Editorial Comment

How to duplicate the procedural success of coronary interventions by the radial approach: tips and tricks in the selection and manipulations of guides

Thach Nguyen, Lan Nguyen

St Mary Medical Center, Hobart IN 46342, USA

In this issue of the *Journal of Geriatric Cardiology*, Jing et al. showed off their near perfect results of percutaneous coronary interventions (PCI) through transfemoral approach (TFA) and transradial approach (TRA) in the elderly Chinese patients. All patients were older than 60 years of age, with an average of 67. In this interventional cardiac laboratory with high operators' expertise level, the results of PCI showed no difference on the length of time for vascular access, fluoroscopy time, procedural success and less complication for TRA. These data favoring TRA were confirmed previously in many studies. In this study, most of the guides used were the Judkins right (JR) and left (JL) with rare exceptions. The majority of the lesions were in the left anterior descending artery (LAD), with smaller number from the left circumflex (LCX) and with the lowest number from the right coronary artery (RCA). The distribution between the non-LAD and LAD lesion was equal at 50/50. However, in the real world, can every operator, experienced and non-experienced alike, duplicate the results of Jing et al. in his own interventional laboratories? The most difficult part of any approach is to have strong guide support, sufficient for stent advancement across the target lesion. So this editorial will discuss how to achieve the same technical results as Jing et al. and focus on the selection and manipulation of guides by TRA.

Guide selection The guide selection from any approach depends mainly on the target lesion features, lesion location, the presence or absence of proximal tortuosity, size of the ascending aorta and location of the coronary ostium. During transradial intervention (TRI), besides the above factors, the operator has to take in consideration other factors such as the distal origin of the brachiocephalic trunk from the aortic arch and subclavian-brachiocephalic tortuosities, which are frequently encountered in the elderly and hypertensive patients. The size of the guide has to be compatible with the patient's radial artery diameter and the planned intended technique (stenting, rotablation, kissing balloon technique, etc.). Extensive manipulation of guides may provoke spasm, especially in anxious patients or those with small radial arteries or anatomical difficulties.

Once a guide is selected, its co-axial alignment with the ostium is more important and safer than an active support or ''power position'' following aggressive guide intubation. Because almost all interventional devices (stent, cutting balloon, directional, rotational ablative, thrombectomy or distal protection devices, etc.) are rigid and of large profile, a non-coaxial alignment of the guide may lead to injury, endothelial denudation causing thrombus or dissection of the ostium of the coronary vessel.

This is why appropriate guide choice is even more critical with the TRA than with the TFA. There are many specially designed guides for right TRA, but the most commonly used ones for the left radial approach are the same workhorse guides from the TFA. However, manipulation of these guides in the TRA is fundamentally different when compared with the manipulations used in the TFA.

Guides for the left coronary system Most operators still use the Judkins guide irrespective of the approach – right or left radial. This is probably due to the fact that most radial operators were originally trained to perform transfemoral angiography and feel comfortable with the Judkins guide. In the Spaulding series on left TRA, there was high success rate for left coronary artery (LCA) cannulation with the Judkins guides but a second guide was needed for right coronary cannulation in every 10th patient.[1] Often successful LCA intubation is achieved with a JL that is 0.5 size smaller than the one selected for transfemoral angiography.[2]

The Judkins guide When a JL4 is used in patients with vertical and normal-sized aorta, the resultant backup support is 1.6 times lower in comparison with the one provided by the same guide if used transfemorally.[3] The point of contact with the contralateral aortic wall during right TRA moves further up above the left coronary ostium and this results in reduced backup force. So a smaller JL guide (e.g., 3.5) would provide stronger support. JL is an appropriate guide in the setting of noncomplex lesions or in left main (LM) stenosis, where good support is not critical. When the target artery is the LCX, a 0.5 larger size is preferred for better coaxial alignment. If active support is deemed necessary, deep seating for the LAD can be achieved with 5F short-tip JL. Extra back-up (EBU) guides could provide greater support than JL, without aggressive manipulation, due to the larger contact area and the nearly right angle with the contralateral aortic wall. An inherent drawback of EBU guides is the tendency for deep intubation of the LAD or LCX in the presence of short LM (especially with larger sizes). In cases of complex LAD or LCX angioplasty and adequate length of LM, wide bifurcation angle or extreme proximal tortuosity, EBU guides often become the guide of first choice. The Amplatz (AL) 1.5 or 2.0 guide is suitable for complex lesions of LCX and provides greater passive support. Because of the pointing downward AL tip, the operator should pay attention to prevent dissection caused by deep intubation when pulling any device out of the ostium.

