KSC 2023 Smart Heart, Smile Life

DAILY

대한심장학회 THE KOREAN SOCIETY OF CARDIOLOGY 심장학연구재단 THE KOREAN CARDIAC RESEARCH FOUNDATION

The 67th Annual Scientific Meeting of The Korean Society of Cardiology

Today's Highlights

Cross Specialty 1: KSCPT-KSC Joint Session

Optimal, Individual Cardiovascular Pharmacotherapy

›› 09:00-10:30, Walker 1

기획세션 1: Interesting ECG

›› 09:00-10:30, Grand 1

기획세션 2: The Old & Cardiology

›› 10:40-12:10, Walker 1

Plenary Session 1 (Keynote Lecture)

›› 13:20-14:50, Walker 1

Cross Specialty 4:
Cardiac Surgery (Mitral Clip, TAVI)

Management of Octogenarian Patients with Severe Mixed Aortic Stenosis and Mitral Regurgitation

›› 15:00-16:30, Walker 1

기획세션 3: Young Cardiologist Boot Camp

Young Cardiologists to Future Cardiologists: Cardiologist as a Vocation

›› 16:40-18:10, Grand 4

Welcome Message

Dong-Soo Kim, MD, PhD
Chairperson, The Korean Society of Cardiology

After two years of a long pandemic, we were able to meet you in person last year, sharing knowledge, exchanging experiences and having a very meaningful time. It is our great pleasure to meet you again this year at the 67th Annual Scientific Meeting of the Korean Society of Cardiology (KSC 2023).

At KSC 2023, we will dive into various topics where current academic attention and interest are focused, fostering KSC 2023 to be a place for academic exchange to share the knowledge among national and international participants.

There are many interesting lectures, including ethics, policy, reimbursement system. In addition, more lectures are prepared to capture your attention and inspire scientific enthusiasm not only through lectures, but also through direct participation in live demonstrations.

Last but not least, I would like to extend my gratitude and respect to the members of KSC endeavoring to organize KSC 2023 and helping the development of our society.

Looking forward to meeting you!

Seung Woo Park, MD, PhD
President & CEO, The Korean Society of Cardiology

On behalf of The Korean Society of Cardiology (KSC), I am honored and pleased to welcome all of attendees at KSC 2023 (The 67th Annual Scientific Meeting of The Korean Society of Cardiology) which is being held on October 13th-15th in Grand Walkerhill, Seoul, Korea.

Under the motto of "KSC Jumping up with Young Generation", we organized the Young Investigator Competition sessions, Abstract/Case presentation sessions of various sub-specialties in cardiology, as well as the Competition sessions to give residents the opportunities to present and the time to discuss their studies with experts. Also, one of the highlighted sessions will be organized by young cardiologists with lots of real-world experiences and know-how on the medical field. The future cardiologists will have the opportunity to learn from them and empathize with their experiences. Young Cardiologists as well as well-known faculties from America, Europe and Asia will participate and share knowledge at the site.

To promote close cooperation and collaboration with overseas societies, there will be the Joint sessions with the American College of Cardiology, European Society of Cardiology, Japanese Circulation Society, Taiwan Society of Cardiology, and Asian Pacific Society of Cardiology. These Joint sessions will offer experts around the world a valuable time to learn the research trends and the latest knowledge from each country.

I hope KSC 2023 will serve as a platform for everyone to meet many cardiologists in person and to actively interact with each other.

KSC 2023 DAILY

Program at a glance: Day 1, Oct 13, 2023

	Walker 1	Walker 2	Grand 1	Grand 3	Grand 4	Grand 5	Grand 6	Art	Pine	Oak	Vista
09:00 - 10:30	**Cross Specialty 1: *KSCPT-KSC Joint Session** Optimal, Individual Cardiovascular Pharmacotherapy	**Intervention 1** 2022-2023 Hot Trials in CV Intervention	**기획세션 1: Interesting ECG**	**Young Investigator Award Competition 1** 1-6	**Young Investigator Award Competition 2** 7-12	**Women Heart Disease 1** Cardio-Obstetrics	**CAD 1** 1-8	**Echocardiography 1** Deep Dive into Tricuspid Regurgitation: from Imaging to Treatment	**Intervention 1** 9-16	**Basic Research 1** 17-24	**E-Poster** 1-38
10:40 - 12:10	**기획세션 2: The Old and Cardiology** Compass to Move Forward	**Intervention 2** Up-to-date Coronary Imaging and Physiology	**Arrhythmia 1** Debate in AF Management	**Young Investigator Award Competition 3** 13-18	**Young Investigator Award Competition 4** 19-24	**Women Heart Disease 2** Emerging Topics Related to Sex Differences in CVD		**Cardiac Surgery** MY Best 2nd Graft Selection in Multivessel CABG	**Arrhythmia 1** 25-32	**Basic Research 2** 33-40	
12:20 - 13:00	**Scientific Session [Samjin]** Treatment of Antithrombotic Therapy for CVD Patients	**Scientific Session [Organon]** Latest Insights of Cardiovascular Disease Prevention in Hypertension and Dyslipidemia	**Scientific Session [Hanmi]** Evidence-based Approach for Hypertension & Dyslipidemia Treatment	**Scientific Session [Daiichisankyo/ Daewoong]** Achieving Best Outcomes for Patients with Cardiovascular Disease with Olmesartan and Edoxaban							**Mini Oral** **A: Basic Research** 1-5 **B: Echocardiography** 6-10 **C: Intervention** 11-15
13:00 - 13:20	**Break**										
13:20 - 14:50	**Plenary Session 1** (Keynote Lecture)	**Cross Specialty 2: Electrophysiology & Heart Failure** Cross Specialty Between Electrophysiology and Heart Failure	**Cross Specialty 3: Sports Cardiology** From Athletes to Exercise in Patients with CV Disease	**Echocardiography 2** Recent Advances of Echo & Imaging: Where are We Going?	**Cardiometabolic Syndrome 1** Update in Obesity Treatment	**KCJ Session with 한국연구재단** 학술지 건전성과 AI 기반 미래 학술지 KCJ	**Case 1 AMI & CAD/ Intervention** 1-7	**Cardiac Pathology** Heart Transplantation and Rejection Pathology	**Case 2 Heart Failure/ Hypertension** 8-14	**Case 3 Arrhythmia** 15-21	**E-Poster** 1-38
15:00 - 16:30	**Cross Specialty 4: Cardiac Surgery (Mitral Clip, TAVI)** Management of Octogenarian Patients with Severe Mixed Aortic Stenosis and Mitral Regurgitation	**Myocardial Infarction 1** AMI in the Special Populations	**Arrhythmia 2** Current Challenges and Unmet Needs in AF Ablation	**Cardiogenic Shock 1** Contemporary Management and Recent Advances	**Cardiometabolic Syndrome 2** What is Going on in the Treatment of Cardiometabolic Syndrome?	**Healthcare Policy 1** 심혈관 질환 응급의료체계의 정상화를 위한 핵심 방안은 무엇인가?	**CAD 2** 41-48	**Basic Research 1** Age Reprogramming	**Pediatric Cardiology & ACHD 1** 49-55	**Arrhythmia 2** 56-63	
16:40 - 18:10	**Cross Specialty 5: Sleep Apnea** What Cardiologists Need to Know!	**Myocardial Infarction 2** AMI A to Z: How to Approach Patients with Chest Pain Suspected of AMI?	**Arrhythmia 3** Recent Advances and Future Perspectives in AF Management	**Cardiogenic Shock 2** Current Problems and Future Perspectives	**기획세션 3: Young Cardiologist Boot Camp** Young Cardiologists to Future Cardiologists - Cardiologist as a Vocation	**Healthcare Policy 2** 필수의료 강화를 위한 지불제도와 인력 부족 해결을 위한 해법 모색	**CAD 3** 64-71	**Basic Research 2** Therapeutic Platforms for Cardiovascular Therapy	**Pediatric Cardiology & ACHD 2** 72-76	**Heart Failure 1** 77-84	

*KSCPT: Korean Society for Clinical Pharmacology and Therapeutics (대한임상약리학회)

Scientific Sessions

Scientific Session [Samjin]

Treatment of Antithrombotic Therapy for CVD Patients

12:20-12:40	ACS Treatment Strategy Focused on Clopidogrel
12:40-13:00	Use of NOACs for Specific Patient Groups in Terms of Age and Gender : Focused on Rivaroxaban

›› Oct 13, 12:20-13:00, Walker 1

Scientific Session [Organon]

Latest Insights of Cardiovascular Disease in Hypertension and Dyslipidemia

12:20-12:40	Evidence-based Practical Strategies for Early Achievement of LDL-C Treatment Goals
12:40-13:00	Role of Losartan for Blood Pressure Management of Various Hypertensive Patients

›› Oct 13, 12:20-13:00, Walker 2

Scientific Session [Hanmi]

Evidence-based Approach for Hypertension & Dyslipidemia Treatment

12:20-12:40	Why Should We Consider Chlorthalidone in Combination Therapy of Antihypertensive Drugs?
12:40-13:00	A Paradigm Shift in Dyslipidemia Treatment

›› Oct 13, 12:20-13:00, Grand 1

Scientific Session [Daiichisankyo/Daewoong]

Achieving Best Outcomes for Patients with Cardiovascular Disease with Olmesartan and Edoxaban

12:20-12:40	Perfect 24h BP Control Strategy Under Anti-hypertensive Drug Treatment
12:40-13:00	Optimal Anticoagulant Therapy in Patients with AF

›› Oct 13, 12:20-13:00, Grand 3

KSC 2023 정기총회 개최

대한심장학회 제67차 추계학술대회 정기총회를 다음과 같이 개최합니다.
각 분야 시상 및 경품 추첨이 있사오니 많은 참석 바랍니다.

| 일시 2023년 10월 14일 토요일 오후 6시 10분
| 장소 Grand 1

※ 정기총회 후 Presidential Dinner가 Grand 1 로비에서 진행됩니다.
자유롭게 참여 가능합니다.

