6. Ostial lesion

i)RCA ostium

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1) Introduction

It is often said that the direct influence of right coronary artery (RCA) disease on cardiovascular function and patient prognosis is less than the influence of disease in the LMT or LAD proximal sites. However, we believe there are many operators who have experienced sudden life-threatening changes in the condition of patients during PCI in the RCA; changes such as a decrease in blood pressure, bradycardia and ventricular fibrillation. Careful responses to such changes are necessary, particularly in high-risk cases such as those in which the cardiac function of the patient is impaired (LVEF<40%) or the patient has a multivessel disease. It is more difficult to operate on RCA ostial lesions than on other RCA lesions. The techniques required to treat RCA ostial lesions are slightly different from those required for other RCA lesions. In this chapter, we describe PCI for RCA ostial lesions by presenting the common strategies that we use.

2) Preparation

In our medical institution, most patients are hospitalized on the day of the operation, at least for elective procedures. All patients take ticlopidine and aspirin in advance, as is also the case for ordinary PCI. In general, intravenous anesthetics or sedatives are not used.

The IABP, PCPS and external pacing system must be on standby. Although in most cases such devices are not necessary, it is safer to begin by deploying the pacing catheter in high-risk cases, such as those in which the lesion is severely calcified, or the lesion is complicated (tortuosity), or cardiac function is impaired (LVEF<40%), or the patient has multivessel disease.

3) Guide catheter

a) *Selection:* In general, we approach the lesion site from the groin. If a DCA device or rotablator with a 2.5 mm burr is used, a 10F guide catheter is used. Even if it is judged that DCA and a large burr rotablator are not necessary, use an 8F or larger catheter in order to increase the number of device options. If a 10F catheter is used, it is better to use a long sheath type, as this is easier to maneuver. We mainly use a JR guide catheter; however, if the vessel is a high-takeoff, or the ostium is further forward or lower than usual, an ordinary JR catheter is not appropriate. In such cases, we use an AL1 guide catheter or JR catheter with a long tip. If firm support is necessary, an AL1 is easy to use. However, if severe calcification or a large amount of plaque are observed at the 'shoulder' of the RCA, careful maneuvering of the AL1 is required because it may touch the shoulder area and cause coronary artery dissection. If an AL1 catheter is selected, make sure to choose one with a side hole so that the tip of the catheter may be deep-seated in the vessel in order to obtain firmer support. (If the AL1 catheter does not have a hole, an opening may be made using the needle of a syringe.)

(Figure 1)

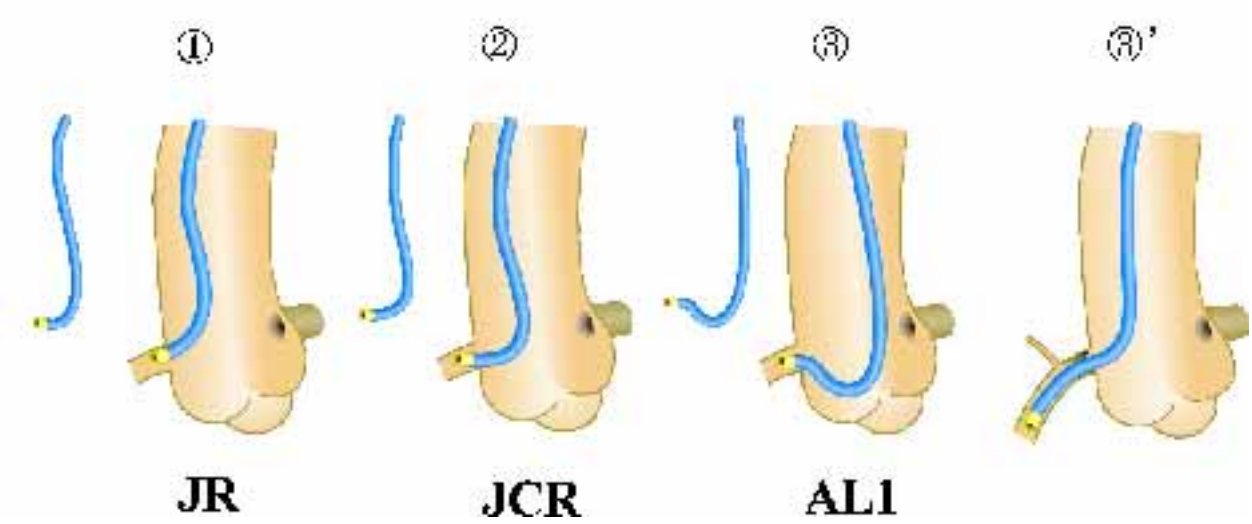


Figure 1

① This is a standard guide catheter. Although it is easy to maneuver, it cannot provide support. The tip tends to face downward at the insertion; it is therefore not suitable for RCAs that run upward.