Cannulation of the LCA ostium and obtaining optimal backup support might be fairly difficult in patients with dilated and unfolded aorta. In cases with more distal location (more to the left) of the origin of the innominate artery, the guide approaches the LCA more from the left and this encumbers manipulation. Deep inspiration, leaving the wire in the guide during maneuvering or selecting guides with brachiocephalic curve may help in this setting.

Guide for the right coronary artery When the RCA arises more anteriorly or above the right cusp, the tip of the Judkins guide will not stay coaxial inside the right ostium. The coaxial position can best be appreciated by viewing the tip of the guide as a ring in a head-on position with the right anterior oblique (RAO) 30 view.

The first choice guide for noncomplex or ostial RCA lesions is the JR in sizes similar to the ones used for TFA. In cases of dilated aorta, there is lack of contact area with the contralateral aortic wall, which results in poor support. The 5F JR and multipurpose (MP) guides are suitable for deep seating or so called guide "Amplatzising". Indeed, best support can be achieved with the AL guide itself but the operator should be extremely careful not to cause dissection with the traumatic AL tip. In some centers, radial interventionists have good experience with the dedicated radial curve guides (e.g., Kimney, Fajadet, Barbeau guides).

Single radial guide techniques Use of a single diagnostic catheter or guide may minimize frequent exchange of hardware and thus may reduce the incidence of spasm and embolism. This offers also a cost benefit – 1 catheter or "guideless" is used. Several types of "MP" catheters like the Kimny and Barbeau have been tested in this regard. Louvard et al., who have had vast experience with the AL guides with exceptionally high success rate, have advised the use of the AL for both coronary arteries. [4]

Even after an optimal guide is selected, for many times, interventional devices could not be advanced so new techniques need to be used in order to strengthen the guide for better support. Different techniques are illustrated below.

Deep-seating a guide A guide could be better aligned by additional clockwise rotation to allow the tip to engage deeper into the ostium. The guide is advanced over an interventional device (stent, balloon catheter, etc) while applying clockwise torque. Once the guide is deep-seated, the interventional device is advanced and positioned. After achieving the position needed, the guide is withdrawn with gentle counterclockwise rotation to outside the coronary ostium. This procedure can be done if the artery is large enough to accommodate the guide, if there is no ostial or proximal lesion, and the guide tip is particularly soft.

Stabilizing a guide with the "Buddy" wire technique In this technique, a second angioplasty wire can be advanced parallel to the first one. It straightens the tortuous proximal segment and provides better support for device tracking. A second wire in a side branch can be very useful in "anchoring" the guide (e.g., second wire in LCX when dilating LAD lesion). This provides for better "backup" and allows retraction of the guide without loss of position when necessary. It also prevents the guide from being "sucked in" beyond the LM when pulling back high profile, poorly rewrapped balloon catheters following stent deployments or post-stent dilations. However, a second wire in a non-diseased branch would cause unnecessary denudation of endothelium in that vessel. If one wire does not help, a third or fourth wires may help to advance the interventional devices.

Stabilizing a guide with a balloon In this technique, a second small balloon (1.5-2 mm diameter) can be inserted in a small proximal branch. Then it is inflated at low pressure (e.g., 2 ATM), in order to anchor the guide, without letting the guide to back out, during advancement of interventional devices.

Stabilizing a guide with a long sheath In this technique, a long sheath can stiffen and support the guide, depending on how close it is advanced to the tip of the guide. The closer it is, the more supportive the system becomes. At first, the sheath tip is positioned high in the ascending aorta. If further back-up is required, the sheath can be advanced further. As the sheath advances over the guide, it straightens the secondary and tertiary curves of the latter causing the tip of the guide to move forward. Therefore, the guides with relatively simple curves (Amplatz, MP, EBU) are probably safer and better suited for this technique. [5]

Strengthening the guide with another guide or catheter In a case report by Saito et al., the 5 F Heartrail straight guide is 120 cm in length, whereas the 6 F guide is 100 cm.