Cardiac Pathology

HLA and Non-HLA Antibodies in Cardiac Allograft Rejection

Eun-Suk Kang, MD, PhD
Samsung Medical Center, Korea

Antibodies against donor human leukocyte antigen (HLA), especially de novo donor specific antibodies (dnDSAs) post-transplantation, pose significant barriers in heart transplantation, affecting outcomes in approximately 30% of recipients. Factors like pre-transplant HLA mismatches, young age, HLA-DQ mismatching, viral infections, early rejection, ischemic reperfusion injury, autoimmune diseases, and insufficient immunosuppression must be assessed carefully.

HLA DSA specificity can be defined at the antigen and allele levels, varying in clinical significance based on reactivity to shared eplets (epitopes) among specific alleles or antigen combinations. The introduction of next-generation sequencing (NGS)-based high-resolution HLA typing has allowed the determination of more significant antibody specificity through single antigen-based antibody identification (SAID) and verification of antibody-verified eplets. Determining whether antibodies have the potential to induce complement-mediated cytotoxicity or antibody-dependent cell-mediated cytotoxicity leading to tissue damage and rejection is important. C1q or C3d assay and IgG subclass (G1, G3) tests can provide functional clues. However, currently available tests are semi-quantitative and rely on the solid-phase coating of a fixed antigen amount, making it challenging to fully assess the correlation between measured mean fluorescence intensity (MFI) values and pathological findings in the graft. The representation of antibody quantification values (mean MFI, max MFI, or sum of MFI) in SAID testing can also influence the interpretation of the clinical relevance of antibodies.

Even without HLA DSA, immune rejection reactions can occur due to antibodies against non-HLA. Non-HLA, excluding polymorphic antigens like major histocompatibility complex class I chain-related gene A (MICA), consists of tissue antigens released from damaged organs pre- or post-transplantation. In heart transplantation, antibodies against cardiovascular and myocardial antigens like AT1R, ETAR, and vimentin have been reported, acting akin to autoantibodies. Non-HLA antibodies can cause not only antibody mediated rejection but also clinical manifestations related to the original function of target antigens. They can also interact with HLA antibodies, exacerbating clinical outcomes. **Thus, evaluating non-HLA antibodies alongside HLA antibodies is crucial for risk stratification and treatment decisions (Figure 1).**

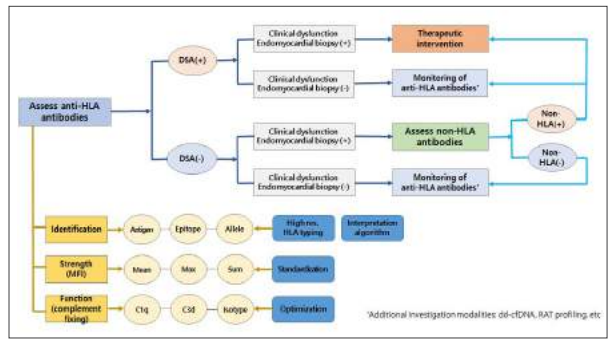


Figure 1. Assessment of anti-HLA and non-HLA antibodies in cardiac transplantation

Cardiac Pathology
Heart Transplantation and Rejection Pathology
›› Friday, Oct 13, 13:20-14:50, Art

Cross Specialty 5: Sleep Apnea

Sleep Apnea: Heart Rate Variability and Cardiopulmonary Coupling

나진오 교수
고려의대

수면은 몸이 회복되고 재충전하는 매우 중요한 시간이지만 수면무호흡증이 있으면 숙면을 취하지 못하게 되어 여러 가지 질환을 일으킨다. 수면무호흡증의 유병률은 거의 20%에 육박하며 특히 심혈관 질환과 밀접하게 관련되어 있다. 수면무호흡증은 수면다원검사를 통해 진단하지만, 이 방법은 환자가 뇌파, 호흡 감지, 근육의 움직임, 심전도, 산소포화도 등을 측정하는 여러 장치를 부착해야 하고 병원에서 수면해야 하는 등 여러 불편한 점이 많다. 따라서 수면의 질을 간단하게 측정할 수 있는 신뢰성 높은 다른 방법이 필요하며 그중 하나가 심전도를 이용한 수면의 질 측정 방법인 심폐결합(cardiopulmonary coupling, CPC) 분석이다. 흡기 시에 폐의 팽창으로 심전도상 R파의 높이에 변화가 오게 되므로 이를 이용해 호흡의 여부를 유추할 수 있다. 그리고 흡기 시에 자율신경계의 개입으로 미세하게 맥박이 빨라지고 호기 시에 맥박이 느려지는 호흡성 맥박 변이(heart rate variability caused by breathing)가 생긴다. 이런 두 가지 현상을 통일하여 분석하는 방법이 바로 심폐결합 분석이다(**Figure 1**). 수면 중 안정적인 호흡을 하는 경우에는 심폐결합 분석상 high frequency coupling이 주로 보이며, 반대로 불안정한 호흡을 하는 경우 즉, 수면무호흡증이 있는 경우에는 low frequency coupling이 주로 나타나게 된다. 이를 널리 활용한다면 **심폐결합 분석을 통해 수면 중 안정적인 호흡을 하는지 수면호흡장애는 없는지 등을 파악할 수 있으며 이는 곧 자율신경계의 작용과도 연관되어 있어 자율신경계의 장애 여부도 확인이 가능할 것으로 생각된다.** 이를 바탕으로 수면 중 심전도 분석만으로도 쉽고 간단하게 환자의 예후와 치료 반응 등을 알아볼 수 있는 방법을 찾을 수 있을 것으로 기대된다.

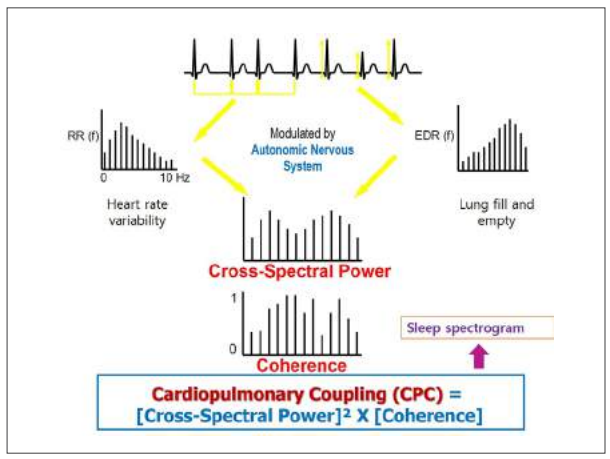


Figure 1. 심폐결합 분석의 원리

CPAP vs. Surgical Treatment for OSA in Patients with CVD

Ji Ho Choi, MD, PhD
Soonchunhyang University College of Medicine, Korea

Obstructive sleep apnea (OSA) is a relatively common sleep disease requiring a comprehensive and multidisciplinary approach. OSA leads to diverse symptoms and consequences such as cardiovascular diseases (CVD). Generally, primary therapeutic options include positive airway pressure (PAP), surgical treatment, and oral appliances (OA), supplemented by weight loss and positional therapy as complementary modalities.

PAP is suggested as the standard approach for managing moderate-to-severe OSA (apnea-hypopnea index [AHI]≥15), while it becomes an alternative choice for treating mild OSA (AHI=5-15). Surgical intervention is typically suggested for patients with surgically manageable anatomical abnormalities or a high likelihood of surgical success. Surgery is also indicated for cases unresponsive to or incompatible with medical modalities. Additionally, surgery is recommended as a supplementary option to enhance the tolerance of other therapeutic modalities.

During consultation, diverse treatment options, therapeutic indications, mechanisms, clinical effects, and limitations should be thoroughly discussed with the patient. Moreover, patients should take an active role in managing their own condition. **In summary, a personalized treatment modality should be considered on the basis of a comprehensive evaluation of the patient's anatomical findings, polysomnographic results, patient's opinion, obesity (if applicable), and comorbidity, including CVD (Figure 2).**

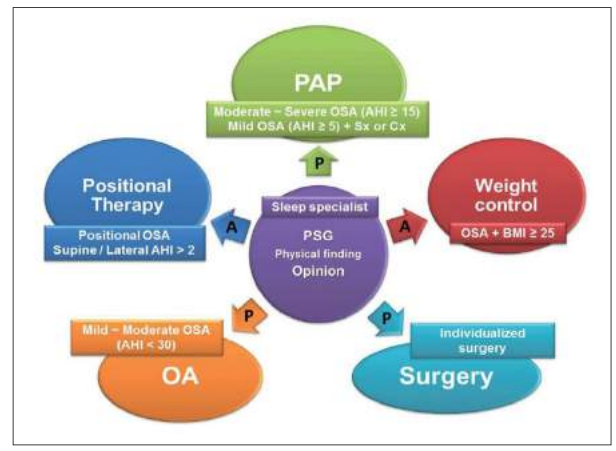


Figure 2. Therapeutic principles underlying OSA (Sleep Med Res 2021;12(1):9-14.)