② The tip of the JCR catheter is less bent than the JR catheter.

③ The AL1 catheter provides excellent support. Maneuvering may be difficult in some cases. Ensure that a side hole is made in the catheter because the tip is sometimes deep-seated in the vessel and it may become wedged.

③' Deep-seated AL1 catheter in the RCA. If there is no side hole, it may become wedged.

If an extremely severe stenosis is present at the ostium of the LMT, an 8F or 10F guide catheter sometimes cannot be engaged. In this case, a 6F AL1 may be useful.

If we judge (from lesion shape) that we will only use a balloon and/or a stent, we will approach the lesion site from a brachial or radial artery. In these cases, we use a 6F stent or balloon. We have found that a 6F AL1 is easy to use because it offers firm support. However, in view of the potential for unexpected sudden changes in which back-up devices such as assisted circulation system or pacing catheter are necessary, we consider it safer to approach the lesion from the groin.

b) *Maneuvering:* Using the LAO view, rotate the tip of the guide catheter clockwise in the right Valsalva sinus, move the catheter close to the ostium so that the catheter is co-axially aligned with the vessel, and engage it into the ostium. Confirm that the catheter is co-axially aligned with the vessel using the RAO view. If ostial stenosis is too severe to engage the catheter, or the catheter becomes wedged, adjust the direction of the tip of the catheter so that the catheter can be co-axially aligned with the vessel near the ostium, and set the catheter firmly and as close to the ostium as possible. It is necessary to be careful not to engage it forcefully because it may cause injury at the ostium. If the catheter and the vessel are co-axially aligned, there will be firm support when inserting the guidewire through the coronary artery; thus making it easy to insert other devices. Maneuver the catheter cautiously in order to avoid possible pre-procedural problems.

4) Guidewire

a) *Selection:* There are no particular rules for the selection of guidewires; however, it is necessary to use a guidewire with a hard shaft (e.g. Grand Slam) if firm support is necessary because the lesion vessel is extremely angulated, or DCA may be performed. In other cases, you may choose a suitable guidewire in accordance with the shape of the distal end. Again, it is necessary to replace the guidewire with a rotawire when a rotablator is used.

b) *Maneuvering:* Maneuvering is the same as for ordinary PCI. However, it is necessary to be careful to avoid the guide catheter disengaging from the ostium when the guidewire crosses (as maneuvering the guidewire would become impossible). It is also important to avoid the guide catheter becoming deep-seated and causing the ostium to become occluded. If the guide catheter is suspended near the ostium after the guidewire crosses to the distal end, blood flow in the coronary artery will be well maintained. If plaque dissection is observed, be careful not to do anything to make the false lumen any bigger.

5) Strategies

The use of IVUS as early as possible can be of great help, as information such as blood vessel diameter, lumen diameter, calcification, and plaque volume and shape can be gleaned from this. IVUS is therefore essential for appropriate device selection.

A series of procedures are conducted by means of one of the following strategies, or a combination of the following strategies selected on the basis of the information obtained from IVUS. In the case of PCI for RCA ostial lesions, it is rare to complete the surgery using balloon angioplasty only.

- conventional balloon angioplasty
- Cutting Balloon
- DCA/Rotablator (debulking)
- Stenting

As the aorto-ostium consists of a large amount of elastic fibers, elastic recoil occurs readily. Therefore, conventional balloon angioplasty alone is often not sufficient. In such cases, other devices are used in conjunction with balloon angioplasty; however, in many cases a conventional balloon is often the only device that can be used.

a) Conventional Balloon Angioplasty (PTCA)

If the balloon is too short, it may slip and migrate into the aorta. Therefore, a balloon that is 20 mm or longer is easier to use, or you may choose one according to another lesion that needs to be treated. In general, high-pressure balloons that are strong enough to dilate elastic fibers are good. It is also important to choose balloons that do not slip easily.

