

# KSC 2022 DAILY

## Today's Highlights

### 기획세션 6: Cardiology 2030

10년 후 우리 분야는 어떻게 될지(New Drug, Device, Future Perspective)  
08:30-10:00 / Rm.324

### 기획세션 7: Hot Trials

2021-2022 주요학회 LBCT  
10:10-11:40 / Rm.325AB

### 기획세션 8: 국내 심혈관 정책

흡연과 심혈관질환 국가가 나서야 한다  
12:50-14:20 / Rm.325AB

### Basic Research Hot Session 1, 2

12:50-16:00 / Rm.323

### JCS-KSC Joint Session: Arrhythmia

Low Dose NOACs in Asian (Insight from J-ROCKET & ELDERCARE-AF)  
14:30-16:00 / Rm.322

### Cross Specialty 5: Intervention & TS

Optimal Management in Structural Heart Disease: MV & TV  
16:10-17:40 / Rm.325CD

### Cross Specialty 6: Endocrinology & Cardiology

Diabetes and SGLT2i: What Endocrinologists and Cardiologists Need to Communicate!  
16:10-17:40 / Rm.324

### TSOC-KSC Joint Session: Intervention

Contemporary Approach to Complex Coronary Lesions  
16:10-17:40 / Rm.323

## Cardiology 2030

### 10년 후 우리 분야는 어떻게 될지(New Drug, Device, Future Perspective)

#### Future of Heart Failure



전은석 교수  
성균관대의대 삼성서울병원

1997년 Braunwald 교수는 20세기 순환기학 분야의 발전을 요약하며 다가올 21세기에 가장 중요한 순환기학 분야를 심부전과 심방 세동으로 예측하였다. 20세기 초반부터 가장 많은 사망원인은 심혈관계질환이었다. 고혈

압 치료가 가능하기 시작하였던 1950년대 이후 심혈관 사망은 감소하기 시작하였고, 허혈성 심질환에 대한 집중 치료와 관동맥성형술로 심근경색 등의 초기 사망률을 현저히 개선되었다. 1980년 이후 지질강하제, 분자생물학의 발전과 유전학 분석 기술은 심혈관질환의 병인 기전 분석과 치료제 개발을 가능하게 하였지만, 인구 노령화에 따른 순환기질환의 변화로 심부전과 심방 세동의 정복이 중요한 과제를 역설하였다. 1992년 Braunwald와 Zhou 교수는 순환기질환의 종착역으로 심부전의 중요성을 cardiovascular continuum 개념을 도입하여 제시하였는데, 이는 이후 심부전 치료지침을 정하는 기본 개념이 되어 왔다. 30여 년이 지난 현재 심

부전 약물치료는 신경호르몬설에 의거한 만성 심부전 치료약제의 대규모 임상 연구를 기반으로 비약적으로 발전하여 4 pillar 개념으로 확립되고 있다. 2000년 이후 유럽과 미국순환기학회 치료 지침을 보급/확산시켜, 새로운 치료 약제 및 체세동기, 재동기화 치료 등의 기술과 더불어 심부전 환자의 생존율이 획기적으로 개선되었다. 그러나, 만성심부전 치료의 비약적인 발전에도 불구하고 아직 급성심부전 치료는 전 세계적으로 경험을 근거로 한 치료 방침만 존재하고, 대규모 임상연구에 의한 정확한 치료지침이 없는 실정이다. 최근 전 세계적으로 급성 심근경색의 효과적인 치료 후 진행되는 중증 심부전 환자가 급격히 증가하고 있는데, 우리나라에서도 좌심실 보조 장치 도입 후 destination therapy 또는 심장이식까지의 대기를 위한 가교 치료까지도 가능하게 되었다. 심부전 진단에 결정적인 도움을 주는 natriuretic peptide는 2000년 이후 임상적으로 사용되어 왔고, 진

단뿐 아니라 예후 예측 또는 치료 효과 판정에도 효과적으로 사용되는 biomarker이다. 현재 연구되고 있는 새로운 biomarker로는 sST2, GDF-15, beta-amyloid, fibrosis marker 등의 연구는 계속 진행되어야 할 것으로 판단된다. 특히 심부전 환자의 재입원 및 악화를 예측할 수 있는 인공 지능 연구, wearable device를 포함한 monitoring device 등도 향후 심부전 연구에 중요한 부분이다.

