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EMBOLIZED MATERIAL RETRIEVAL CORONARY

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While traversing severely diseased coronary arteries and manipulating equipment, particularly devices with detachable components, the opportunity for loss or embolization of material in the coronary circulation presents itself. Some of the common devices embolized during percutaneous coronary intervention (PCI) are: Stents, broken balloon catheter, wire tip fragment and stuck rotablator burrs.

However, in most cases, as a result of a cracked central venous or long-term intravascular catheter, catheter fragments are frequently the commonly embolized material that needs to be removed. Although the number of incidences has come down over the past few years, owing to: Improvement in equipment design and technology, universal use of remounted stents.

Occlusion devices, stents, guidewires and pacing wires are just a few of the many embolized materials and devices that have been reported. The four main scenarios of coronary stent loss are: Partial stent loss (balloon is partially placed in the balloon); total stent loss - guidewire *in situ* and stent on the guidewire; total stent loss - with stent off the guidewire; stent loss in the aorta or peripheral circulation.

Snares are the devices used more frequently for retrieval procedures, with single-loop and multiple-loop snares being used for retrieval of most types of embolized foreign bodies. Goose neck snare is a common choice in such cases as the loop can remain coaxial to vessel lumen, can trap retrieved fragments outside the catheter, etc.

However, some of its disadvantages are: One end of the foreign body must be free and accessible; foreign body and sheath must be removed together. In this case, maintain guidewire through the sheath to maintain vascular access. Capture fragments can double up requiring larger sheath.

GUIDE EXTENSION CATHETER – TIPS AND TRICKS

Dr Deepak Davidson, Kottayam

Remember to avoid accepting satisfactory backup and always prefer optimal backup.

Guide catheter extension system (GCES) represents a valuable tool for interventional cardiologists, particularly in complex cases. Guide extension catheter (GEC) increases guide backup support and is vital in complex PCI procedures.

The balloon surfing technique requires using a balloon to deliver a GEC to the “rail” and center the device away from the vessel wall and any potential vessel damage. The technique involves positioning a small balloon at the distal tip of the GEC, with half sticking out of the catheter. The balloon is used as a bumper to get past or to the lesion and minimizes the razor effect of the GEC tip. A dedicated dilator such as a Navigation catheter (Vascular Solutions, Minneapolis, MN) or a microcatheter can be utilized instead of a balloon catheter.

The balloon anchor technique involves inflating a balloon proximal to or within the target lesion to assist in GEC advancement. The balloon acts as an anchor to pull the guide extension down the vessel. It entails inflating the balloon, whether a compliant or noncompliant balloon, at the distal vessel where the lesion is located, and while the balloon is inflated, tracking the guide catheter extension system to the lesion, to the balloon.

Balloon-assisted tracking or the “inchworm” technique involves positioning an inflated balloon halfway at the distal tip of the catheter during delivery and advancing the GEC immediately as the balloon is deflated, thus advancing the GEC distally over the deflated balloon. GEC may be associated with certain complications like air embolism or dissection.

POST-PCI STROKE

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Stroke is one of the rare complications of PCI and arguably the most feared one. Post-PCI stroke is strongly associated with higher short- and long-term mortality rates and can result in life-altering disabilities. Most post-PCI strokes are ischemic and embolic in nature. However, they are secondary to dislodgment of atherosclerotic plaque or embolization of coronary- or catheter-derived thrombus. There are two types of major stroke: Ischemic - 83% and hemorrhagic - 17%.

It has been seen that the right radial approach can theoretically increase the stroke risk due to increased wire and catheter manipulations, especially with challenging brachiocephalic and coronary anatomy. However, a meta-analysis study showed that no statistical difference was observed in the rate of stroke between radial and femoral access. Wide adaptation of radial access in contemporary practice does not explain the increasing trend of post-PCI stroke.

When we talk about the incidence of post-PCI stroke, it occurs within 24 hours of the procedure. The overall increasing trends of the stroke can be attributed to a higher number of patients undergoing PCI in advanced age and a higher rate of cardiogenic shock. Other unique aspects of post-PCI ischemic stroke that should be acknowledged are: Thrombolysis will have a very limited effect if dislodged debris consists of atheromatous material, not thrombus. Anticoagulation during PCI increases the risk of hemorrhagic complications. The risk of access site bleeding is an obvious concern, especially in the femoral approach.

ANCHOR BALLOON TECHNIQUE

Dr Prathap Kumar, Kerala

The balloon anchoring technique was initially described by Fujita in 2003 as a new technique for superior guiding catheter support during the advancement of a balloon in coronary angioplasty. Anchoring is done to increase guide catheter support. It is ideal when additional support is required to cross an occlusion with the wire. It is used:

- When there are no suitable side branches into which a balloon can be safely inflated.
- It should only be considered for crossing occlusions when there is sufficient collateral filling to guide the progression of the wire through contralateral injection. Only as a last resource when other options are not available.

A side branch anchor is used:

- When there is difficulty advancing a long, stiff stent through a tortuous vessel, especially in calcified segments.
- When a "buddy" wire does not offer sufficient support or tends to migrate proximally when the stent is advanced.

A buddy wire stent anchor is used if the proximal vessel needs stenting. A buddy wire can be inserted, and a stent deployed over the first wire. This traps the buddy wire. Trapped wire provides strong guide catheter support.

Anchor balloon techniques have several advantages, including: Keep the guiding catheter in a coaxial position. Superior backup support to cross balloon or stent. No need to exchange the guiding catheter during the procedure.