Cross Specialty 5: Sleep Apnea
Sleep Apnea: What Cardiologists Need to Know!
›› Friday, Oct 13, 16:40-18:10, Walker 1

Cardiogenic Shock

Optimal Use of Various MCS in the Field of Cardiac Critical Care

Carlos Leon Alviar, MD
New York University School of Medicine, USA

Mortality for cardiogenic shock (CS) remains elevated, and the only therapy that has been shown to improve survival in an acute myocardial infarction-related CS (AMI-CS) is early revascularization as demonstrated by the SHOCK trial, as well as revascularization of culprit-only revascularization in patients presenting with AMI-CS and multivessel coronary artery disease as demonstrated in the CULPRIT-SHOCK trial. However, other studies assessing the use of vasoactive medications, including vasopressors and inotropic agents, have not demonstrated any difference in survival between the treatment arms. Similarly, randomized controlled trials (RCTs) of mechanical circulatory support (MCS) devices have failed to demonstrate improvement in mortality, including intra-aortic balloon pump (IABP) as shown by the IABP-SHOCK II trial, as well as veno-arterial membrane oxygenation (VA-ECMO) as demonstrated by the ECMO-CS and ECLS-SHOCK trials. Similarly, other small underpowered studies comparing temporary percutaneous left ventricular assisted devices (e.g., Impella) have also failed to demonstrate superiority over other forms of MCS. **Notably, while these trials deserve major credit for completing and addressing such key investigational questions where it is extremely challenging to design RCTs, it is important to understand the patient population included in the trials. In addition, it is crucial to understand how to integrate such key information provided by these very well conducted RCTs into clinical practice.**

For instance, published studies so far have only included patients with AMI-CS, limiting the applicability of the RCTs' findings to those with other etiologies of CS, such as acute and chronic heart failure, myocarditis, valvular heart disease and others. Moreover, it is also important to appropriately classify CS according to its phenotype, including the severity of shock using the SCAI SHOCK stages or other risk scores (IABP SHOCK II score or CardShock score), ventricular involvement, organ perfusion and congestion, and hemodynamic profile. Hence, the appropriate phenotyping and understanding of a patient's presentation are key for determining therapies and monitoring strategies, including medications, invasive versus non-invasive monitoring and MCS devices. Therefore, the implementation of a goal-directed, holistic, and multi/interdisciplinary approach, with SHOCK teams and SHOCK algorithms, is key to improving outcomes in CS.

Cardiogenic Shock 1
Contemporary Management and Recent Advances
›› Friday, Oct 13, 15:00-16:30, Grand 3

Unresolved Issues and Future Perspectives on Cardiogenic Shock

Hyeon-Cheol Gwon, MD, PhD
Sungkyunkwan University School of Medicine, Korea

CS remains a critical condition with high in-hospital mortality, despite recent progress in survival rates. Additionally, regional disparities in survival are linked to healthcare variations. Management approaches often rely on personal experience, with limited evidence-based therapies with promising outcomes. The complexity of CS management is underscored by unresolved questions with limited solutions.

Firstly, timely CS identification and diagnosis remain challenging. The diagnosis of CS is frequently delayed as it is solely dependent on hypotension and missing the signs of hypoperfusion of major organs. Currently, the Society for Cardiovascular Angiography and Interventions (SCAI) Shock Stage Classification aids in the early diagnosis of CS as well as in defining its severity.

Secondly, optimal hemodynamic monitoring is a continuing challenge. The role of the pulmonary artery catheter (PAC) was questioned as a benchmark, as the PACMAN and ESCAPE studies showed no clear benefit. However, the quality of PAC use was not well-determined in both studies. The ongoing PACCS trial focuses on refining PAC usage, including the cardiac power assessment.

Thirdly, pharmacological interventions lack clarity, especially trials comparing vasopressors and inotropes. The SOAP II trial favored norepinephrine over dopamine for a vasopressor, but no study has focused on identifying the best inotropic yet. As it is becoming clearer that excessive dosing is harmful, the path forward is shifting towards MCS.

Fourthly, MCS usage currently lacks definitive guidance. MCS application saves lives in critical patients, as some patients still succumb despite intervention. MCS-related complications can lead to poor survival, and the optimal initiation timing to prevent multiorgan failure is still uncertain. Fortunately, ongoing trials aim to define the optimal timing and indications of MCS, while many prior studies focused on mitigating vascular complications and unloading left-side congestion. Additionally, trans-septal or pulmonary artery venting and Impella use are also under investigation.

Fifthly, cause-specific CS management is crucial. Myocardial infarction is the most frequent cause of CS. Though optimal revascularization strategy and pharmacological therapeutics are still under study, cause-specific treatment should be properly managed in addition to shock management.

Lastly, institutional and administrative support is crucial. **According to a recent big data analysis, regional and center-specific mortality rate disparities for CS in Korea**

Continued on page 5

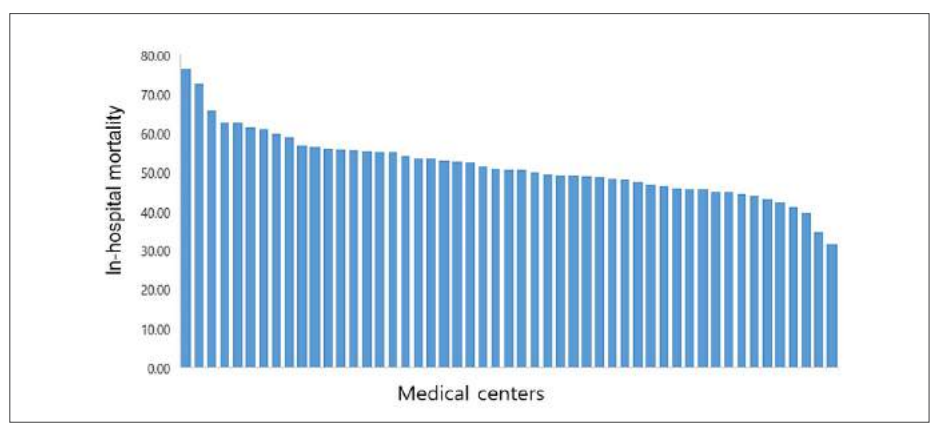


Figure 1. In-hospital mortality of cardiogenic shock in Korean centers (Database analysis of National Health Insurance Service)

Basic Research

Evidence for Forward and Reverse Aging via Epigenetic Manipulation

Jae-Hyun Yang, PhD
Harvard Medical School, USA

All living things experience entropy, manifested as a loss of inherited genetic and epigenetic information. In mammals, epigenetic information is also lost over time, but what causes it to be lost and whether it is a cause or a consequence of aging is not known. Using a system called "Inducible Changes to the Epigenome (ICE)", we find the act of faithful DNA repair advances aging at physiological, cognitive, and molecular levels, including erosion of the epigenetic landscape, cellular ex-differentiation, senescence, and advancement of the DNA methylation clock, which can be reversed by OSK-mediated epigenetic reprogramming. These data support a model in which a loss of epigenetic information is a cause of aging in mammals.

Basic Research 1
Age Reprogramming
›› Friday, Oct 13, 15:00-16:30, Art

Transcriptional Landscape of Endothelial Senescence: Machine Learning-based Meta-Analysis

Sung Young Kim, MD, PhD
Konkuk University School of Medicine, Korea

Systemic vascular dysfunctions associated with age-related conditions are strongly linked to the senescence of endothelial cells (ECs). Therefore, it is essential to investigate the common attributes of EC senescence to unravel mechanisms and identify potential therapeutic targets. Here, by analyzing eight transcriptomic studies from different origins of ECs with machine learning, common features were effectively analyzed at both the gene and pathway levels (**Figure 1**). A sum of 400 genes exhibiting differential expression (DEGs) was newly uncovered through meta-analysis. **The penalized regression model identified 36 genes and 57 pathway features with non-zero coefficient, indicating a significant link between phosphoglycerate dehydrogenase and the serine biosynthesis pathway in EC senescence.** Leave-one-study-out cross-validation (LOSOCV) was employed, yielding an overall area under the receiver operating characteristic (AUROC) of 0.983 (95% CI 0.952-1.000) and 0.982 (95% CI 0.945-1.000) for genes and pathways, respectively, demonstrating outstanding discriminative capability. The robust model with its enhanced performance underscores the value of deploying sophisticated meta-analysis to unveil shared characteristics of EC senescence. Such insights could potentially lead to the identification of therapeutic targets and a more advanced comprehension of the pathogenesis underlying vascular dysfunction.

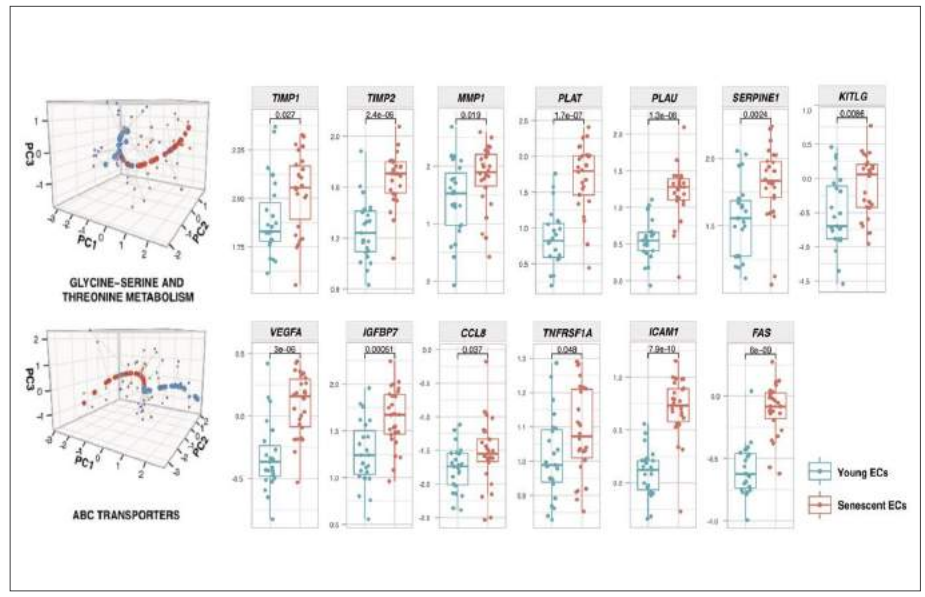


Figure 1. Multi study-derived pathway centric analysis reveals core features of endothelial senescence related pathways. Left panel represents principal curves of two selected pathways. Box plot and Wilcoxon rank-sum test results represent 13 endothelial cell specific senescence-associated secretory phenotype (SASP) gene expressions.

Basic Research 2
Therapeutic Platforms for Cardiovascular Therapy
›› Friday, Oct 13, 16:40-18:10, Art

Continued from page 4

exceed twofold (Figure 1). As CS requires a multidisciplinary approach, aside from space and equipment availability, deployment of specialized personnel is extremely important to enhance patient outcomes.

Effective CS management entails addressing underlying causes in addition to shock treatment. The absence of breakthrough technologies highlights the importance of advancing technology and accumulating experience to enhance the prognosis for critically ill patients.

