The 64th Annual Scientific Sessions and Exposition of the American College of Cardiology (ACC) were held at the San Diego Convention Center from March 14–16, 2015. The ACC Scientific Sessions are 1 of 2 major scientific cardiology meetings in the United States, with nearly 20,000 attendees, including 15,000 cardiovascular professionals. There were over 2,100 oral and poster abstracts, and more than 15 late-breaking clinical trials (LBCTs) abstracts. This report presents the highlights and several key presentations, especially the LBCTs, from the ACC Scientific Sessions 2015. I hope this review will help cardiologists update to the latest information.

Key Words: American College of Cardiology; Japanese Circulation Society; Late-breaking clinical trials; Proprotein convertase subtilisin/kexin type 9 (PCSK9); Transcatheter aortic valve replacement (TAVR)

Opening Showcase

In the opening showcase, the ACC President, Professor Patrick T. O’Gara, emphasized that this year’s main theme was “More Learning, Less Lecturing”, with many new features that made ACC 2015 a step up from previous meetings, including new learning formats, increased interactive opportunities, and the more than 275 exhibiting companies with some live interactive demonstrations (Figure 1). He also highlighted the many ways the field of cardiology has led the way in innovation over the past decades and noted some new technologies for the future of cardiology such as proprotein convertase subtilisin/kexin type 9 (PCSK9) inhibitors, 3-D printers and big data etc. He finally emphasized the importance of “Leadership” in the advancement of cardiovascular science by admiring 3 giant leaders in cardiology, Dr Paul White, Dr Eugene Braunwald and Dr Valentin Fuster.

LBCTs

Now, I would like to summarize the topics of several LBCTs (Figure 2).

PROMISE Trial

In this trial, Dr Pamela Douglas and coworkers used the first-ever randomized, controlled trial to compare the effectiveness of functional physiological testing (eg, exercise electrocardiography, nuclear stress testing, or stress echocardiography) vs. coronary CT angiography (CTA) in discovering signs of coronary artery disease (CAD) in symptomatic patients with no prior diagnosis of CAD. The study included 10,003 patients for whom diagnostic testing was recommended because of their symptoms. The composite primary endpoint was death, myocardial infarction (MI), hospitalization for unstable angina, or major procedural complication. Over a median follow-up period of 25 months, the study found no difference in primary composite outcomes between the 2 groups (164 of 4,996 patients in the CTA group (3.3%) and 151 of 5,007 (3.0%) in the functional-testing group). CTA was associated with fewer catheterizations showing no obstructive CAD than was functional testing (3.4% vs. 4.3%, P=0.02), although more patients in the CTA group underwent catheterization within 90 days after randomization (12.2% vs. 8.1%). Thus, the authors...
Figure 1. The American College of Cardiology Scientific Sessions 2015 were held at the San Diego Convention Center. (A) The ACC president Professor Patrick T. O’Gara addresses opening remarks. (B) Professor O’Gara emphasized the importance of leadership by admiring 3 giant leaders in the cardiovascular field, Dr White, Dr Braunwald and Dr Fuster.

Figure 2. Snapshots from ACC 2015. (A) LBCT announcement panel. (B) Presentation of LBCT abstract by a scientist at the main hall. (C) On the first day, the main hall was full of people during the LBCT sessions. (D) Those who could not go into the main hall were watching monitors outside the hall.
suggested that CTA might be the safer test with fewer catheterizations for patients without obstructive CAD. They concluded that the results are important because unnecessary coronary angiography of symptomatic patients but who do not have obstructive CAD can be avoided. Their results were simultaneously published in the New England Journal of Medicine. However, in Japan there are substantial numbers of patients with coronary spastic angina who do not have significant organic stenosis of coronary arteries. In these patients, CTA alone may fail to detect severe coronary artery spasm that sometimes progresses to acute coronary syndrome or even sudden death.