Confirm that the guide catheter is co-axially aligned with the vessel. Position the balloon so that the point midway along the length of the balloon is at the ostium. Withdraw the guide catheter up the aorta until the balloon is fully exposed (the balloon must not move). If it is difficult to insert the balloon, withdraw the guide catheter slightly so that the catheter and the vessel are aligned. This reduces resistance caused by the

bend in the vessel; thus making insertion easier.
(Figure 2)

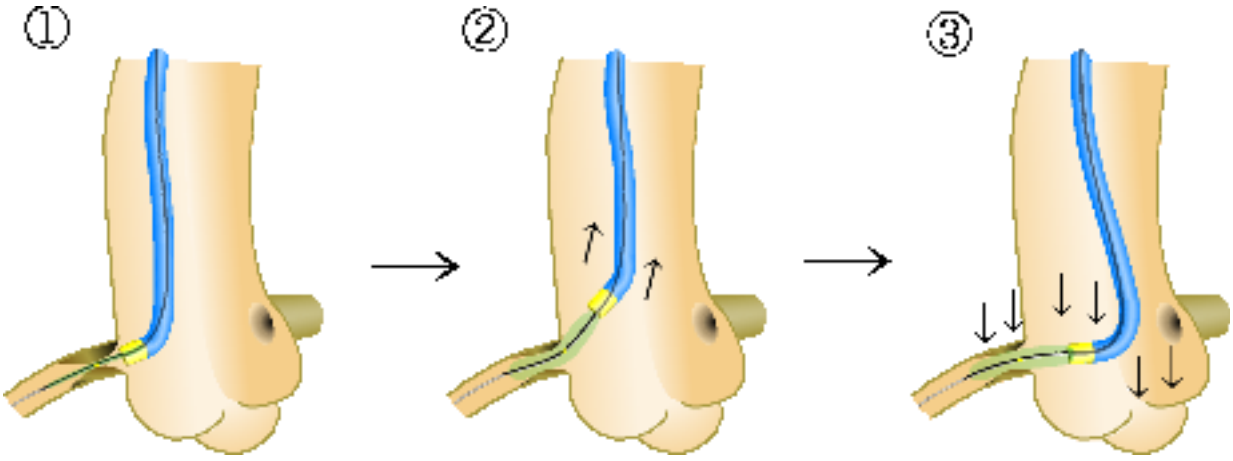


Figure 2
① Withdraw the balloon until half it's length is in the aorta.
② Inflate the balloon and simultaneously withdraw the guide catheter.
③ Push the guide catheter until the balloon is horizontal. This position applies pressure evenly to the entire lesion.

The balloon must be inflated slowly as it often falls out of alignment when inflated quickly. When it is fully inflated, push the guide catheter so that the tip of the catheter and the balloon are horizontal. This helps dilatation because pressure is applied to the entire lesion.
In our institution, we inflate the balloon for one minute. The balloon is inflated several times during the procedure. Lower pressure is used in the early stages and then gradually increased as the procedure progresses. (This is also the case for other lesions). If a decrease in blood pressure, bradycardia, or significant changes in the electrocardiogram are observed, stop inflating the balloon and wait for recovery before resuming.

b) Cutting Balloon

Indications include cases in which a large amount of plaque is present, but for which debulking cannot be attempted due to severe calcification or because it is impossible to insert devices. In this method, the 'debulking effect' is achieved by tearing or incising the plaque.

A 4 × 10 mm Cutting Balloon is often used because the diameter of the vessel is large. If the diameter of the vessel is more than 5 mm and a balloon of 4 mm or larger is required, conventional balloon angioplasty may be a better method. The Cutting Balloon procedure is the same as an ordinary balloon procedure; however, the Cutting Balloon does not pass into the lesion as well as conventional balloons, so a guide catheter with good support is necessary.

c) - 1 Rotablator

Indications include highly calcified lesions and lesions with in-stent-restenosis. A rotablator is particularly useful in cases where there is inadequate dilatation, dislocation and stent deformity. Select an initial burr size that satisfies the B/A ratio of 0.5, and a final burr size that satisfies the B/A ratio of 0.8. The burrs that are currently available are 2.5 mm or smaller, and therefore, additional dilatation by means of conventional balloon angioplasty, a Cutting Balloon or stent is required in many cases.