What We Have Learned from Observation Studies and Clinical Trials in CCCTN

Carlos Leon Alviar, MD
New York University School of Medicine, USA

The field of critical care cardiology has significantly grown in the last few decades and has rapidly evolved as a result of the growing complexity of the patients admitted to contemporary cardiac intensive care units (CICU). This transition from the "coronary care unit" to the "cardiac intensive care unit" has underscored the importance of the integration of cardiovascular medicine and critical care medicine, in order to best incorporate intensive care concepts tailored to the specific pathophysiology of the critically ill cardiac patients.

Thus, the current practice of critical care cardiology has evolved and adapted to meet these demands, including ongoing discussions about the need to better understand the optimal strategies for staffing, training, credentialing, networking and advancing academia in critical care cardiology. Moreover, as critical care cardiology sets itself apart as a distinct subspecialty, there has been a pivotal need to provide high quality data and evidence-based recommendations that are specific and tailored to the contemporary CICU. This has led to the development of the Critical Care Cardiology Trials Network (CCCTN), a collaborative research network coordinated by the TIMI Study Group, that includes key opinion leaders from the United States and Canada in critical care cardiology. The CCCTN's main objective is to design and execute observational studies and clinical trials that will help advance the care of critically ill cardiac patients.

The CCCTN has provided key evidence to understand the contemporary demographics and treatment patterns in level 1 CICUs, including specific characterization of the diagnosis, disease severity, resource utilization, demographics and other key data in the current practice of critical care cardiology. Similarly, it has allowed us to better understand the specifics of cardiogenic shock features, from clinical presentation to specific hemodynamics, as well as risk stratification, phenotyping, device utilization and outcome data. It has also provided key information regarding non-cardiac conditions complicating admissions to the CICU, including respiratory failure, renal dysfunction, end-of-life issues and others. To date, the CCCTN includes over 40,000 patients with key granular data following strict data collection criteria, making it the most important and largest database in critical care cardiology created to date. In summary, the CCCTN serves as a unique tool to enhance the evidence-based practice of critical care cardiology.

Cardiogenic Shock 2
Current Problems and Future Perspectives
›› Friday, Oct 13, 16:40-18:10, Grand 3

Arrhythmia

Debate: After EAST-AFNET4 Trial, Rhythm Control Therapy Should be Offered to Asymptomatic AF Patients

Pros

Minsoo Ahn, MD, PhD
Yonsei University Wonju College of Medicine, Korea

Atrial fibrillation (AF) is a significant contributor to cardiovascular (CV) mortality, strokes, and heart failure, even with optimal management. Surprisingly, about one-third of AF patients do not exhibit AF-related symptoms, which are predominantly seen in older populations and those with persistent forms of AF. Asymptomatic AF carries similar risks of stroke, CV death, and other CV events as symptomatic AF.

Contemporary AF guidelines advise anticoagulation and concurrent CV condition management for all AF patients, with rhythm control primarily reserved for symptomatic individuals. However, the EAST-AFNET 4 trial, conducted internationally with 2,789 patients diagnosed with recent AF, challenged this approach. Patients were randomized into two groups: early rhythm control or usual care. The study found that initiating rhythm control soon after AF diagnosis, regardless of symptoms (termed 'early' AF), lowered the risk of a composite primary endpoint (CV death, stroke, or hospitalization for heart failure or acute coronary syndrome) over five years compared to the standard care. The primary endpoint occurred at rates of 3.9 vs. 5.0 per 100 person-years in the early rhythm control vs. usual care groups, respectively, with an absolute difference of 1.1 per 100 person-years and a hazard ratio (HR) of 0.79. **Furthermore, the effectiveness of rhythm control therapy was similar in asymptomatic patients (EHRA score I) compared to symptomatic patients, irrespective of symptom severity.**

In summary, the EAST-AFNET 4 results highlight the benefits of adopting a systematic approach involving early anticoagulation, rate control, and upstream therapy for all AF patients, not just those with symptoms. This approach could underscore the importance of AF screening to initiate therapy promptly, potentially reducing adverse CV outcomes.

Cons

Dae In Lee, MD
Korea University College of Medicine, Korea

The EAST-AFNET 4 trial explored rhythm control versus heart rate control in high-risk AF patients diagnosed within a year compared to standard care and it yielded significant findings. Rhythm control reduced CV deaths, strokes, and serious adverse events (249 cases vs. 316 cases; HR 0.79) and CV deaths (67 cases vs. 94 cases; HR 0.72). Rhythm control also decreased ischemic strokes (40 cases vs. 62 cases; HR 0.65), with early treatment explaining 81% of stroke risk reduction.

However, the study's relevance to asymptomatic AF patients was questioned due to similar stroke and CV event risks. As a result, post-hoc analysis of the EAST-AFNET study compared asymptomatic and symptomatic patients. The primary outcome did not significantly differ between groups. **Among asymptomatic patients randomly assigned to early rhythm control, there was a lower risk of the primary composite outcome compared to those receiving standard care, but this difference did not reach statistical significance.**

Meanwhile, the probable limitations of post-hoc analysis of the EAST-AFNET study of a small sample size should be noted. Additionally, assessing symptoms can be challenging; asymptomatic patients sometimes report symptom improvement after rate control. Furthermore, symptom assessment in this subgroup analysis was restricted to capturing AF-related symptoms using the validated EHRA score.

In summary, the EAST-AFNET 4 study found rhythm control to be beneficial for high-risk AF patients, but its applicability to asymptomatic patients remains uncertain due to limitations, including a small sample size and challenges in symptom assessment. Further research is needed to clarify the treatment's efficacy in this subgroup.

Arrhythmia 1
Debate in AF Management
›› Friday, Oct 13, 10:40-12:10, Grand 1

Cross Specialty 3: Sports Cardiology

Prescribing Exercise in Patients with Cardiovascular Diseases

Sae Young Jae, PhD
University of Seoul, Korea

Sports cardiology focuses on the cardiovascular (CV) health in athletes and active individuals, including the effects of exercise and sports participation on the heart. Regular physical activity, including structured exercise, is crucial for managing cardiovascular disease (CVD) and reducing mortality. With an increase in sedentary behaviors, it is becoming essential to promote physical activity.

Exercise prescription for patients with CVD is a vital component of secondary prevention. Research shows exercise benefits for CVD patients which include: improved physical performance and CV function, reduced mortality, better managed stress and anxiety, and enhanced quality of life. Moderate physical activity is recommended for individuals with CVD, as very high activity levels may not provide additional benefits.

	Aerobic exercise	Resistance exercise
Frequency	3-5 days/week, optimally daily	2-3 days/week; balance training daily
Intensity	40-80% of VO2peak	Borg RPE <15 (40-60% of 1RM)
Duration	20-60 min	10-15 repetitions in at least 1 set of 8-10 different upper and lower body exercises
Mode	Continuous or interval	
Progression	A progressively increasing training regimen should be prescribed with regular follow-up controls (at least every 3-6 months) to adjust the duration and the level of the exercise to the reached level of tolerance	A progressively increasing training regimen should be prescribed with regular follow-up controls (at least every 3-6 months) to adjust the duration and the level of the exercise to the reached level of tolerance

1 RM = one repetition maximum; RPE = rating of perceived exertion; VO2peak = peak oxygen consumption

Table 1. Example of exercise prescription for patients with CVD (Eur Heart J 2021;42(1):17-96.)

Despite proven efficacy and cost-effectiveness, exercise-based cardiac rehabilitation is underutilized due to referral, uptake, and adherence challenges. When considering individualized exercise prescriptions, it is crucial to be based on clinical evaluation, risk assessment, and exercise testing. Prescriptions should include the type of exercise, intensity, duration, and frequency, aiming for CV benefits while minimizing risks (**Table 1**). Proper risk stratification and optimal therapy are essential for prescribing more vigorous activities for CVD patients.

Physical activity and exercise are vital therapeutic tools for managing CVDs. Physicians should integrate exercise promotion into routine consultations, emphasizing its significance for overall health and well-being.

Cross Specialty 3: Sports Cardiology
From Athletes to Exercise in Patients with CV Disease
›› Friday, Oct 13, 13:20-14:50, Grand 1

Echocardiography

Multimodal Imaging in 2023 and Future

Bernard Cosyns
University Hospital Brussels, Belgium

Over the past four decades, the evolution of cardiovascular imaging has showcased an impressive trajectory of advancements, catalyzing transformation in diagnostic quality, reproducibility, automation, accuracy, and patient-centric outcomes. The journey from the early 1980s to 2023 highlights the strides made in addressing key requirements for optimal cardiovascular imaging.

The 1980s marked the inception of non-invasive imaging, with echocardiography allowing visualization of the cardiac structures in real-time. Since then, improvements in resolution, interpretability, and reproducibility led to integrations of high-resolution modalities, reducing intervendor variability and yielding more reliable results.

In the 1990s, MRI and CT angiography emerged, exemplifying the quest for accuracy and modality combinations. These modalities granted precise anatomical and functional assessments, enhancing diagnostic confidence and guiding treatment decisions.

The 2000s witnessed the rise of automation, reducing the acquisition time while enhancing user-friendliness. Concurrently, nuclear imaging's progress bolstered quantification accuracy, while intravascular imaging minimized invasiveness.

The present era witnesses the integration of AI, ensuring better interpretability, risk stratification, and data transferability. The amalgamation of digital databases and risk assessment in imaging ushers in precision medicine, offering personalized treatment approaches.

The paramount concern of patient safety was addressed by radiation reduction, contrast agent management, and novel imaging strategies. This not only benefits patient well-being but also improves cost-effectiveness.

Collectively, the last 40 years have demonstrated remarkable strides in cardiovascular imaging, such as enhanced quality, automation, reliability, reduced harm, and patient benefit, shaping a more effective and patient-centered approach to cardiovascular care.