2021년 미국과 유럽순환기학회는 심부전을 좌심실 박출물로 박출률감소심부전, 박출률경도감소심부전, 박출률보존심부전으로 분류하는데 동의하였고, 기존 박출률감소심부전과는 전혀 다른 병태생리학적 기전을 제시하고, 기존 SGLT2i 등의 약물 치료와 심방사이의 shunt 치료 등의 효과가

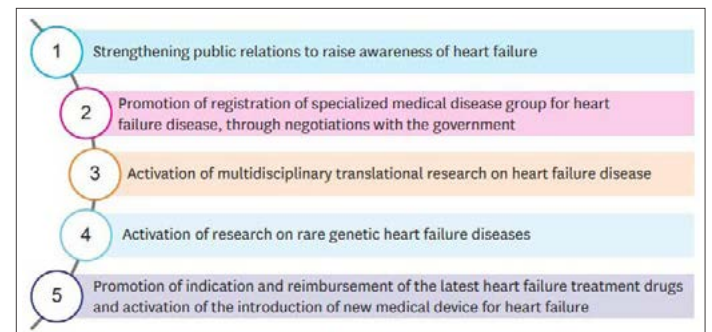


Figure 1. 대한심부전학회 주요 과제 5가지



증명되고 있다. 특히 우리나라는 향후 10여 년간 세계에서 가장 빨리 초고령 사회를 진입하게 되어 어느 나라 보다는 심부전 환자가 급격히 증가할 것으로 예상되는 바 심부전학회, 심장학회 및 노인학회 등 관련 학회와 한 목소리로 이런 변화에 부응하는 의료체계를 준비하기 위해 보건 당국과 논의해야 할 심부전 학회의 대책(Int J Heart Fail 2022;4:136)을 위의 Figure 1과 같이 소개한다.

Continued on page 3

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## Program at a glance: Day 2, Sep 24, 2022