A few disadvantages associated with the anchor balloon techniques are: May injure the orifice of the coronary artery by the guiding catheter. May injure the nontarget vessel by an anchor balloon. Two balloon catheters are needed. Hence, a large lumen guiding catheter .6Fr is necessary. Damage to the balloon or dislodgment/distortion of the stent may be caused by excessive pushing of the balloon or stent delivery balloon. Overconfidence in the ability of the inflated balloon to hold the system in place may lead to stent damage or loss or even severe vessel wall damage and perforation.

CORONARY MICROCATHETERS – WAY TO HANDLE

Prof Ajith Pillai, Chennai

Among the different types of microcatheters available are large-diameter microcatheters, small-diameter micro-catheters, angulated microcatheters, dual-lumen micro-catheters and plaque modification microcatheters.

A few characteristic features of small-diameter micro-catheters are small antegrade channels, tiny septals and epicardial channels, no torque is required, and a gentle push is needed. Large-diameter microcatheters are used in antegrade wiring through a tough and calcified chronic total occlusion (CTO) along with a high penetration wire, and in retrograde septal channels when the course is straight and need a "push". Angulated microcatheters do not require a push or torque and only require dedicated angulation. Dual lumen microcatheters have parallel wiring, access side branch after wire exteriorization, and reverse wiring for the bifurcation branch at the exit for CTO.

CTO – BASIC PRINCIPLE OR WIRE SELECTION AND HANDLING

Dr PK Goel, Lucknow

A wire is made up of three parts, namely proximal cap, body and distal cap. When we discuss the physics of CTO wire tracking, three factors have to be taken into consideration, i.e.,

- Wire tip force
- Resistance in loose tissue
- Resistance in plaque.

Different types of wires available include Gaia, Infiltrac and Pilot. The Gaia wire family can advance the performance of tapered wires further. Infiltrac wires reduce friction and tactile feedback arising from points other than the wire tip and enhance wire passage through sclerotic occlusive tissue. Pilot wires employ a jacket or sleeve of polymer fitted over a conventional spring-coil core-to-tip to enhance wire shaping, torque control and steering.

However, the key relationship between these algorithms is that wire tip force should be greater than resistance in loose tissue but less than resistance in plaque. Also, it has been seen that GC backup adds to wire penetration force. But if during the wire advancement GC backs out, it indicates that the wire is too weak compared to the resistance in lesion or is heading the wrong way.

Antegrade wiring techniques or guidewire selection is based on:

- Antegrade wire escalation and lumen to lumen crossing
- Antegrade directional penetration and step down
- Parallel wire technique
- Direction re-entry in cases of inadvertent subinitial entry at distal cap
- Elective antegrade dissection and re-entry
  - CB, if proxy cap tapering
  - Knuckle wire technique, if blunt cap.
- Salvage ADR using Sting ray balloon and wire following an inadvertent subintimal entry.

Also remember, softer may not always be safer as they are not stiff enough to penetrate very hard calcium in CTO. However, they are stiff enough to penetrate the external elastic membrane and migrate into the false lumen. On one hand stiff guidewire reduces the rate deflection because of its straight directional force. But it can sometimes take wrong turn owing to the greater penetration power.

Similarly, in a softer tip guide, though it enhances the controllability within the occluded lesion, it can deflect within the lesion. Also, it has low penetration power.

While choosing the wire, the decision should be made based on these factors:

- Duration of occlusion
- Post-MI setting/none
- Micro channels+/very faint AG trickle+
- Prox cap tapered vs. blunt/flush
- Bend/Tortuosity in the CTO segment
- Calcification
- Branch point at distal cap

Wire handling principles

- Controlled Drill: 360 degree rotation with little active advancement, the wire finds its way based on wire stiffness and lesion resistance dynamics.
- Penetration: Active wire advancement with directional deflection and torque control.

Lastly to conclude, remember perseverance, patience and perfection are the qualities to heed, but the key is to "know when to stop".

CORONARY AIR EMBOLISM

Dr Vijay Trehan, New Delhi

Coronary air embolism is a rare type of embolism that occurs when a bubble of air gets trapped in the blood and causes blockage in the vascular system. In most cases, coronary air embolisms are almost and always iatrogenic. The clinical presentations of the air embolism depend upon:

- Quantum of the air
- Number of the vessels affected
- Degree of stenosis
- Left ventricular function.

In some cases, a tiny air bubble injected into the unobstructed coronary of an individual with normal left ventricular ejection fraction (LVEF), especially in a high-flow state with a vasodilator, is just an angiographic phenomenon. These air bubbles might catch some attention in imaging due to adjoining contrast.

However, if a large air bubble is injected into the system, it can result in chest pain, bradycardia, atrioventricular (AV) blocks, slow flow and hypotension. Sometimes, one might have to visit multiple branches to suck the air, which is impossible with the guiding catheter.

Hence, as a key measure for reducing the possibility of an air bubble, remember, "Rapid aspiration of air out of the coronary circulation is the single most important step." Some of the other general measures are:

- Supporting the circulation by using an IV vasopressor while the coronary is getting de-aired is the quickest HD support
- Mechanical circulatory support may be needed if IV vasopressor are inadequate and resuscitation is getting prolonged.
- Other supportive drugs include IV atropine, dopamine and ADR for babies
- Temporary pacing
- Ensure anticoagulation status.