



## The evolution of percutaneous coronary intervention in Asia: in celebration of the 40<sup>th</sup> anniversary of percutaneous transluminal coronary angioplasty



Runlin Gao, *Chief Editor, AsiaIntervention*

Forty years ago, in September 1977, Dr Andreas Grüntzig heralded the era of interventional cardiology by successfully performing the first percutaneous transluminal coronary angioplasty (PTCA) in Zurich, Switzerland<sup>1</sup>. Through live demonstration courses, he went on to train cardiologists from around the world, leading to the rapid introduction of PTCA into clinical practice in the rest of Europe, the United States and beyond.

In October 1981, Dr Nobuyoshi from Kokura Memorial Hospital, Japan, performed the first PTCA in Japan and in Asia<sup>2</sup>. Unfortunately, the procedure failed and the patient underwent emergency cardiac bypass surgery. Dr Nobuyoshi's next two cases met the same fate. To refine his skills further, he visited several famous hospitals in the United States and learned from prominent masters, including Drs Myler, Simpson, Dorros, and Hotzler, carefully noting every precise detail of the procedure. In 1982, Dr Nobuyoshi performed his fourth PTCA case at Kokura Memorial Hospital with a successful outcome<sup>2</sup>. Thereafter, his caseload reached 93 during 1983, and 40 weekly in 1984, when he held the first live demonstration course in Japan with about 300 attendees. This live demonstration has been held yearly since, being instrumental in the rapid expansion of PTCA use in Japan during the 1980s, and its uptake in several Asian countries.

PTCA was first performed almost simultaneously to the first Japanese case in Taiwan, China, in 1981, in Korea and Malaysia in 1983, in Singapore and India in 1984, and in Hong Kong and mainland China in 1985. However, expansion of PTCA use was relatively slower in many Asian countries. In mainland China, for instance, during the first decade after its introduction in 1985,

PTCA could only be performed at a few centres and by a few cardiologists. By the end of 1996, a total of only 6,200 percutaneous coronary intervention (PCI) cases had been performed at 51 hospitals. However, along with economic growth and extensive training, the last 10-15 years have witnessed an explosive growth in annual numbers of PCI, reaching a total of 666,495 cases performed at over 2,000 hospitals nationwide in 2016. During the same period, PCI use also expanded rapidly in most developing countries in Asia. According to a rough case count, approximately one million PCI were performed in 2016 in Asia, which is close to the figure for Europe or North America. Asia therefore has become a non-negligible force within the global PCI community.

Although PCI uptake was slower overall in Asia than in North America or Europe, interventional cardiologists in Asia have made remarkable contributions to PCI. In Japan, the skill and patience of interventionalists along with their development of specialised techniques and devices have translated into the highest success rates in the treatment of chronic total occlusion (CTO) lesions. Various antegrade approaches combined with retrograde CTO techniques developed by Japanese scholars<sup>3</sup> have increased the success rate of CTO treatment to 80%-90%; their adoption around the world has improved overall treatment outcomes for CTO lesions. Japan remains the worldwide leader in CTO treatment and, in recent years, Chinese interventional cardiologists have achieved great progress in the battle to conquer CTO lesions.

For their pioneering work, thanks are due to our Korean colleagues, who accumulated clinical experience on left main coronary artery stenting and shared it with the rest of the world via live

demonstrations and international meetings. Korean investigators also led the early real-world registry and randomised trial comparing stenting vs. CABG to treat left main coronary artery disease<sup>4,5</sup>, which provided important evidence to inform revascularisation strategy choice for left main coronary artery disease. Clinical practice and research on left main coronary artery stenting have also progressed in China in recent years<sup>6,7</sup>.

Soon after Dr Kiemeneij first performed PCI via the transradial approach<sup>8</sup>, the technique was introduced into Japan<sup>9</sup>, China<sup>10</sup>, and many other countries and regions in Asia. PCI via the transradial approach has many advantages compared to the femoral approach: patients can ambulate earlier, feel more comfortable, and experience significantly decreased rates of vascular and bleeding complications. Use of the transradial approach has rapidly spread in Asia where it is used in the highest proportions in the world. Currently, more than 90% of PCI in China are performed via the transradial approach.