Time	Rm. 325AB	Rm. 325CD	Rm. 324	Rm. 323	Rm. 322	Rm. 321	Rm. 320	Rm. 306A	Rm. 306B	Rm. 315	Grand Ballroom		
											Zone A	Zone B	Zone C
08:30-10:00	Arrhythmia 4 CIED (Debate Session)	Myocardial Infarction 3 Challenging Scenarios in AMI	기획세션 6: Cardiology 2030 10년후 우리 분야는 어떻게 될지 (New Drug, Device, Future Perspective)	Echocardiography 3 Echocardiography for Special Populations	Pediatric Cardiology 1 Cardiac Implantable Electronic Devices (CIED) in Children	Cardiogenic Shock 1 Learn from Mortality Case in Patients with Cardiogenic Shock	Lipid 1 Under-studied Factors for ASCVD	CAD 4 97-104	Heart Failure 2 105-112	Echocardiography 1 113-120	E-Poster 1-50 (08:30-11:40)		
10:10-11:40	기획세션 7: Hot Trials 2021-2022 주요학회 LBCT	Intervention 3 Hot Debate on TAVR 2022	Arrhythmia 5 Current Management of Atrial Fibrillation	Echocardiography 4 Valvular Heart Disease, Look Beyond the Valve	Pediatric Cardiology 2 SCD in Pediatric Population	Cardiogenic Shock 2 End Stage Heart Failure & Cardiogenic Shock - Bridging and Destination Therapy	Lipid 2 Personalize or Aggressive Lipid Lowering for Net Benefit?	CAD 5 121-128	Heart Failure 3 129-136	Hypertension 137-144			
11:50-12:30	Scientific Session [Amgen] Guideline-based Strategy in LDL-C Management with Evolocumab in Very High-risk Patients	Scientific Session [Boryung] Therapeutic Strategies in Cardiovascular Risk	Diamond Session [BMS/Pfizer] Challenging Clinical Scenarios in Anticoagulation for Atrial Fibrillation	Scientific Session [Novartis] ARNI - The Essential Standard of Care for Heart Failure	Scientific Session [Celltrion Pharm/ Dong-A ST] Benefits of Intensive & Consistent BP Control for Reducing CVD Risk						Mini Oral 4 (Heart Failure) 16-20	Mini Oral 5 (CAD) 21-25	Mini Oral 6 (Pediatric Cardiology) 26-30
12:30-12:50	Break												
12:50-14:20	기획세션 8: 국내 심혈관 정책 흡연과 심혈관질환 국가가 나서야 한다	Intervention 4 Tips and Tricks of Complex PCI Treatment	Heart Failure 1 2022 KSHF Guideline - What's New?	Basic Research Hot Session 1 Stem Cell Research and Regeneration on Cardiology	Smart Health How to Applicate Smart Solutions in Clinical Practice	Pediatric Cardiology 3 Advance in Pediatric Heart Failure		Case 4 (Echo & Imaging) 24-29	Case 5 (AMI & CAD & Hypertension) 30-35		E-Poster 1-50 (12:50-17:40)		
14:30-16:00	Heart Failure 2 Essence of Recent HF Trials	Intervention 5 Rethink Coronary Imaging and Physiology Collaboration	Ethics Workshop 2022 [필수교육] 진료와 연구 사이 - 그 아름다운 조화	Basic Research Hot Session 2 The Latest Trends in Cardiovascular Research	JCS-KSC Joint Session (Arrhythmia) Low Dose NOACs in Asian (Insight from J-ROCKET & ELDERCARE-AF)	ACHD 1 Trend in Cardiovascular Issues in ACHD	Hypertension 1 Hypertension in the Elderly	Intervention 3 145-152	Arrhythmia 3 153-160	Pediatric Cardiology 1 161-168			
16:10-17:40		Cross Specialty 5: Intervention & TS Optimal Management in Structural Heart Disease: MV & TV	Cross Specialty 6: Endocrinology & Cardiology Diabetes and SGLT2: What Endocrinologists and Cardiologists Need to Communicate!	TSOC-KSC Joint Session (Intervention) Contemporary Approach to Complex Coronary Lesions	ACHD 2 Ebstein Anomaly in Adults	Imaging Application of AI in Cardiovascular Imaging	Hypertension 2 Hypertension and Heart Failure	CAD 6 169-176	Arrhythmia 4 177-184	Pediatric Cardiology 2 185-192			
17:50			총회										

### Ethics Workshop 2022 [필수교육]

#### 진료와 연구 사이 - 그 아름다운 조화

» Saturday, Sep 24, 14:30-16:00, 324

Chairpersons: 이철환, 채인호

Panel: 강도윤, 김장영, 김현숙, 양태현

#### 14:30-15:00

빛과 그림자: 의학과 생명윤리, 불멸의 HeLa Cell 이  
야기

#### 15:00-15:30

진료의 씨앗: 임상시험, 대상자 모집지연과 참여도 제  
고

#### 15:30-15:40

KCJ의 경험: 사례로 알아보는 연구윤리의 위반

#### 15:40-16:00

Discussion

## Scientific & Diamond Session

### Scientific Session [Amgen]

#### Guideline-based Strategy in LDL-C Management with Evolocumab in Very High-risk Patients

11:50-12:10	New LDL-C Goal: Is Lower and Earlier Better in ACS?
12:10-12:30	Familial Hypercholesterolemia: Why Is Early Diagnosis Important?