It is better to use an external pacing device for patients with impaired cardiac function because 'ablation particles' accumulate at the distal end and may cause bradycardia or ventricular fibrillation due to reduced blood flow. The guidewire must be replaced with a rotawire by means of a wire-exchange device, if and when a rotablator is applied.

In the case of ostial lesions, a burr often cannot be inserted into the vessel. In these cases, the guide catheter must be suspended and used as a platform. Withdraw the guide catheter slightly or make the tip of the catheter horizontal so that the guide catheter and the coronary artery are aligned, as in the manner of balloon insertion. This may help to achieve co-axiality. Ensure that the rotawire is co-axially aligned with the vessel because it kinks easily and incorrect positioning may cause problems.

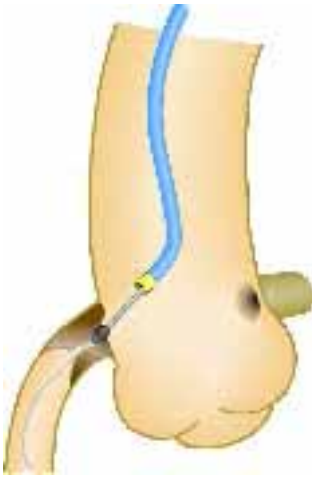


Figure 3

(Figure 3)

With regard to maneuvering techniques, the rotablator requires sure and quick handling. We use a 'pecking motion' in which the rotablator shuttles between the platform and the lesion 30 - 40 times per minute. With this method, the duration of the contact between the burr and the lesion decreases with each shuttle movement, the burr maintains its rotational speed very well, and blood flow is not likely to be reduced.

c) - 2 DCA

If there is a large amount of soft plaque in the vessel, debulking by DCA is the obvious indication. Use a guidewire with firm back-up support. Co-axially align the guide catheter with the vessel and insert the device slowly. In many cases, half of the housing remains in the aorta. If it is difficult to insert the device, suspend the guide catheter and withdraw the guide catheter slightly, or make the tip of the catheter horizontal so that the guide catheter and the coronary artery are aligned, as in the manner of the rotablator.

(Figure 4)

After checking the distribution of plaque with IVUS, gradually rotate the device to ablate as much plaque as possible. Ablate the plaque carefully and repeat the ablation process several times in a single procedure. Continually monitor the changes in electrocardiogram and hemodynamics during the procedure.

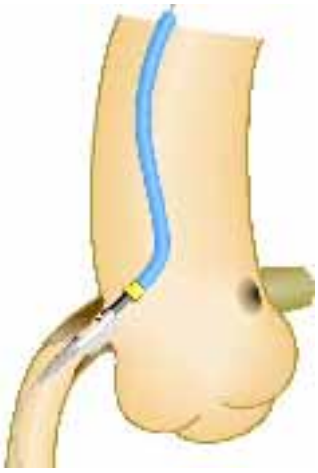


Figure 4

d) Stent

From our experience, the restenosis rate following stenting of RCA ostial lesions is comparatively high. Therefore, treatment by means of debulking and/or ballooning alone should be selected as often as possible. Do not conduct stenting without full and careful consideration. However, if severe dissection is observed, or full dilatation cannot be achieved, stenting may well be necessary. In such cases, tubular stents are suitable for use as the aorto-ostium consists of a large amount of elastic fibers and elastic recoil occurs readily. The important point in maneuvering the stent are precise positioning and as full dilation as possible with at as high pressure as possible.

Ensure that the stent is correctly positioned and that stent deployment is conducted properly. In cases of severe calcification or a severely tortuous lesion, it is often difficult to deploy the stent to the most appropriate position. In such cases, it is very important to conduct debulking or pre-dilatation prior to stent insertion, if possible.

Deploy the stent in the target vessel leaving the edge of the stent (approximately 1 mm) in the aorta. Withdraw the balloon until approximately half its length is in the aorta and use high pressure to dilate the stent. This attaches the edge of the stent to the wall of the aorta. It is desirable to use high pressure to dilate the blood vessel fully (preferably 15 - 20 atm or more) in both the pre-dilatation procedure and the actual dilatation procedure.

