel. Alternatively Long balloons (30-40 mm) with slightly inflated balloon tip proximally can help straighten angulation proximal to the lesion to facilitate passage of the guidewire.



Delivery of Stents in Angulated in Tortuous Lesions

If OTW systems, lower profile monorail and fixed wire system (SVELTE stent in some countries) fail, one should change the stent. Shorter stents are easier to deliver than the long ones. Among the bare metal stents, newer generations such as those made of a chromium cobalt alloy may be easier to deliver. Among the drug eluting stents (DES), the newer generation such as Xience/Promus or Endeavor which have smaller strut profiles would be easier to deliver, in comparison to first generation DES.

Difficulty in passing a stent through a stent

Previously deployed stent - Stent to more distal coronary bed; There is considerable date suggesting that if the diameter of the artery is 2.5 mm or less, an indwelling stent is more likely to cause restenosis.

Difficulty in passing stent to the side branch through the main branch stent: Novel dedicated bifurcation stents have recently been developed to provide easier access to SB and Scaffold more effectively its ostium, matching the stent configuration more closely to the anatomy of the bifurcation.

In conclusion, the major success of PCI depends on the negotiation of the stent or balloon to the target lesion site without producing complications. For that the prerequisite is excellent guide support with the different manoeuvres mentioned above. All these manoeuvres mentioned above are associated with complications, so operator has to pay attention to prevent complications. To discuss these components are beyond this article preview.

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