» Sep 24, 11:50-12:30, 325AB

### Scientific Session [Boryung]

#### Therapeutic Strategies in Cardiovascular Risk

11:50-12:10	First-line Therapy depending on Comorbidities and Patient Preference
12:10-12:30	Achieving Target Blood Pressure with Triple-combination Therapy, Dukarb Plus

» Sep 24, 11:50-12:30, 325CD

### Diamond Session [BMS/Pfizer]

#### Challenging Clinical Scenarios in Anticoagulation for Atrial Fibrillation

11:50-12:10	The Comorbid Complexity of Atrial Fibrillation Treatment
12:10-12:30	Anticoagulation in Aged Population with AF

» Sep 24, 11:50-12:30, 324

### Scientific Session [Novartis]

#### ARNI: The Essential Standard of Care for Heart Failure

11:50-12:10	Evolving Role of Entresto as the latest GDMT
12:10-12:30	Robust Proof Built Up through RWE of Reverse Cardiac Remodeling

» Sep 24, 11:50-12:30, 323

### Scientific Session [Celltrion Pharm/Dong-A ST]

#### Benefits of Intensive & Consistent BP Control for Reducing CVD Risk

11:50-12:10	Importance of 24h BP Control for Reducing CVD Risk; The Role of Edarbi
12:10-12:30	Intensive Treatment Strategy in Hypertension

» Sep 24, 11:50-12:30, 322

# 정기총회

2022. 9. 24(토) 오후 5시 50분, EXCO Rm.324



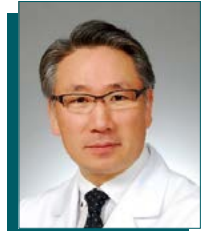
※ 각 분야 시상 및 경품 추첨이 있사오니 많은 참석 부탁드립니다



Continued from page 1

# Cardiology 2030

## Future of Arrhythmia



Young-Hoon Kim,  
MD, PhD  
Korea University  
Medical Center,  
Korea

In the next 10 years, improvements to the strategy, design, and technique of catheter-based ablation for atrial fibrillation (AF) will be made and continue to be innovated to improve efficacy. Newer ablation energy sources, including pulsed field

ablation, ultra-low cryo, and radiation energy will become popular for clinical use, along with a single shot ablation.

The important improvements that should soon become widely available include the newer and more precise electroanatomic mapping system using an ultra-density of multipolar electrode, with an advanced software. Cartofinder AF mapping, cardioNXT mapping using RA-DAR mapping, or non-contact mapping using charge density are newer options for mapping and detecting key dynamics of persistent AF. Fibrosis specific MRI assessed by highly sensitive and specific software and 3-D myocardial tissue thickness map will be beneficial to identify underlying substrate of AF and then can guide more effective ablation.

Virtual computer modeling, big data and artificial intelligence (AI)-based simulator, and avatar-guided ablation for persistent AF and ventricular tachycardia will become widely used. I believe these approaches will significantly reduce the ablation procedure time, predict the outcome, and improve the mortality after ablation as well. With precision medicine, in parallel, gene therapy for genetically determined arrhythmias will be a hope for many patients.

Commercially available, direct-to-consumer digital health technologies, wearable and smartphone-based devices will be widely used for rhythm monitoring in various clinical conditions. The widespread adoption and incorporation of AI into commu-

nity-based screening could have vast impacts by allowing for improved passive arrhythmia detection and sensitivity for detecting short arrhythmia episodes.

Photoplethysmography (PPG), relies on the use of a light source and photodetector at the skin surface that can perceive changes in light intensity due to alterations in blood tissue volume during different points in the cardiac cycle. Devices with PPG technology will allow them to identify periods of AF or other dysrhythmias. Ballistocardiography (BCG) detects microscopic vibrations at the skin surface to reconstitute the cardiac cycle due to dynamic cardiac signaling, subsequently employing neural networks to detect abnormalities that could identify cardiac arrhythmias.