**TAVR Clinical Trials**

Transcatheter aortic valve replacement (TAVR) is an effective alternative to surgical aortic valve replacement (SAVR) for high-risk patients with aortic stenosis (AS). Dr. Michael L. Mack and coworkers reported the 5-year outcomes results of the previously reported PARTNER 1 trial. They used a computer-generated method to randomly assign AS patients to either SAVR or TAVR with a balloon-expandable bovine pericardial tissue valve by either a transapical or transfemoral approach. Patients and their treating physicians were not masked to treatment allocation. The primary outcome of the trial was all-cause mortality in the intention-to-treat population at 1 year, and they presented predefined outcomes at 5 years in this session. The study analyzed 699 patients, 348 of whom were assigned to TAVR and 351 to SAVR. Overall mean Society of Thoracic Surgeons Predicted Risk of Mortality score was 11.7%. At 5 years, the risk of death was 67.8% in the TAVR group compared with 62.4% in the SAVR group (hazard ratio of TAVR 1.04; P=0.76). Moderate or severe aortic regurgitation occurred in 40 (14%) of 280 patients in the TAVR group and in 2 (1%) of 228 in the SAVR group (P<0.0001), and was associated with increased 5-year risk of mortality in the TAVR group (72.4% for moderate or severe aortic regurgitation vs. 56.6% for those with mild aortic regurgitation or less; P=0.003).

In another late-breaking abstract from the PARTNER 1 Trial, the authors showed that TAVR should be strongly considered for patients who are not surgical candidates for aortic valve replacement to improve their survival and functional status. The study recruited 358 patients with severe symptomatic, inoperable AS and randomly assigned (1:1) them to transfemoral TAVR or to standard treatment, which often included balloon aortic valvuloplasty. The primary outcome of the trial was all-cause mortality at 1 year in the intention-to-treat population, and the authors presented the prespecified findings after 5 years. The risk of all-cause mortality at 5 years was 71.8% in the TAVR group vs. 93.6% in the standard treatment group (hazard ratio of TAVR 0.50; P=0.0001). Echocardiography after TAVR showed durable hemodynamic benefit (aortic valve area 1.52 cm² and mean gradient 10.6 mmHg at 5 years), with no evidence of structural valve deterioration. They mentioned that “appropriate selection of patients will help to maximize the benefit of TAVR and reduce mortality from severe comorbidities”. These 2 trial results were simultaneously published in the Lancet.

In Japan, TAVR has been launched and cases are accumulating in several medical centers. We can learn a lot of things from these clinical trial results.

Results from the CoreValve® US Pivotal Trial were also presented in the same LBCT session. The study compared long-term (24 months) outcomes in TAVR patients who received a self-expanding CoreValve®, as opposed to SAVR. The results indicated that high-risk AS patients who underwent TAVR with CoreValve® had a better survival rate than those undergoing SAVR.

By the way, at the opening of this LBCT Session, the chairpersons announced the tragic death of Dr Michael J. Davidson who was a talented surgeon and Director of Endovascular Cardiac Surgery, Brigham and Women’s Hospital, Boston. Dr Davidson was one of the pioneers who originally developed the TAVR technique. He was sadly killed by a senseless gunshot in January 2015 inside the very hospital at age 44. All the people in the main hall of the ACC 2015 expressed their condolences.

**TMVR Clinical Results With MitraClip® Registry**

Transcatheter mitral valve repair (TMVR) with MitraClip® has been shown to be a safe, effective strategy for patients with symptomatic mitral regurgitation (MR). The STS/ACC TVT Registry trial studied all commercial TMVR cases with MitraClip® included in the registry, for a total of 564 participants across 61 centers in the United States. It also examined 30-day patient outcomes for procedural success, complications, and device-related events. Results showed that the procedure was free from complications in 91.8% and the primary therapeutic benefit of the procedure, which is reduction in MR, was achieved in 63.7%. Only 7.8% of patients experienced complications; and patient mortality was 5.8% after the 30-day period. Average hospital stay was only 3 days. These results are remarkable, especially when one considers that the patients were elderly with significant morbidities and surgical risk.

**PCSK9 Inhibitors Clinical Trials**

Proprotein convertase subtilisin/kexin type 9, also known as PCSK9, has a great medical import because it plays a major regulatory role in cholesterol homeostasis. PCSK9 binds to the epidermal growth factor-like repeat A (EGF-A) domain of the low-density lipoprotein receptor (LDL-R), mediating LDL-R degradation. Reduced LDL-R levels result in decreased absorption of LDL cholesterol (LDL-C), which leads to hypercholesterolemia. But if PCSK9 fails to bind, the LDL-R can return to the surface of the hepatic cell and remove more cholesterol from the blood. Thus, drugs targeting PCSK9 have been intensively studied by many researchers.

