Cardiac catheter intervention

Ischemic heart disease is caused by insufficient blood supply to myocardium, mainly due to arteriosclerosis of coronary arteries leading to narrowing (stenosis) and clogging (occlusion). Therapeutic strategies to open stenosis and occlusion of coronary arteries include percutaneous coronary intervention (coronary intervention) and coronary artery bypass grafting. Coronary intervention is more popular. Especially, Transradial intervention (TRI), in which a catheter is inserted through radial artery at the wrist, has become the mainstream procedure worldwide.

1. Myocardial ischemia and myocardial infarction

When a coronary artery that supplies blood to the myocardium is obstructed, it leads to ischemic heart disease. Long-term obstruction of coronary artery reduces oxygen and nutrients from being carried to the heart muscle, and the movement of heart is severely affected. It is myocardial infarction. And, the condition that heartbeat becomes irregular or slows down is arrhythmia. The pumping function to supply blood to the body cannot be maintained, and symptoms such as severe chest pain, difficulty in breathing, cold sweat, nausea, and vomiting occur. In addition, as complications, heart failure with decreasing blood pressure and swelling and cardiac angina with severe chest pain occur. The risk factors for myocardial infarction include hypertension, hyperlipidemia, diabetes, obesity, smoking, and stress.
2. The present state of heart disease in Japan

The leading cause of death in Japan is malignant neoplasm (cancer), and heart disease is in second place. Ischemic heart disease is significantly influenced by lifestyle factors, including eating habits, lack of exercise, and stress. Patients with ischemic heart disease are raising in their thirties and forties.

While the number of patients with ischemic heart disease in Japan has reached a million, the death rate in the population is the lowest in the world. This depends on Japan’s health insurance system and advanced treatment technologies. In recent years, coronary intervention accounts for approximately 70% of all treatments for ischemic heart diseases because the physical burden is lower than surgical treatment.

There are many technological innovations in various medical devices for treatment. With the appearance of drug-eluting stents, coronary intervention is actively applied to difficult lesions and the number of the procedures is raising.

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**Coronary revascularisation procedure, 2011 (or nearest year)**

Coronary angioplasty

Coronary bypass

Source: OEDC Health Statistics 2013 and etc.
3. Treatment of ischemic heart disease

The treatment of ischemic heart disease include coronary artery bypass grafting, in which a blood vessel is surgically connected so as to bypass an obstructed blood vessel, or coronary intervention, in which thin wire and tube (catheter) with a deflated balloon at the tip are inserted percutaneously into the narrow part of artery and open the narrow site by inflating the balloon. Coronary intervention is less invasive and permits discharge from hospital after one to three days. It became more popular than coronary artery bypass grafting, which usually requires a hospital stay of approximately one month.

In traditional coronary intervention procedures, the thin wire and catheter is inserted through femoral artery at the base of the leg. Currently, transradial intervention (TRI), in which the catheter is inserted through radial artery at the wrist, has become the mainstream procedure worldwide.
4. **Transradial intervention (TRI)**

Transradial intervention (TRI) can be expected to produce the therapeutic results that are as favorable as transfemoral intervention (TFI). Hemorrhagic complications from the puncture site (the catheter insertion site), which is caused by TFI, are decreased. Meanwhile, TRI has the great advantage of being less invasive. For example, patient can stand up soon after the treatment, and leave hospital earlier. The treatment of complications can be reduced and shorter hospital stays can be shortened. Furthermore, hospital costs can be reduced, too. (From the results of a US study.)

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<th></th>
<th>TRI</th>
<th>TFI</th>
<th>Difference</th>
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<tbody>
<tr>
<td>Length of stay</td>
<td>2.5 days</td>
<td>3.0 days</td>
<td>0.38 day</td>
</tr>
<tr>
<td>Incidence of hemorrhagic complication</td>
<td>1.1%</td>
<td>2.4%</td>
<td>1.3%</td>
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<td>Hospital cost</td>
<td>US$ 14,954</td>
<td>US$ 15,784</td>
<td>US$ 830</td>
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PCI from January 1, 2010, to March 31, 2011, at 5 U.S. hospitals

**Safety of TRI in Japan**

In the clinical study in Japan, it demonstrated that TRI is safer for hemorrhagic complications especially. It can be said that TRI is a safe procedure as the overseas study suggested.

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<th>TRI</th>
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<tr>
<td>Acute-phase cases</td>
<td>0.4%</td>
<td>3.4%</td>
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<tr>
<td>Elective cases</td>
<td>0%</td>
<td>2.2%</td>
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5. Prospects of percutaneous coronary intervention

In interventional cardiology, percutaneous coronary intervention is the standard procedure, but the number of procedures is slowing down recently.

The largest cause is the appearance of drug-eluting stent (DES). The frequency of restenosis occurrence in this stent is clearly lower than that of non-drug-eluting stent. So, the number of patient who received coronary intervention repeatedly has been decreased. And, the second cause for this trend is to implement primary and secondary prevention certainly. Primary prevention involves removing factors that lead to ischemic heart disease before the development of coronary lesion. In other word, the treatment of hypertension, hyperlipidemia, diabetes, hyperuricemia, and so on starts from their early stages. Naturally, not only treatment, but also improvement of lifestyle, such as non-smoking, appropriate daily exercise and weight control, are important. Primary prevention inhibits the development of ischemic heart disease. And also, after developing coronary lesion, effective secondary prevention such as drug administration and improvement of lifestyle is implemented certainly. This allows that the recurrence rate of ischemic heart disease is reducing.

Moreover, at present, in clinical cases being made a judgment on that coronary intervention is necessary as the results of X-ray imaging examination, cases without coronary intervention are increasing according to the physiological judgment. From the patient perspective, these matters are a great pleasure and are proof of a little victory for ischemic heart disease in the cardiology.

Guide wire insertion beyond the lesion  Balloon Inflation  Stent insertion  Stent placement
6. Profile of the author

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Vice Director, Director of Cardiology & Catheterization Laboratories, Shonan Kamakura General Hospital

Career
1975     Graduated from the Faculty of Medicine, Osaka University
1975     Osaka University Hospital
1976     Kansai Rosai Hospital
1983     Chief, Kansai Rosai Hospital
1988     Director of Cardiology & Catheterization Laboratories, Shonan Kamakura General Hospital
2000     Vice Director, Shonan Kamakura General Hospital

Academic activity
Vice Chair, Fellow, and Trainer of the Japanese Association of Cardiovascular Intervention and Therapeutics
Fellow of the Japanese Association of Vascular Catheter Treatment
Fellow of the Japanese College of Cardiology (FJCC)
Board Certified Member of the Japanese Cardiology Society
Board Certified Member of the Japanese Society of Internal Medicine
Fellow of American College of Cardiology (FACC)
Fellow of the Society for Cardiac Angiography & Intervention (FSCAI)
The Japanese Society of Cardiac Pacing and Electrophysiology
The Japanese Society of Electrocardiology
Certified Trainer of Clinical Training
Society of Cardiology