Future implantable devices including pacemakers and ICD in various clinical conditions of heart failure (HF), neuromodulation in HF, dual chamber's leadless pacemaker, and advanced sensor technologies will be widely used.

Optogenetics combines optical and molecular biology (genetic) approaches for light-enabled sensing and generation of electrical activity, which has the potential to address the deficiencies of current electrical devices by offering routes for non-electrical, low-energy pacing and cardioversion that can be cell-specific and painless.

**The arrhythmia is a medical field that causes tremendous changes with development of technological revolution.**

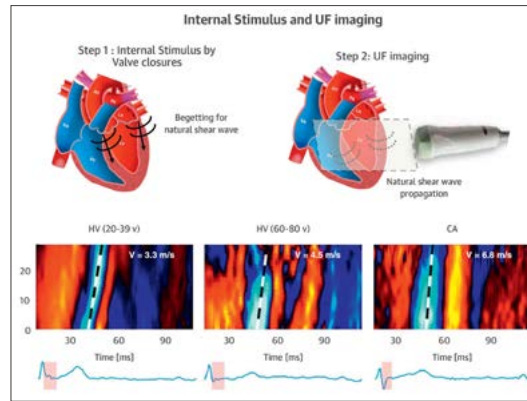
## Future of Echocardiography



Goo-Young Cho,  
MD, PhD  
Seoul National  
University Bundang  
Hospital, Korea

There have been some breakthrough discoveries such as Doppler, transesophageal echocardiography, tissue Doppler, strain, and 3D echocardiography since the mid-1970s, when 2D echocardiography was developed. Unfortunately, there has been little develop-

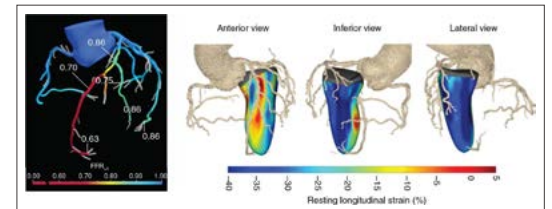
ment since the mid-2010s. rather, it is moving toward developing the existing field in more depth. The recent 3D echocardiography can scan the whole ventricle with single beat and with volume ratio > 30/sec. With development of 3D images, 3D strain will potentially allow verifying its applicability in routine clinical practice. Current ultrasound relies on the focused beam, which intrinsically limits frame rate and temporal resolution. Technical development of ultrasound has become a step in which the frame rate can be increased more than 1000/s while maintaining the scan line density. Ultrafast echocardiography has great



**Figure 3.** Shear wave imaging using intrinsic shock wave from valve closure. Propagation velocity of shear waves increases as the myocardium becomes stiffer. HV, healthy volunteer, CA, cardiac amyloidosis. (JACC Cardiovasc Imaging 2019;12:2389-2398)

clinical potential in the assessment of myocardial stiffness (**Figure 3**) and non-invasive hemodynamics, while providing novel techniques for imaging coronary perfusion and evaluating rhythm disorder. However, ultrafast echocardiography at the moment is only at the clinical proof of concept stage.

In parallel with the technical evolution of echocardiography, fusion imaging with CT or MRI can provide superior diagnostic capability to any of the modalities in isolation. For example, for an accurate

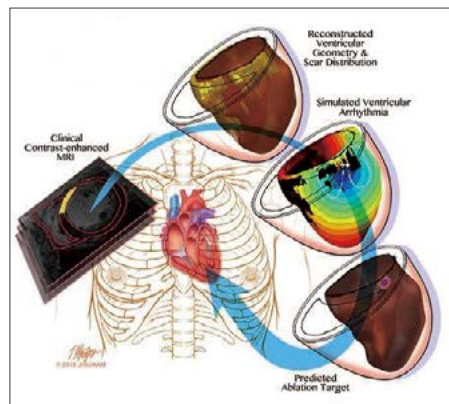


**Figure 4.** Fusion imaging of CT angiography and 3D strain (J Am Soc Echocardiogr 2018;31:664-673)

## 기획세션 6: Cardiology 2030

10년 후 우리 분야는 어떻게 될지(New Drug, Device, Future Perspective)

» Saturday, Sep 24, 08:30-10:00, 324



**Figure 2.** Virtual-heart technology for guiding ablation of ventricular tachycardia

관상동맥 심장질환에서 1,2차 예방\*을 위해  
LDL-C 강하\* 효과를 고려한다면.