(Figure 5)

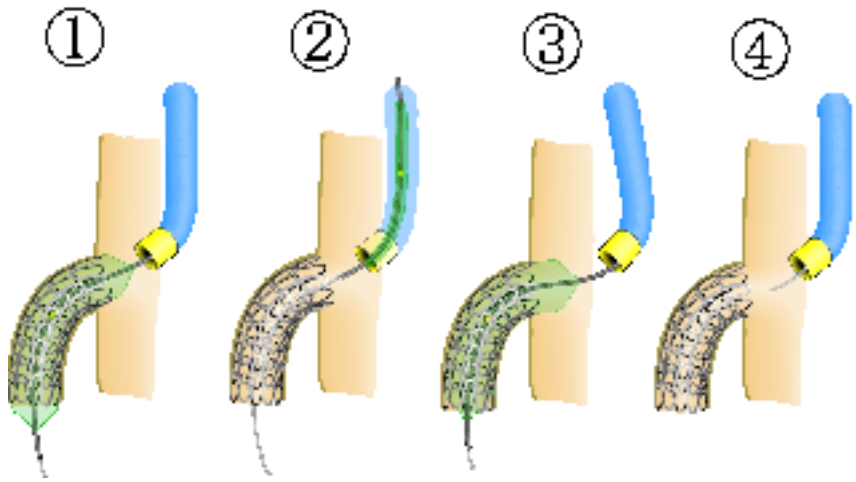


Figure 5

6) Postoperative care

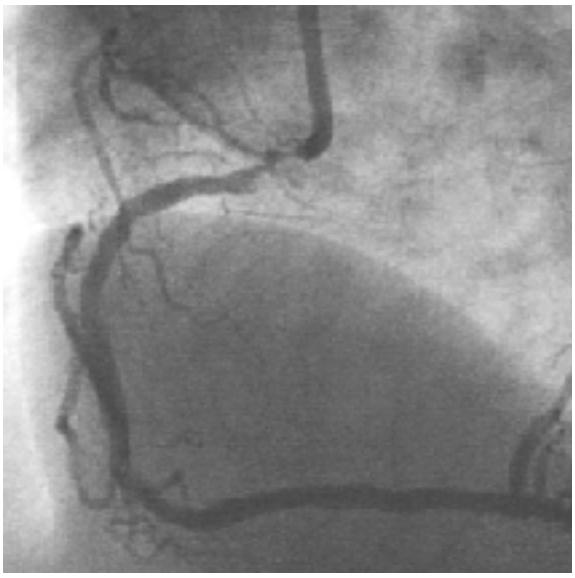
If there are no changes in the hemodynamics and cardiovascular function, and no significant complications are observed during or following the procedure, we remove the sheath two hours after the operation, which is the same as for ordinary PCI. The patient is then required to remain at complete rest for four hours. If there are no complications, the patient is discharged the following day.

Conduct follow-up CAG at 3-6 months and one year following the operation. We re-study sub-optimal lesions or high-risk cases at 2 - 3 months post-procedure, if possible.