The research and development on bioresorbable scaffolds (BRS) was flourishing worldwide until the Absorb BVS (Abbott Vascular, Santa Clara, CA, USA) was withdrawn from the global market; however, research and development on a second-generation BRS continues in China and India. First-in-man studies presented at TCT 2016 documented the safety and efficacy of the Firesorb bioresorbable sirolimus target eluting scaffold (MicroPort, Shanghai, China) and the MeRes bioresorbable scaffold (Meril Life Sciences, Vapi, India) with a strut thickness of 100-120  $\mu\text{m}$ . The multicentre randomised trial of Firesorb has been launched in China. Asia is therefore in a leading position worldwide in terms of research and development of second-generation BRS.

The four decades since Dr Grüntzig ushered in the era of interventional cardiology have witnessed tremendous progress in revascularisation therapy of coronary artery disease. Although cardiologists in Asia initially lagged in assimilation of this new approach compared to those in the western world, PCI use and research on coronary intervention have grown in quantity and quality in recent years in the region, rendering Asia a powerhouse in interventional cardiology that is bound for continued growth and innovation.

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## References

1. Gruntzig AR, Senning A, Siegenthaler WE. Nonoperative dilatation of coronary-artery stenosis: percutaneous transluminal coronary angioplasty. *N Engl J Med*. 1979;301:61-8.

2. Nobuyoshi M. My career as a cardiologist and the developmental history of coronary intervention in Japan. *Cardiovasc Interv Ther*. 2010;25:51-2.

3. Rathore S, Katoh O, Tuschikane E, Oida A, Suzuki T, Takase SD. A novel modification of the retrograde approach for the recanalization of chronic total occlusion of the coronary artery intravascular ultrasound-guided reverse controlled antegrade and retrograde tracking. *JACC Cardiovasc Interv*. 2010;3:155-64.

4. Park SJ, Park DW. Percutaneous coronary intervention with stent implantation versus coronary artery bypass surgery for treatment of left main coronary artery disease: is it time to change guidelines? *Circ Cardiovasc Interv*. 2009;2:59-68.

5. Park DW, Seung KB, Kim YH, Lee JY, Kim WJ, Kang SJ, Lee SW, Lee CW, Park SW, Yun SC, Gwon HC, Jeong MH, Jang YS, Kim HS, Kim PJ, Seong IW, Park HS, Ahn T, Chae IH, Tahk SJ, Chung WS, Park SJ. Long-term safety and efficacy of stenting versus coronary artery bypass grafting for unprotected left main coronary artery disease: 5-year results from the MAIN-COMPARE (Revascularization for Unprotected Left Main Coronary Artery Stenosis: Comparison of Percutaneous Coronary Angioplasty Versus Surgical Revascularization) registry. *J Am Coll Cardiol*. 2010;56:117-24.

6. Chen SL, Xu B, Han YL, Sheiban I, Zhang JJ, Ye F, Kwan TW, Paiboon C, Zhou YJ, Lv SZ, Dangas GD, Xu YW, Wen SY, Hong L, Zhang RY, Wang HC, Jiang TM, Wang Y, Chen F, Yuan ZY, Li WM, Leon MB. Comparison of double kissing crush versus Culotte stenting for unprotected distal left main bifurcation lesions: results from a multicenter, randomized, prospective DKCRUSH-III study. *J Am Coll Cardiol*. 2013;61:1482-8.

7. Xu B, Redfors B, Yang Y, Qiao S, Wu Y, Chen J, Liu H, Chen J, Xu L, Zhao Y, Guan C, Gao R, Génereux P. Impact of operator experience and volume on outcomes after left main coronary artery percutaneous coronary intervention. *JACC Cardiovasc Interv*. 2016;24;9:2086-93.

8. Kiemeneij F, Laarman GJ. Percutaneous transradial artery approach for coronary stent implantation. *Cathet Cardiovasc Diagn*. 1993;30:173-8.

9. Saito S, Tanaka S, Hiroe Y, Miyashita Y, Takahashi S, Tanaka K, Satake S. Comparative study on transradial approach vs. transfemoral approach in primary stent implantation for patients with acute myocardial infarction: results of the test for myocardial infarction by prospective unicenter randomization for access sites (TEMPURA) trial. *Catheter Cardiovasc Interv*. 2003;59:26-33.

10. Yang YJ, Kandzari DE, Gao Z, Xu B, Chen JL, Qiao SB, Li JJ, Qin XW, Yao M, Wu YJ, Yuan JQ, Chen J, Liu HB, Dai J, Chen T, Wang Y, Li W, Gao RL. Transradial versus transfemoral method of percutaneous coronary revascularization for unprotected left main coronary artery disease: comparison of procedural and late-term outcomes. *JACC Cardiovasc Interv*. 2010;3:1035-42.