The 5 F Heartrail guide has a very soft 13 cm end portion. This soft end portion can easily negotiate the tortuous coronary artery with the minimal damage and then it can be inserted more deeply into the artery. The inner lumen of the 5 F Heartrail catheter is 0.059′ in diameter; it can accept normal balloons or stent delivery systems less than 4.0 mm in diameter. The inner lumen of the outer 6 F catheter needs to be more than 0.071′ in diameter to accommodate the 5 F Heartrail catheter; Launcher (Medtronic), Heartrail, and Radiguide (Terumo) guides have this large inner lumen diameter. When a lesion could not be crossed by a balloon or a stent in the regular 6 F system, the five-in-six technique could be tried. First, the balloon or the stent is removed from the 6 F guide, while the wire and the 6 F guide remained in place. Next, a 5 F guide is inserted over the wire inside the 6 F guide. At this point, the 5 F guide should not protrude out of the tip of the 6 F guide. Finally, the Y-connector is connected to the 5 F guide and PCI could be restarted. Before the 5 F guide is advanced into the target artery, a balloon catheter is advanced near the target lesion in the artery. Keeping a slight tension on the balloon catheter, the 5 F guide is pushed out slowly in order to avoid the possible injury to the coronary artery by the tip of the 5 F guide. [6]

Factors determining the support of a guide Three factors are found to be associated with increased backup of a guide: 1) the size of the guide (larger is stronger, if the same material in the construction of the shaft); 2) the angle between the wall of the ascending aorta and the segment of the guide spanning the aortic root. This segment is the long tip of the EBU or MP or Amplatz guide or the segment between the primary and secondary curve in the JL. The maximal angle is 90 degree (perpendicular to the opposite wall of the ascending aorta). In a relaxed position, the backup force of a Judkins Left is weak. However, as the guide is deep-seated, this angle changes and becomes bigger so the backup force is better; 3) the aortic wall area which the secondary curve rests on (the larger the better [up to 25cm]). Between all the 3 criteria, the EBU guide fares the best with the 3 above criteria. The Amplazt design shows a very long line resting on the opposite wall of the ascending aorta and this is the mechanism of strong back-up of the AL. [3]

Which technique is BEST in stabilizing a guide? In order to advance interventional devices to the intended position, a guide needs to provide enough back-up support. If the first guide is not a strong guide with co-axial tip at the ostium, then this guide needs to be changed. However, once all equipments are deployed, to remove everything and insert a new guide is not time- and cost-effective.

At this time, advancing an extra wire along with the angioplasty wire to straighten the guide, straighten the artery, modify the contact surface of the wire to the arterial wall (wire bias) is the best choice. Hopefully the interventional device could be advanced further. This mechanism is reinforced further if more than one wire is inserted or the second wire is anchored in a different branch. If a second wire could not help to cross the lesion or the tortuous segment or the tight angle, then the balloon technique may help.

In the balloon anchoring technique, a second small balloon is inflated at low pressure in a proximal branch. This works by preventing the guide to back out. The drawbacks are that 1) the balloon can damage the endothelium of the side branch, 2) if there is no accessible side-branch to anchor the balloon, 3) in case of CTO, the balloon could be anchored in a proximal branch which provide antegrade collaterals. By that, during procedure, no opacification of the distal segment can be performed. If the buddy wire or the anchoring balloon technique does not work, the guide has to be changed.

If the guide is optimal and the interventional device could not be advanced, the long sheath technique would help. It works by stiffening the guide and preventing the guide to back out of the ostium.

Between all those above techniques, which ones will work BEST? The criteria to judge any new technique, technical tip or equipment include: 1) simple, 2) cost-effective (no need for extra-equipment), 3) if second equipment is needed, cheaper and user-friendly devices are suggested, and 4) time-effective.

We are sure that the Jing et al. did use all the above tricks to advance the stents across the target lesions. Without these tricks to strengthen the guide, there will be no procedural success. We believe these are the reasons of success for Jing et al. We have to master these techniques to duplicate their result, a reasonable goal to be achieved, only after a lot of practice.

References

1. Spaulding C, Lefevre T, Funck F, et al. Left radial approach for coronary angiography: results of a prospective study. Cathet Cardiovasc Diagn 1996;39:365-70.
2. Doganov A, Saito S. Transradial approach interventions. In Nguyen T, ed. Practical handbook of advanced interventional cardiology. Oxford UK: Blackwell, Wiley-Liss, 2007 (in press)
3. Ikari Y, Nagaoka M, Kim JY, et al. The physics of catheters for the left coronary artery in transfemoral and transradial interventions. J Invasive Cardiol 2005;17;636-41.
4. Slagboom T, Kiemeneij F, Laarman GJ, et al. Actual outpatient PTCA: results of the OUTCLAS pilot study. Catheter Cardiovasc Interv 2001;53:204-8.
5. Stys AT, Lawson W, Brown D. Extreme coronary guide catheter support: report of two cases of a novel telescopic guide catheter system. Catheter Cardiovasc Interv 2006;67:908-11.
6. Takahashi S, Saito S, Tanaka S, et al. New method to increase a backup support of a 6 French guiding coronary catheter. Catheter Cardiovasc Interv 2004;63:452-6.