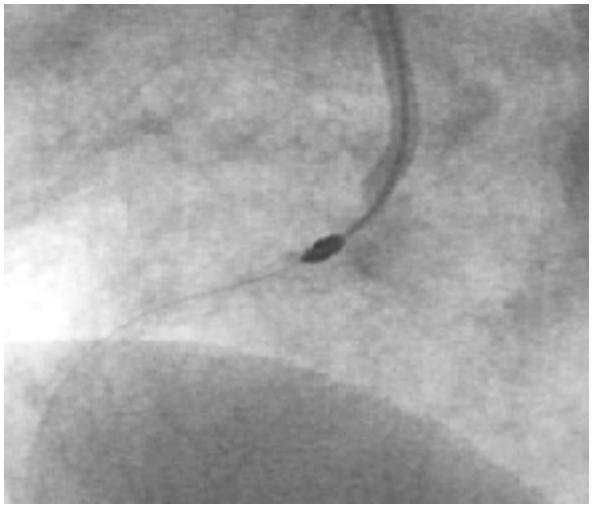
7) Case

a) Rotablator

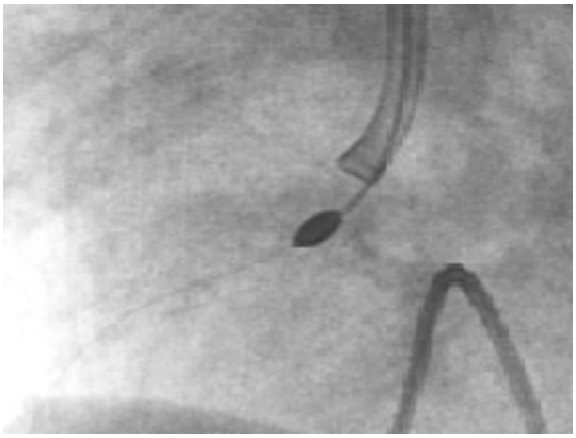
Severe calcification was observed at the RCA ostium. The rotablator was used. The initial burr size was 1.75 mm, and a 2.5 mm burr was used for ablation. A balloon (3.5 × 20 mm) was used for dilatation. (Static pictures 1-① - ⑤)



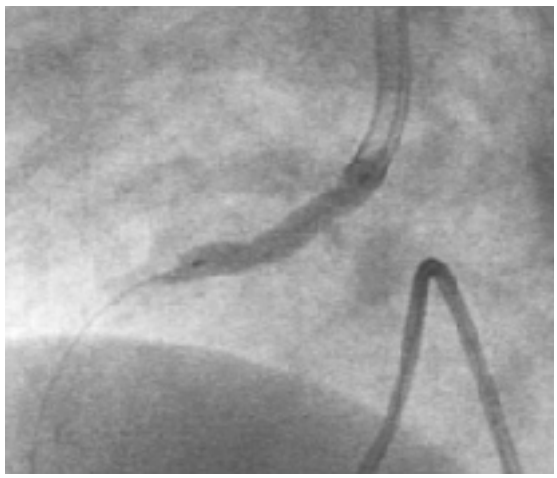
Static picture 1-① Pre-procedure. This is a lesion with 90% stenosis and severe calcification at the RCA ostium.



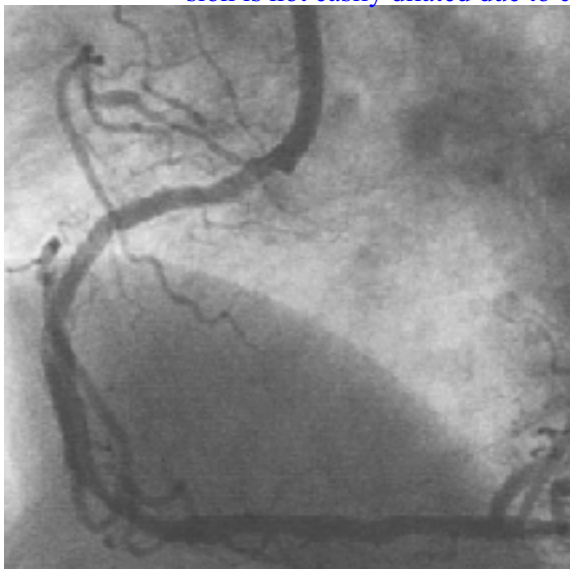
Static picture 1-② The procedure began with a rotablator with a 1.75 mm burr, using a pecking motion.



Static picture 1-③ The burr was changed to a 2.5 mm burr, and the procedure continued.



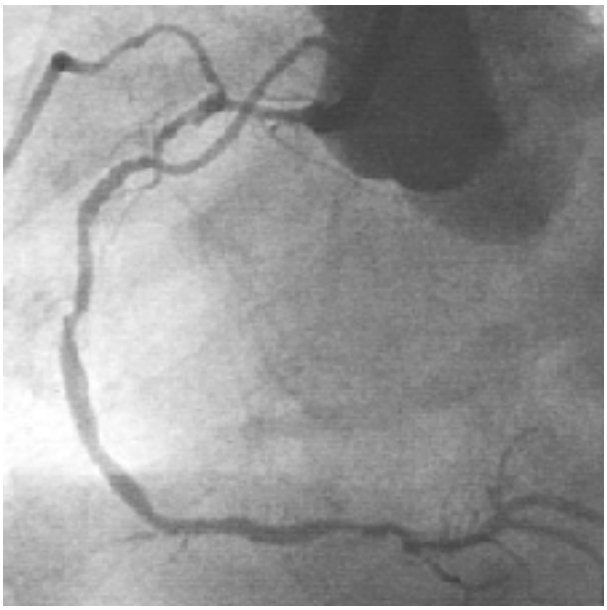
Static picture 1-④ Inflating the balloon. The lesion is not easily dilated due to calcification.