Echocardiography 2
Recent Advances of Echo & Imaging: Where Are We Going?
›› Friday, Oct 13, 13:20-14:50, Grand 3

Cardiometabolic Syndrome

New Anti-dyslipidemic Agents

Jin Wi, MD, PhD
Gachon University Gil Medical Center, Korea

There is an unmet clinical need to reduce residual cardiovascular risk attributable to apolipoprotein B-containing lipoproteins, particularly low-density lipoprotein, and remnant particles. Traditional small organic compound drugs target enzymes or receptors in the extracellular and/or intracellular space by affecting enzyme function or signaling, respectively. Biologics such as monoclonal antibodies also bind specific sites of receptors or proteins extracellularly and, by this, affect their function or neutralize them. Emerging and innovative technologies that operate upstream are arising. mRNA-targeting drugs cross the cell membrane and are released into the cytoplasm, eventually blocking the mRNA translation of the proteins specifically involved in lipid metabolism. Two major classes of mRNA-targeting agents have been developed: antisense oligonucleotides (ASO) and small interfering RNA (siRNAs). Early problems with their use have been overcome by conjugation with N-acetylgalactosamine (GalNAc), an adduct that targets their delivery to the primary site of action in the liver. **Inhibition of the translation of key regulatory proteins such as PCSK9, apolipoprotein CIII, apolipoprotein(a), and angiopoietin-like 3 has been shown to be effective in attenuating dyslipidemic states** (**Figure 1**). The advantages of these agents include long dosing intervals of up to 6 months and the potential to regulate the abundance of any disease-related protein. Long-term safety has yet to be demonstrated in large-scale clinical trials.

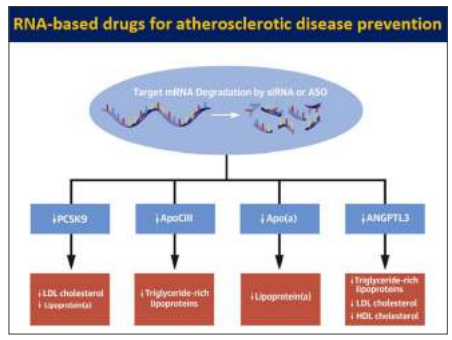


Figure 1. Reducing the abundance of the four shown proteins through degradation of their mRNA leads to changes in blood lipids/lipoproteins (JACC 2020;76:563-79.)

Cardiometabolic Syndrome 2
What is Going on in the Treatment of Cardiometabolic Syndrome?
›› Friday, Oct 13, 15:00-16:30, Grand 4

Cross Specialty 1: KSCPT-KSC Joint Session

Pharmacogenomics of Cardiovascular Drugs

조용순 교수
인제의대

심혈관 질환은 전 세계적으로 가장 큰 사망 원인이며 혈관 및 심장의 해부학적 및 기능적인 이상으로 아우러지는 복합적인 질환이다. 적절한 약물을 사용하면 이러한 복잡한 질환을 치료하거나 예방할 수 있지만 한 가지 약물만으로는 치료가 어려워서 여러 가지 약물을 투여하는 경우가 많다. 그러나 이로 인해 때때로 심각한 약물이상반응이 나타날 수 있다. 또한 권장되는 최고 용량의 약을 사용하더라도 환자마다 효과가 다를 수 있다. 기존 연구에 따르면 혈중 콜레스테롤 수치 및 혈압 정도와 같은 심혈관 위험 인자의 심각성과 유전자 사이의 상관관계가 있는 것으로 알려져 있다. 그리고 지난 40년 동안 수행된 연구들은 유전적 다양성과 심혈관 질환 치료의 효능 사이의 관계를 입증하였다. 약물 유전체학 분야는 개인의 유전체 다양성이 약물의 독성과 반응성에 어떤 영향을 미치는지 밝히는 것을 목표로 한다. **지난 10년 동안 심혈관 질환 치료에 사용되는 약물의 반응성에 영향을 미치는 약동학 및 약력학 관련 유전자와 유전적 변이에 대한 지식이 상당히 향상되었다.** 특히 clopidogrel의 CYP2C19, warfarin의 CYP2C9과 VKORC1, statin계 약물의 SLCO1B1 등은 임상 현장에서 약물 처방 시 약물 유전체가 고려되는 대표적인 약물과 해당 유전자의 예이다(**Figure 1**).

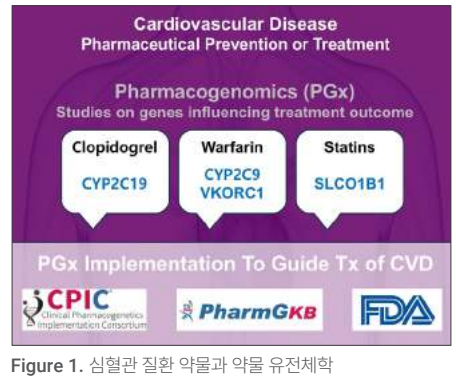


Figure 1. 심혈관 질환 약물과 약물 유전체학

그리고 약물 유전체학 분야는 관련 위험과 비용을 줄임으로써 약물 치료를 개선할 수 있는 잠재적 역량을 가지고 있다. 따라서 약물 유전학 연구에 종사하는 중개 연구자뿐 아니라 심혈관 질환을 다루는 임상 연구자 모두에게 심혈관 약물 유전체학 및 약물 유전학의 최근 발전 사항에 대한 지식을 업데이트할 필요성이 요구된다.

Cross Specialty 1: KSCPT-KSC Joint Session
Optimal, Individual Cardiovascular Pharmacotherapy
›› Friday, Oct 13, 09:00-10:30, Walker 1

Arrhythmia

What is the Best Strategy for Redo PAF Ablation When All PVs Isolated?

Hyoung-Seob Park, MD, PhD
Keimyung University School of Medicine, Korea

Atrial fibrillation (AF) is the most common arrhythmia encountered in clinical practice and is associated with an increased incidence of mortality, hospitalizations, and heart failure. Pulmonary vein isolation (PVI) is the cornerstone of AF ablation strategies for patients with symptomatic paroxysmal or persistent AF. Recurrences of AF after an initial ablation are mainly due to pulmonary vein (PV) reconnection. However, according to recent studies, the absence of PV reconnection (durable PVI) is observed in up to 60% of patients undergoing redo ablation of AF. The findings of these studies demonstrate that durable PVI is not always required to maintain sinus rhythm in some patients. There are several possible explanations. First, arrhythmogenic PV(s) has been isolated, and the reconnected PVs were bystanders in patients without clinical recurrences despite PV reconnections. Second, AF drivers and substrates around the PV antrum have been ablated during electrical PVI. Third, antral PVI incidentally ablated ganglionated plexi, which have been implicated in the initiation and maintenance of AF.

When conducting redo procedures for paroxysmal AF, the initial step is to assess for PV reconnection and reisolate the veins, if necessary. Repeat PVI provides effective treatment for many instances of recurrent AF in patients in whom an initial PVI procedure has failed. In patients in whom no PV reconnection is observed, there is a consensus that a number of non-PV-based strategies should be considered, including searching for the non-PV triggers, delivery of one or more linear lesions, isolation of the coronary sinus (CS), isolation of the left atrial appendage (LAA), ablation of autonomic ganglia, complex fractionated atrial electrograms (CFAE) ablation, and rotational activity ablation. A recent report suggested that the best outcomes following ablation of the non-PV triggers are achieved in patients with a well-defined provocable target.

Arrhythmia 2
Current Challenges and Unmet Needs in AF Ablation
›› Friday, Oct 13, 15:00-16:30, Grand 1

Vein of Marshall Ethanol Infusion

Mélèze Hocini, MD, PhD
University of Bordeaux, France

Beyond PVI, the two main additional strategies are Cox-Maze procedure or targeting of electrical signatures (focal bursts, rotational activities, meandering wavelets), which remain controversial.

Firstly, high-density mapping of these arrhythmias has demonstrated that a patchy lesion set is highly arrhythmogenic, favoring macro-re-entry through conduction slowing and providing pivots for localized re-entry. Secondly, discrete anatomical structures such as the Vein or Ligament of Marshall (VOM/LOM) and the CS have epicardial muscular bundles that are more frequently involved in re-entry than previously thought. The Marshall bundle can be ablated at any point along its course from the mid-to-distal CS sinus to the LAA. If necessary, the VOM may be directly ablated using ethanol infusion to eliminate PV contributions and produce conduction block across the mistral isthmus. **Ethanol ablation of the VOM, supplemented with radiofrequency (RF) ablation may be more effective than repeat RF ablation alone.**

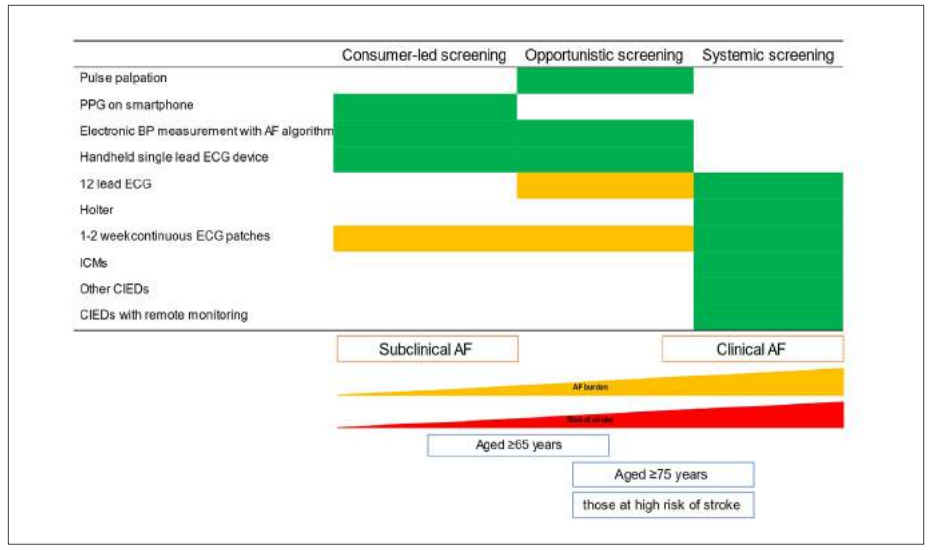


Figure 1. Screening tests for AF

Screening for Atrial Fibrillation: When, How, and Whom?

