Optimal assessment observation of intravascular ultrasound

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Intravascular ultrasound (IVUS) is an invasive imaging device to visualize coronary cross-sectional anatomy and is superior to coronary angiography (CAG) in assessing vessel size, calcium content, and lesion severity.
Backgorund

• Optimal stent sizing may be clinically important in preventing incomplete stent apposition (ISA) and in optimizing initial stent deployment.

• It can detect some morphological alterations and may be make a prediction of some complication.
In the beginning, I will talk about the basic IVUS method, an assessment observation for the IVUS, and a routine observation and measurements in our hospital.
First of all, let me talk about a basic IVUS method.
As we know, using IVUS we can observe coronary cross-sectional anatomy as if we see it from the proximal to the distal portion of coronary artery.
Basic IVUS method 2: Driven proximally from the distal

Distal → Proximal

like this animation.
Basic IVUS method 3: Assessment of the three-layer wall

The left panel shows the gray scale IVUS and the right panel shows a schema of the left IVUS image. As we know, the muscular arteries, such as the coronary arteries, usually have three layers. Most inner layer consists of a complex of three elements: intima, atheroma, and internal elastic membrane. This atheroma classifies by echogenicity compared with the adventitia. Moving outward from the lumen, the second layer is the media, which is usually less echogenic than the intima. The trailing edge of the media matches the external elastic membrane (EEM). The third and the most outer layer consist of the adventitia and periadventitial tissues. There is no distinct boundary on IVUS images separating the true adventitia from surrounding perivascular tissues.
Basic IVUS method 4: Measurements for optimal stent sizing

Term of the measurements

- Distal landing site: Lumen diameter: **Stent size**
- Stenosis site: Vessel diameter: **Post dilatation balloon size**
- Proximal landing site: Lumen diameter: **Get at complete apposition**
- Between 2 landings: Diameter of the long axis: **Stent length**

In our hospital, after IVUS examination, our co-medical staffs measure them and suggest balloon or stent size for PCI operators.
Basic IVUS method 5: Atheroma morphology

Classed by echogenicity compared with the adventitia

Soft plaque

Fibrous plaque

They have intermediate echogenicity between soft atheroma and highly echogenic calcific plaques. These plaques can be seen in the majority of atherosclerotic lesion.
Basic IVUS method 5: Atheroma morphology

Classed by echogenicity compared with the adventitia

Calcific plaque

It can be also seen as bright echoes with acoustic shadowing, and the one accompanied by reverberations or multiple reflections.
Now, let’s move on to our second theme, assessment observation the IVUS.
Hypothesis
You cannot assess the IVUS

- Can not provide the information
- Get scolded
- Dislike the IVUS

Thus, it speaks for itself that you must be able to assess IVUS. So, you are getting to love IVUS assessment.
Assessment observation the IVUS 2 : 2 steps things

1. To detect: detect the morphological alterations
2. To diagnose: identify what kind of IVUS findings

There is the flap
There is no media at 5 O’clock

Medial dissection.

We should report “There is the flap and no media at the position of 5 O’clock. Then, we can detect them and diagnose the IVUS findings.”
Assessment observation the IVUS 3: Training method

1. Running a IVUS video
2. Making a note of only lumen
3. Making a note of whole media

Lumen inside of the media

To observe in the whole vessel

Next, see the same video,
I will suggest the training method for detection in our hospital.
ROUTINE OBSERVATION AND MEASUREMENTS IN CLINICAL CASE
CAG revealed 75% stenosis in the proximal LAD.
Routine observation and measurements in clinical case

Proximal LAD diffuse lesion
75% stenosis
Runthrough NS wire was advanced
IVUS pulled back from middle LAD

First procedure, a 7Fr back up left 3.5 cm guiding catheter was engaged in the left coronary artery through the right femoral approach. Then, PCI guide wire (runthrough NS) was advanced in the lesion. Next, we are going to show the IVUS information before PCI procedure.
Routine observation and measurements in clinical case

This is automatic pull-back from mid LAD.
Using IVUS, severe calcific plaque was confirmed. We ablated to the lesion by 2.00 mm rota-burr. After ablation, with IVUS images, we evaluated the stenting zone.

The left panel shows proximal marking point. And right panel shows distal marking point. We measured the length by manual pull back, because it can makes smaller gap than automatic pull back. We decided the lesion length was 26mm between two marking points. So we selected the stent which is the 2.5 mm diameter and 28 mm length.

Proximal reference marking

Distal reference marking

We measured the length by manual pull back, because it can makes smaller gap than automatic pull back. So we selected the stent which is the 2.5 mm diameter and 28 mm length.
Routine observation and measurements in clinical case

We deployed the BES in the lesion. Right panel shows the angiogram after stent TIMI3 flow was obtained.
Routine observation and measurements in clinical case

This is automatic pull back from stent distal site after stent deployed
Routine observation and measurements in clinical case

This panel shows the long axis image. We can see the medial dissection at distal LMCA.

At this time, we pointed out this IVUS finding as medial dissection to operator at the instant of detection it.
Routine observation and measurements in clinical case

After 5 minutes later

Then, we confirmed it had no change the angiogram which has no changing.
Conclusion

• Some measuring is almost measuring automatically by IVUS-staff after the examination in our hospital.

• For the assessment observation the IVUS has 2 procedure steps which are to detect, and to diagnose.

• For the safety and speedy procedure, I think IVUS-staff should need to point out the IVUS findings too.