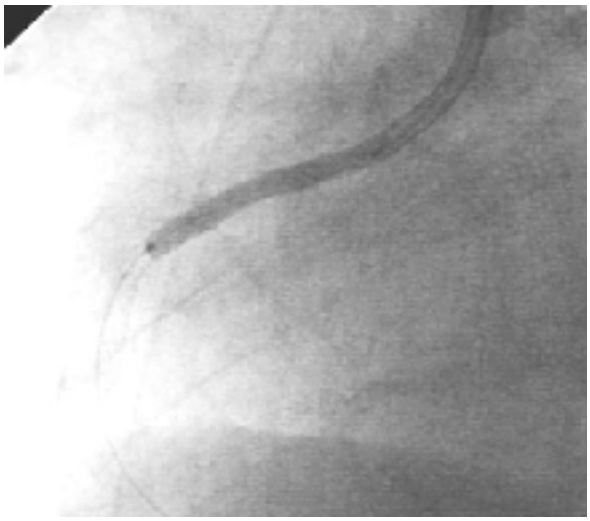
Static picture 1-⑤ The balloon was inflated several times. The procedure is complete.

A balloon was used for the initial dilatation, however this was unsuccessful due to strong recoil. There was no alternative to stenting.

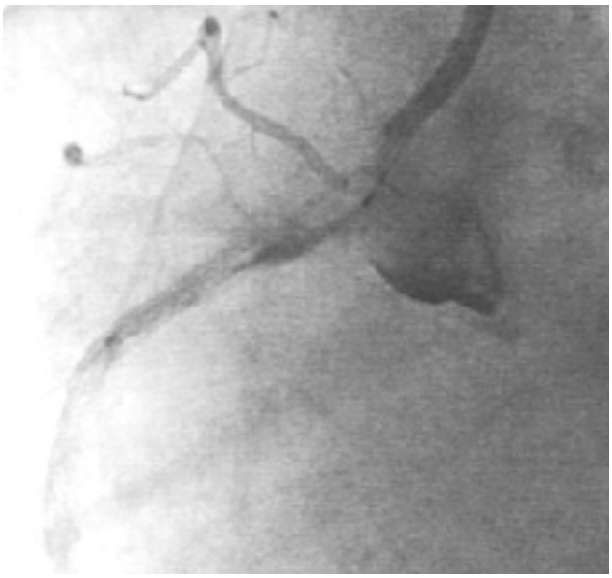
(Static pictures 2-① - ⑤)



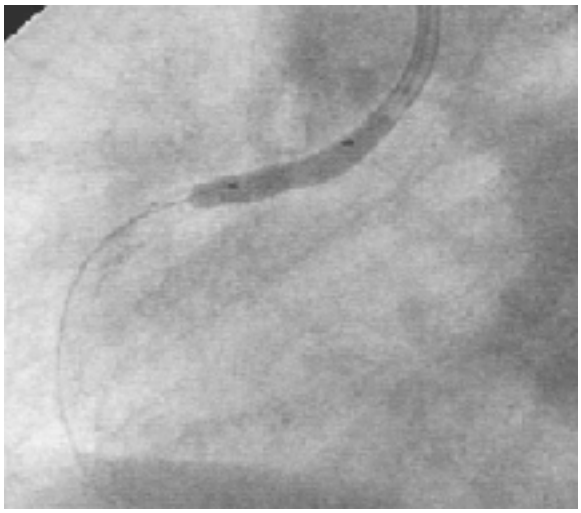
Static picture 2-①



Static picture 2-②



Static picture 2-③



Static picture 2-④

Static picture 2-⑤