Il-young Oh, MD, PhD
Seoul National University College of Medicine, Korea

AF is the most common persistent cardiac arrhythmia. AF occurs in 1 in 4 middle-aged adults in Europe and the United States, with a prevalence of about 3% in the population over 20 years of age. In addition, the prevalence is high in patients with old age, hypertension, heart failure, coronary artery disease, valve disease, obesity, diabetes, or chronic kidney disease.

AF is a major risk factor for ischemic stroke and is associated with a significant increase in stroke risk. **To note, many episodes of AF are asymptomatic. In at least 25% of AF-associated strokes, the first sign of AF is stroke, which underlies the principle of screening for unknown AF to prevent stroke.** As shown in **Figure 1**, screening tests for AF have been conducted for a long period through opportunistic screening and systemic screening performed by healthcare professionals. Recently, with the development of various devices, consumer-led screening is also being carried out.

This lecture summarizes the existing evidence and knowledge gaps on AF screening. It is intended to support decision-making in real-world practice by providing when, how, and for whom AF screening is most appropriate.

Arrhythmia 3
Recent Advances and Future Perspectives in AF Management
›› Friday, Oct 13, 16:40-18:10, Grand 1

The Old and Cardiology

Pharmacological Characteristics of Very Old People

Jae-Yong Chung, MD, PhD
Seoul National University College of Medicine, Korea

Aging changes our body composition and the function of major organs involved in drug metabolism and excretion, such as the liver and kidneys, may become less effective, resulting in shifts in pharmacokinetics and pharmacodynamics. Consequently, the efficacy and safety of medications can differ in older adults.

Clinical trials are the gold standard for researching how medications interact with the body, especially in older adults. However, older adults are often excluded from such trials due to their vulnerability and ethical considerations, although they are a major population on prescription drugs.

The 2021 FDA white paper promoted the use of physiologically based pharmacokinetic (PBPK) models to study how age-related changes affect drug characteristics in older adults. A PBPK model can predict how drugs act in older adults by integrating factors like drug-specific properties, physiological characteristics, and clinical data (**Figure 1**). Applying the PBPK model enhances our understanding and prediction of drug behavior in older adults. As older adults often experience diverse diseases and polypharma-

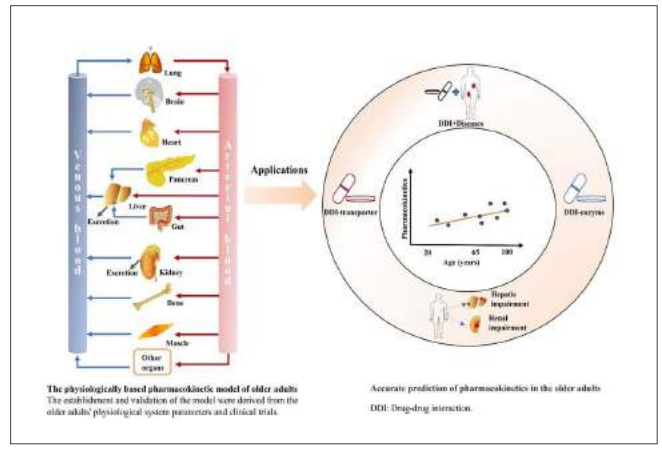


Figure 1. Integration of age-related physiological changes into the PBPK model and its implications for pharmacokinetic predictions in the older adults (Curr Drug Metab 2023;24(3):211-22).

Continued on page 9

Myocardial Infarction

Premature AMI in the Young

이장훈 교수
경북의대

세계적인 고령화 추세에 따라 급성심근경색증(acute myocardial infarction, AMI) 환자의 평균 연령이 65세 이상으로 증가하는 동안 조기 AMI (premature AMI)의 발생률은 감소하지 않았다. 이는 고령화 시대에도 불구하고 조기 AMI 환자가 계속 증가하고 있음을 의미한다. 조기 관상동맥질환(premature coronary artery disease [CAD])은 허혈성 심질환의 발생과 재발 및 사망률을 높이며 의료비용을 증가시키기 때문에 보건학적으로 중요하다. 이에 CAD의 예후 개선을 위해 조기 AMI의 임상적 특징, 치료 및 예후를 알아보고자 한다.

조기 CAD에 대한 보편적인 정의는 없지만 주로 45세의 연령을 기준으로 하며 조기 AMI의 빈도는 45세 이하에서 4-10%로 보고되고 있다. 조기 AMI는 고령 환자에 비해 병변 부위가 광범위하지 않으며 단일 혈관 질환 유병률이 더 높다. 좌 주간부의 침범은 드물지만 예후는 좋지 않다. 폐쇄성 CAD가 있는 조기 AMI 환자는 흡연, 지질 장애, 조기 CAD 가족력이 높고 당뇨병과 고혈압의 유병률이 낮다는 점을 제외하면 고령 환자와 비슷한 위험 인자를 가진다. 한국인 급성심근경색증 등록연구자료에서 연령에 따른 위험 인자의 분포(Figure 1A)와 AMI의 발생 기여도(Figure 1B) 및 주요 심뇌혈관사건 발생의 기여도(Figure 1C)는 **Figure 1**에서 확인할 수 있다.

조기 AMI 환자 8명 중 1명은 비폐쇄성 관상동맥을 동반한 심근경색증(myocardial infarction with normal coronary artery, MINOCA)의 형태로 나타난다. 광간섭단층촬영과 심장 자기공명영상은 MINOCA 치료에 도움이 될 수 있다. 흡연, 저밀도 지단백 콜레스테롤 증가, 지단백(a) 상승, 코카인 사용은 조기 AMI의 가장 중요한 위험 인자이다. 사망률 감소에 금연이 매우 중요하며 치료는 적극적인 위험 인자의 관리와 혈관 재생술이 기본이다.

조기 AMI는 퇴원 후 1년 이내에 30.4%의 환자가 재입원하며 여성의 예후가 불량한 것으로 알려져 있다. AMI 한국인 등록 연구에서 3년 추적 시 여성, Killip class >2, 당뇨 등이 불량한 예후를 예측하는 독립적인 인자였다.

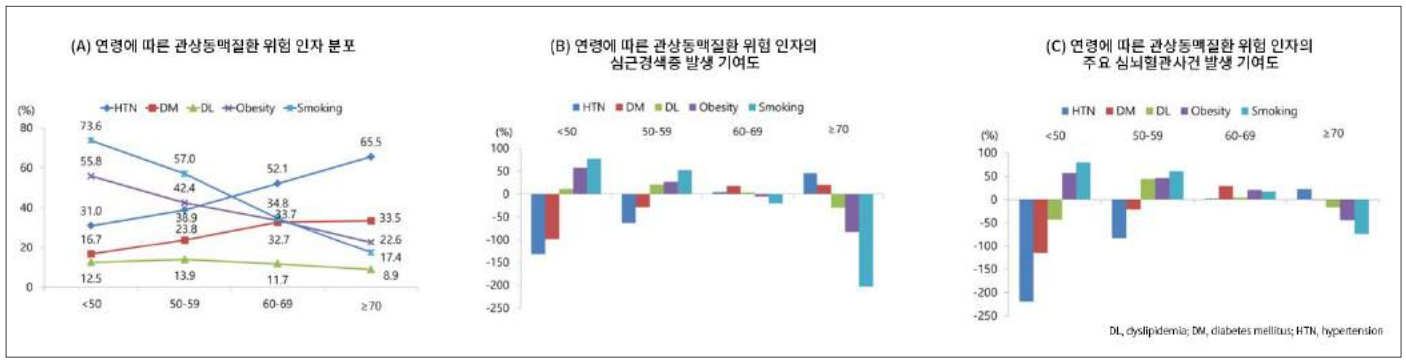
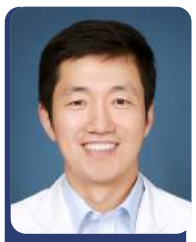


Figure 1. 관상동맥질환의 위험 인자(Korea Acute Myocardial Infarction Registry-National Institutes of Health, KAMIR-NIH)

AMI with Anemia or Thrombocytopenia



Young Jin Youn MD, PhD
Yonsei University Wonju College of Medicine, Korea

Anemia and thrombocytopenia are frequently observed in AMI patients. They are associated with increased mortality, recurrent MI, major bleeding, and thrombotic events. Hence, AMI treatment with potent P2Y12 inhibitors, heparin, glycoprotein IIb/IIIa inhibitors (GPIs), and thrombolytics require evaluation for causes of anemia or thrombocytopenia, notably occult bleeds. However, because most patients with severe anemia or thrombocytopenia are excluded from clinical trials, guidelines are limited in these patients.

Some patients present with type 2 AMI due to severe anemia, and thus, assessment of the cause of anemia is important. Bleeding warrants meticulous consideration for coronary angiography, access site, percutaneous coronary intervention (PCI) necessity, and antithrombotics or treatment choice (balloon angioplasty, bare-metal stent [BMS] or drug-eluting stent [DES]) to decrease blood loss. Opting for radial access, shorter half-life or reversible agents, and proven safety profile devices on short-term dual antiplatelet therapy (DAPT) minimizes bleeding risk. Meanwhile, **blood transfusions are associated with poor clinical outcomes, potentially due to reactive platelets causing excess ischemic events.** European guidelines suggest anemia-related blood transfusion for compromised hemodynamics, where the hematocrit level is <25% or hemoglobin level is <8 g/dL without active bleeding.

Clinically significant thrombocytopenia is defined as platelet count ≤100,000/uL or a 50% drop from baseline. PCI-linked thrombocytopenia may be related to GPIs or heparin. About 10% of cancer patients have thrombocytopenia, prompting the recently published cardio-oncology guidance from the Society for Cardiovascular Angiography and Interventions (SCAI). There is no specific platelet threshold bars for coronary angiography; >40,000/uL suffices for PCI. Meanwhile, prophylactic platelet transfusion is recommended at <20,000/uL, and reduced heparin (30–50 U/kg) is recommended when platelet is <50,000/uL. Aspirin may be used when platelet levels are >10,000/uL, while DAPT involving clopidogrel is permissible at >30,000/uL. Prasugrel or ticagrelor and GPIs should not be used in patients with platelet counts <50,000/uL. Duration of DAPT may be restricted to 2 weeks following balloon angioplasty alone, 4 weeks after BMS, and 6 months after DES after confirming optimal stent expansion if platelet counts are <50,000/uL.