Evolocumab (AMG 145), a human monoclonal antibody directed against PCSK9, significantly reduced LDL-C levels in short-term studies. The OSLER Trial recruited 4,465 patients who had previously completed 1 of 12 phase 2 or 3 “parent trials” of evolocumab. Regardless of study-group assignment in the parent trials, eligible patients were randomly assigned in a 2:1 ratio to receive either evolocumab (140 mg every 2 weeks or 420 mg monthly) plus standard therapy or standard therapy alone. Patients were followed for a median of 11.1 months with assessment of lipids levels, safety, and adjudicated cardiovascular events including death, MI, unstable angina, coronary revascularization, stroke, transient ischemic attack, and heart failure. The results revealed that patients receiving evolocumab showed a 61% reduction of LDL-C from 120 mg/dl to 48 mg/dl (P<0.001). The rate of cardiovascular events at 1 year was reduced from 2.18% in the standard-therapy group to 0.95% in the evolocumab group (hazard ratio 0.47; P=0.003). Adverse events occurred with similar frequency in the 2 groups, although neurocognitive events were reported more frequently in the evolocumab group with unknown reasons. The authors implicated a new, larger trial to further evaluate the efficacies of evolocumab against car-
The primary efficacy endpoint was the percentage change in calculated LDL-C level from baseline to week 24. At week 24, the difference between the alirocumab and placebo groups in the mean percentage change from baseline in calculated LDL-C level was −62 percentage points (P<0.001); the treatment effect remained consistent over a period of 78 weeks. In a post hoc analysis, the rate of major adverse cardiovascular events (death from CAD, nonfatal MI, fatal or nonfatal ischemic stroke, or unstable angina requiring hospitalization) was lower with alirocumab than with placebo (1.7% vs. 3.3%; hazard ratio, 0.52; P=0.02). The results of the ODYSSEY LONG TERM Trial were simultaneously published in the New England Journal of Medicine.  

In another clinical trial called ODYSSEY, Dr Jennifer Robinson and coworkers presented longer-term efficacy results of another anti-PCSK9 monoclonal antibody, alirocumab, which has been shown to reduce LDL-C levels in patients who are receiving statins. They conducted a randomized trial involving 2,341 patients at high risk for cardiovascular events who had LDL-C levels ≥70 mg/dl and were receiving statins at the maximum tolerated dose. Patients were randomly assigned in a 2:1 ratio to receive alirocumab (150 mg) or placebo every 2 weeks for 78 weeks. The results of the OSLER Trial were simultaneously published in the New England Journal of Medicine.
In Japan, Hirayama and coworkers\textsuperscript{15} recently reported the effects of evolocumab on LDL-C levels in Japanese patients at high cardiovascular risk with hypercholesterolemia on stable statin therapy. Mean changes in LDL-C levels compared with the placebo group were $-68.6\%$ and $-63.9\%$ in the 140-mg fortnightly group and the 420-mg monthly group, respectively. It is interesting that the percentage LDL-C reductions by evolocumab or aliromucab were around 60–70\% in both US and Japanese studies, indicating that the efficacies of these drugs could be equally expected regardless of Asian or Caucasian race.

**Everolimus-Eluting Stents vs. Bypass Surgery for CAD**

There were 2 LBCT abstracts regarding the comparison between everolimus-eluting stents, one of the second-generation drug-eluting stents, vs. bypass surgery for CAD patients from Korea\textsuperscript{16} and the United States.\textsuperscript{17} Dr Seung-Jung Park and coworkers conducted their BEST Trial,\textsuperscript{16} a randomized non-inferiority trial in which they randomly assigned 880 patients with multivessel CAD to percutaneous coronary intervention (PCI) with everolimus-eluting stents or to coronary-artery bypass grafting (CABG). The primary endpoint was a composite of death, MI, or target-vessel revascularization at 2 years after randomization. At 2 years, the primary endpoint had occurred in 11.0\% of the PCI group and in 7.9\% of the CABG group (P=0.32 for non-inferiority). At longer-term follow-up (median, 6.4 years), the primary endpoint had occurred in 15.3\% of the PCI group and in 10.6\% of the CABG group (hazard ratio, 1.47; P=0.04). No significant differences were seen between the 2 groups in the occurrence of a composite endpoint of death, MI, or stroke. However, the rates of any repeat revascularization and spontaneous MI were significantly higher after PCI than after CABG.

In another clinical study,\textsuperscript{17} Dr Sripal Bangalore and coworkers conducted a observational registry to compare the outcomes in patients with multivessel CAD who underwent CABG with the outcomes in those who underwent PCI using everolimus-eluting stents. The primary outcome was all-cause death. Secondary outcomes were the rates of MI, stroke, and revascularization. They used propensity-score matching to assemble a cohort of patients with similar clinical characteristics. At a mean of 2.9 years follow up, PCI with everolimus-eluting stents, as compared with CABG, had a similar risk of death (3.1\% vs. 2.9\% per year, hazard ratio, 1.04; P=0.50), higher risks of MI (1.9\% vs. 1.1\% per year; hazard ratio, 1.51; P<0.001) and repeat revascularization (7.2\% vs. 3.1\% per year; hazard ratio, 2.35; P<0.001), and a lower risk of stroke (0.7\% vs. 1.0\% per year; hazard ratio, 0.62; P<0.001). The higher risk of MI with PCI than with CABG was not significant among patients with complete revascularization but was significant among those with incomplete revascularization. Although the study designs are quite different, both studies showed an increased risk of revascularization and some form of MI in the PCI with everolimus-eluting stents group compared with CABG in patients with multivessel CAD. Based on these studies we must be cautious in selecting the treatment strategy for patients with multivessel CAD. These study results were simultaneously published in the *New England Journal of Medicine*.\textsuperscript{16,17}

**Cardiovascular Care of Patients With Cancer**

Another interesting topic was cardiovascular care of patients with cancer and cancer survivors. Not only cardiovascular disease but also cancer patients are increasing in most of countries in the world, and more and more individuals have difficulties with the treatment and care. The ACC created its cardio-oncology working group, and they debuted a special session called the “Cardio-Oncology Intensive Session” at ACC 2015. They emphasized that we first must recognize the growth and complexity of a field that spans different cardiology subspecialties, cardiac team members and diverse oncology areas. There are many clinical questions to be answered. For example, how to identify cancer patients at high cardiovascular risk; how to perform cardioprotective strategies prior, during and after cancer therapy (eg, cardiotoxic chemotherapy); and how to care for patients’ mental health. Apparently, we need a cardio-oncology treatment team with a multidisciplinary care program. Surprisingly, there is only limited clinical data on cancer patients with cardiovascular risk and/or diseases despite these being the most common diseases today.

**Comparison With Other Cardiology Society Congresses**

Finally I would like to compare the ACC Congress with other cardiology society meetings including ours, the JCS Scientific session, from the standpoint of Japanese participants (Table).\textsuperscript{18,19} Although the ACC Sessions in 2015 and past years have been very attractive for many Japanese cardiologists and researchers, there are several points that sometime make us feel uncomfortable about attending. First, the ACC and JCS meetings are close to each other in March. Several years ago, the sessions partially overlapped and many Japanese cardiologists gave up attendance at the ACC. I recently heard that ACC 2017 and JCS 2017 will completely overlap, which will reduce the number of attendees at each congress. Second, admission to ACC is expensive for nonmembers. Thus, attendees are encouraged to register as ACC members or FACC.

**Closing Remarks**

In conclusion, the overall scientific quality was very high and I learn many practical things at ACC 2015, such as the LBCT, oral and poster sessions, interactive meetings, live demonstrations, expositions, etc. The fine weather in San Diego also contributed to enjoyment of the conference (Figure 3). Attending such congresses with plenty of people stimulates myself to further promote research and also reminds me of the experience that I presented a LBCT abstract at ACC 2011 in New Orleans, LA.

**Acknowledgments**

The author appreciates Professor Hiroaki Shimokawa’s invitation to present this report.

**Disclosures**

The author has no conflict of interest to disclose regarding the contents.

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