Myocardial Infarction 1
AMI in the Special Populations
›› Friday, Oct 13, 15:00-16:30, Walker 2

Continued from page 8

cy, PBPK models are evolving to incorporate multiple factors and illnesses. The ongoing enhancement of PBPK models aligns with growing physiological insights and clinical data. **This progression positions PBPK models as potential tools for predicting various cardiovascular drug-related issues in older adults.**

기획세션 2: The Old & Cardiology
The Old and Cardiology: Compass to Move Forward
›› Friday, Oct 13, 10:40-12:10, Walker 1

Intervention

RENOVATE-COMPLEX-PCI and Imaging Trials

Joo-Yong Hahn MD, PhD
Sungkyunkwan University School of Medicine, Korea

As data are limited regarding the prognostic value of intravascular imaging-guided percutaneous coronary intervention (PCI) in various types of complex coronary artery lesions, the randomized controlled trial of Intravascular Imaging Guidance versus Angiography-Guidance on Clinical Outcomes After Complex Percutaneous Coronary Intervention (RENOVATE-COMPLEX-PCI) sought to demonstrate the superiority of intravascular imaging-guided PCI compared with angiography-guided PCI in patients with complex coronary artery lesions. In this multicenter trial, patients with complex coronary artery lesions were randomly assigned to undergo either intravascular imaging-guided PCI or angiography-guided PCI with a 2:1 ratio. In the intravascular imaging group, the choice between intravascular ultrasound and optical coherence tomography (OCT) was left to the operators' discretion. The primary endpoint was a composite of cardiac death, target vessel-related myocardial infarction (MI) or clinically-driven target vessel revascularization (TVR). A total of 1,639 patients underwent randomization. At a median follow-up of 2.1 years (interquartile range 1.4 to 3.0 years), the primary endpoint occurred in 76 of 1,092 patients in the intravascular imaging group and 60 of 547 patients in the angiography group (7.7% vs. 12.3%; HR, 0.64; 95% CI, 0.45 to 0.89; *p*=0.008). The occurrence of events in the intravascular imaging group and the angiography group were as follows: cardiac death in 16 (1.7%) and 17 (3.8%) patients, target vessel-related MI in 38 (3.7%) and 30 (5.6%) patients, and clinically-driven TVR in 32 (3.4%) and 25 (5.5%) patients, respectively. **In patients with complex coronary artery lesions, intravascular imaging-guided PCI was superior to angiography-guided PCI in reducing the risk of the TVR (Figure 1).**

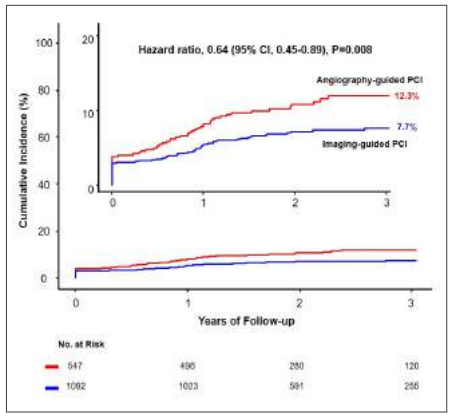
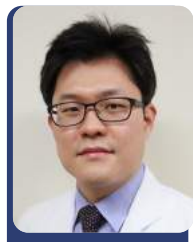


Figure 1. RENOVATE-COMPLEX-PCI: Cumulative incidences of target vessel failure (N Engl J Med 2023;388:1668-79.)

Other important trials to note are the ILUMIEN IV and OCTIVUS trials. The ILUMIEN IV study is a prospective, single-blind clinical investigation that randomized between 2,490 and 3,656 patients using an adaptive design to OCT-guided versus angiography-guided coronary stent implantation in a 1:1 ratio. The primary endpoints were: (1) post-PCI minimal stent area assessed by OCT in each randomized arm, and (2) target vessel failure, the composite of cardiac death, target vessel MI or ischemia-driven TVR. The OCTIVUS study is a prospective, multicenter, open-label, parallel-arm, randomized trial that compared the effectiveness of two imaging-guided strategies in patients with stable angina or acute coronary syndromes undergoing PCI in Korea. A total of 2,000 patients were randomly assigned in a 1:1 ratio to either an OCT-guided PCI strategy or an intravascular ultrasound (IVUS)-guided PCI strategy. PCI optimization criteria were predefined using a common algorithm for online OCT or IVUS. The primary endpoint, which was tested for both noninferiority (margin, 3.1 percentage points for the risk difference) and superiority, was target-vessel failure (cardiac death, target-vessel MI or ischemia-driven TVR) at 1 year. The results of the ILUMIEN IV and OCTIVUS studies were presented at ESC Congress 2023.

HOST-IDEA and Antiplatelet Agent Trials



한정규 교수
서울의대

현재의 가이드라인은 약물 용출형 스텐트(drug-eluting stent, DES) 삽입 후 안정형 허혈성 심질환에서 6개월, 급성 관동맥증후군(acute coronary syndrome, ACS)에서 12개월 이중항혈소판요법(dual antiplatelet therapy, DAPT)을 권고한다. 하지만 초박형 스텐트 지주(ultrathin stent strut)와 진보된 중합체 기술이 적용된 3세대 DES 시대에는 6개월 미만의 초단기 DAPT를 적용할 만하다. HOST-IDEA 연구는 Orsiro나 Coroflex ISAR를 삽입한 환자를 3-6개월 혹은 12개월 DAPT군으로 무작위배정하여 초단기 DAPT를 평가하였다. 이는 3세대 DES 삽입 후 DAPT의 적절한 기간을 평가하는 최초의 대규모 임상시험이다. 연구 대상자는 ST분절상승 심근경색증 환자를 제외한 환자군으로 총 2,013명이 무작위배정되었으며 이 중 45%는 안정형 허혈성 심질환, 55%는 ACS 환자였다. 연구 결과 일차 종말점인 순유해임상사건(net adverse clinical events, NACE) 발생에 있어 3-6개월 DAPT는 12개월 DAPT와 비교해 1년 시점에 비열등하였고 (3.7% vs. 4.1%, *p* for non-inferiority <0.001) (**Figure 2**), 목표병변실패(2.4% vs. 2.5%)와 주요 출혈의 발생률(1.5% vs. 1.9%)은 양 군간에 유의한 차이가 없었다. 일차 종말점에 대한 3-6개월 대 12개월 DAPT의 영향은 65세 초과 여부, 스텐트 길이 ≥40 mm 여부, 다혈관 질환 여부, 시술 당시 진단명 등 하위 군을 가리지 않고 일관되게 관찰되었다.

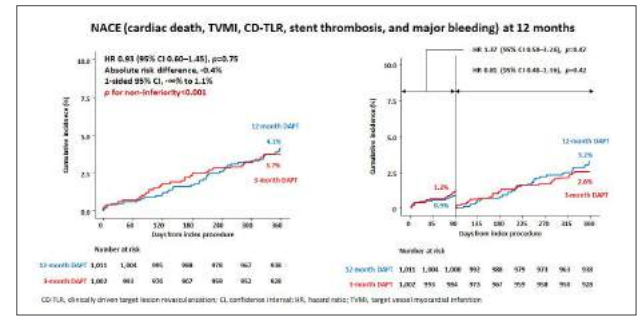


Figure 2. 일차 종말점인 순유해임상사건(NACE)의 결과(Circulation 2023;147:1358–68.)

ACS에서 2세대 DES로 수행된 SMART-DATE 연구에서 6개월간 DAPT 후 aspirin 단독 투약은 12개월 DAPT와 비교해 일차 종말점에서 비열등하였지만, 심근경색의 증가된 위험과 연관되었다. 반면 역시 대부분 2세대 DES로 수행된 SMART-CHOICE 연구에서 절반 이상의 환자가 ACS 환자였지만 3개월간 DAPT 후 P2Y12 억제제 단독 투약은 12개월 DAPT과 비교해 일차 종말점 뿐만 아니라 심근경색 발생의 위험에서도 차이가 없었다. HOST-EXAM 연구에서 만성 유지요법으로 clopidogrel이 aspirin보다 혈전성 및 출혈성 사건의 발생에서 우월하였음을 감안하면, SMART-DATE와 SMART-CHOICE에서 심근경색의 발생 위험이 달랐던 것은 단독 항혈소판제제로서 각각 aspirin과 P2Y12 억제제를 사용했기 때문일 수 있다. 흥미롭게도 HOST-IDEA 연구에서 DAPT 종료 후 단독 항혈소판제제로 aspirin을 더 많이 사용했음에도(aspirin 64%, P2Y12 억제제 36%) 단기 항혈소판요법군에서 심근경색의 증가된 위험이 관찰되지 않았다. 이것은 3세대 DES의 향상된 안전성과 관련되었을 수 있다.

2세대 DES에서 수행된 몇몇 연구들은 1개월 DAPT의 효과와 안전성을 평가하였는데, 그 결과는 일관되지 않으며 관상동맥중재술 후 1개월 요법을 일반화하기에는 근거가 부족하다. DES 삽입 후 혈관의 회복에 3개월이 걸린다는 광간섭단층영상(OCT) 관찰연구나 대부분의 DES에서 약물 용출에 3-6개월이 소요된다는 점을 감안하면 1개월 요법은 출혈 위험이 높은 일부 환자군에서 고려할만하겠으나, 일반적인 관상동맥중재술 환자에서 기본적으로 제시되는 DAPT의 기간은 3개월이 적절할 것이다.

결론적으로 **HOST-IDEA 연구는 3세대 DES로 관상동맥중재술을 받은 환자에서 DAPT의 기간을 단축하여 의료비용을 절감하고 출혈 위험을 가능한 회피하면서도 기존의 일반화된 12개월 요법에 준하는 임상 결과를 얻을 수 있음을 증명하였다.**

Intervention 1
2022-2023 Hot Trials in CV Intervention
›› Friday, Oct 13, 09:00-10:30, Walker 2

Continued on page 11

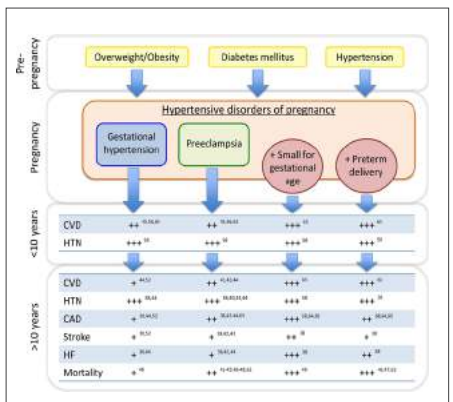
Women Heart Disease

Hypertensive Disease in Pregnancy

조인정 교수
이화의대

국내 고령 임신의 증가와 더불어 임신 중 고혈압성 질환도 가파른 증가를 보이고 있다. 2021 고혈압 팩트 시트에서 임신 중 고혈압성 질환은 국내 전체 출산 여성의 9%에서 발생하며 만성 고혈압은 5.4%, 임신 유발 고혈압은 3.1%, 전자간/자간은 1.8% 순으로 보고되었다.

임신 중 고혈압성 질환의 위험 요소는 비만, 당뇨, 고혈압 등이 있으며 임신 중 고혈압성 질환이 발생할 경우 단기적으로는 산모와 태아의 임신 합병증의 위험성이 커지고 장기적으로는 산모의 심뇌혈관 질환의 위험도가 증가하는 것으로 알려져 있다(Figure 1). 임신 유발 고혈압은 태반의 혈류 장애와 산모의 위험 요소의 상호작용이 원인이 되며 이때 발생한 산화 스트레스가 산모의 혈관 내피세포 기능장애를 초래하여 혈관 수축, 모세혈관의 누출에 의한 전신부종, 단백뇨, 혈액 농축, 범발성 혈관 내 응고 장애 등을 일으키는 것으로 생각되고 있다. 최근에는 임신 중 고혈압성 질환이 단일 질환이 아닌 서로 다른 원인에 의해 발생하는 여러 질환들이 임신 중 고혈압성 질환이라는 결과로 나타나는 것이라는 견해도 있다. 임신 중 고혈압성 질환의 치료에서 혈압의 관리는 산모와 태아의 예후 개선을 위한 주요 치료법으로 제시되고 있다. Chronic Hypertension and Pregnancy 연구에서 만성 고혈압 산모의 임신 중 목표 혈압을 140/90 mmHg 미만으로 해서 치료한 경우 기존 치료보다 개선된 예후를 보였고 이러한 결과에 따라 2022년 미국 산부인과학회는 만성 고혈압 환자의 임신 중 약물 치료 시작 혈압을 기존 160/110 mmHg에서 140/90 mmHg로 낮추었다. 우리나라 진료 지침은 아직 변화는 없으나 이러한 최신 변화 트렌드를 고려하여 임신 중 고혈압성 질환의 혈압 관리에 적용해야 하겠다.



+Mildly increased risk (hazard ratio <2 in most studies); ++Moderately increased risk (hazard ratio >2 in most studies); +++Markedly increased risk (hazard ratio >3 in most studies)

Figure 1. 임신 중 고혈압성 질환의 위험 요소(J Am Heart Assoc 2018;7(17): e009382)

Women Heart Disease 1
Cardio-Obstetrics
›› Friday, Oct 13, 09:00-10:30, Grand 5

Inflammation and Vascular Aging

Hack-Lyoung Kim, MD, PhD
Seoul National University College of Medicine, Korea

Inflammation and vascular aging are key processes contributing to cardiovascular diseases (CVD). Accumulating evidence suggests significant sex-based differences in these processes.

The sex hormone estrogen, found predominantly in women, is known to have anti-inflammatory effects. Postmenopausal women, with declining estrogen levels in the blood, demonstrate increased systemic inflammation compared to premenopausal women. This suggests a protective role of estrogen against systemic inflammation. In contrast, men tend to exhibit higher levels of pro-inflammatory molecules like C-reactive protein and interleukin-6. Moreover, testosterone, the predominant sex hormone in men, has both pro-inflammatory and anti-inflammatory effects depending on the context, adding complexity to the male inflammatory response.

Vascular aging, which is characterized by changes in the blood vessel structure and function, also shows sex-specific patterns. Women prior to menopause have a lower risk of atherosclerosis compared to men of the same age. This is likely due to the protective effects of estrogen, which promotes the release of nitric oxide and discourages the formation of plaque in the blood vessels. However, the incidence of CVD in women rapidly increases after menopause. This could be linked to the post-menopause decline in estrogen, resulting in an increased pro-inflammatory state and greater endothelial dysfunction. **For similar reasons, the increase in arterial stiffness is more prominent in older women than in men, which makes them more likely to develop left ventricular hypertrophy, diastolic dysfunction, and heart failure with preserved ejection fraction.** Men, on the other hand, experience a more constant risk of vascular aging across their lifespan, possibly due to the relatively stable levels of testosterone.

It's essential to note that these differences are influenced by not only sex hormones, but also by lifestyle factors such as diet, exercise, and stress, which can all impact inflammation and vascular aging. Understanding these sex-specific disparities could lead to more personalized approaches in preventing and treating age-related diseases.

Women Heart Disease 2
Emerging Topics Related to Sex Differences in CVD
›› Friday, Oct 13, 10:40-12:10, Grand 5

Continued from page 10

Angiogram-derived FFR and IMR

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Hospital Clinico San Carlos, Spain

Intracoronary physiology has demonstrated its clinical value in guiding coronary revascularization and assessing non-obstructive causes of myocardial ischemia. Fractional flow reserve (FFR) and the more recently developed non-hyperemic pressure ratios like the instantaneous wave-free ratio are recommended with the highest level of evidence by the European guidelines to guide coronary revascularization in patients with intermediate stable coronary stenosis. Furthermore, in patients with non-obstructive coronary stenosis and clinically suspected myocardial ischemia, it is also recommended to perform a wire-based assessment of the coronary microcirculation, since an appropriate treatment of coronary microcirculatory dysfunction may improve patients' quality of life and prognosis. However, given the requirement of dedicated coronary physiology wires, hyperemic drugs, additional procedure time and patient discomfort, the real adoption of these recommendations in the catheterization laboratory remains low.

Recently, several angiogram-based techniques have been developed to assess the functional relevance of coronary stenosis without the need of physiology wires nor hyperemic drugs. Based on 3D reconstruction of the coronary vessels and computational fluid dynamics or advanced mathematical algorithms, novel techniques like quantitative flow ratio (QFR) allow estimation of FFR. Besides its well-demonstrated high accuracy in predicting FFR, QFR has shown to be superior to angiography in terms of 1-year clinical outcomes when used to guide PCI.

In the case of the coronary microcirculatory compartment, angiogram-based techniques have also shown its value in assessing the coronary microcirculatory resistance (i.e., IMR [index of microcirculatory resistance]). Several mathematical formulas applied to angiogram-based techniques have recently shown the feasibility and accuracy of these methods to estimate IMR without the need of physiology wires. Although the evidence is still scarce, angiogram-derived IMR appears to be a promising method that may help in improving the adoption of coronary microcirculatory assessment.

Intervention 2
Up-to-date Coronary Imaging and Physiology
›› Friday, Oct 13, 10:40-12:10, Walker 2

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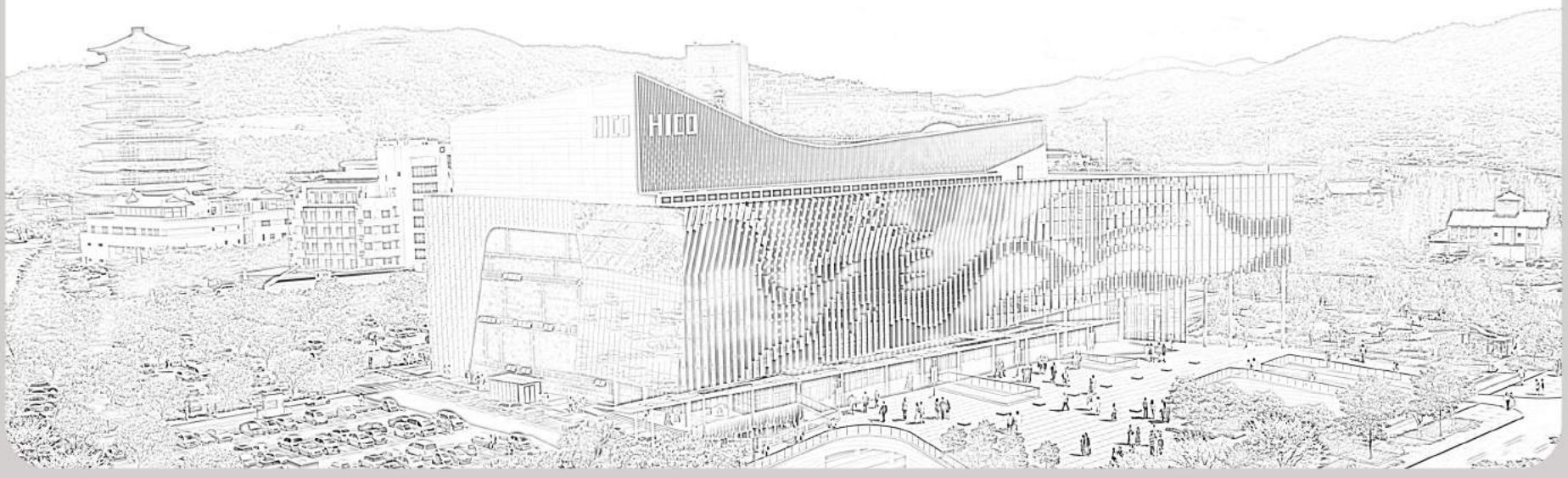

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