# 심장에 강하다 리피토

리피토는 관상동맥심장질환자에게  
2차 예방 적응증\*을 가지고 있습니다.\*

\* 관상동맥질환에 대한 임상적 증거가 있는 성인에게서 1차 예방 및 2차 예방을 위한 관상동맥질환 예방을 위한 임상시험 결과에 따르면, LDL-C 강하를 위한 치료는 관상동맥질환 예방에 효과적입니다. LDL-C 강하를 위한 치료는 관상동맥질환 예방에 효과적입니다. LDL-C 강하를 위한 치료는 관상동맥질환 예방에 효과적입니다.

Reference 1. 리피토® 사용설명서(제2판) 2022.03.24

\* 고지혈증 위험성 고지혈증치료제(스타틴계) 사용지침서(제2판) 2022.03.24

1. 리피토® 사용설명서(제2판) 2022.03.24

2. 리피토® 사용설명서(제2판) 2022.03.24

3. 리피토® 사용설명서(제2판) 2022.03.24

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10. 리피토® 사용설명서(제2판) 2022.03.24



## Cross Specialty 5: Intervention &amp; TS

Interventionist's Perspective  
(Severe Functional MR)

Joo-Yong Hahn,  
MD, PhD  
Sungkyunkwan  
University  
Samsung  
Medical Center,  
Korea

Mitral regurgitation (MR) is the most common valvular abnormality worldwide, affecting over 2% of the total population and has a prevalence that increases with age. MR is classified as primary (degenerative) MR and chronic secondary (functional) MR. Secondary

MR is a disease of the ventricle or atria and is associated with severe left ventricular (LV) dysfunction caused by coronary artery disease or idiopathic myocardial disease. In chronic secondary MR, the mitral valve leaflets and chordae usually are normal or minimally thickened. The abnormal and dilated LV causes papillary muscle displacement, which in turn results in leaflet tethering with associated annular dilation that prevents adequate leaflet coaptation.

Guideline-directed management and therapy (GDMT) for heart failure with reduced ejection fraction (EF) in patients with severe secondary MR should be provided. When symptoms are truly refractory to GDMT, transcatheter treatment or surgery is recommended but must be decided by a structured collaborative Heart Team. Current ACC/AHA guideline recommends that in patients with chronic severe secondary MR related to LV systolic dysfunction (LVEF <50%) who have persistent symptoms (NYHA class II, III, or IV) while on optimal GDMT for heart failure (Stage D), transcatheter edge-to-edge repair (TEER) is reasonable in patients with appropriate anatomy (Class 2a). Appropriate anatomy is defined on transesophageal echocardiography as LVEF between 20% and 50%, LV end-systolic dimension  $\leq 70$  mm, and pulmonary artery systolic pressure  $\leq 70$  mmHg (Figure 1).

Currently, the most widely used device for TEER is MitraClip. Although there are several limitations regarding valve morphology, flail gap and width, more challenging lesions are tried with G4 system that offer four sizes (NTW, XTW, NT, and XT), based on two different arm lengths (12 mm for XT/XTW and 9 mm for NT/NTW) and two different arm widths (4 mm for NT/XT and 6 mm for NTW/XTW).

**In summary, mitral TEER is of benefit to patients with secondary MR who remain severely symptomatic despite GDMT for heart failure.** Transcatheter devices for mitral annuloplasty, mitral valve chordal repair, and MV replacement are being de-

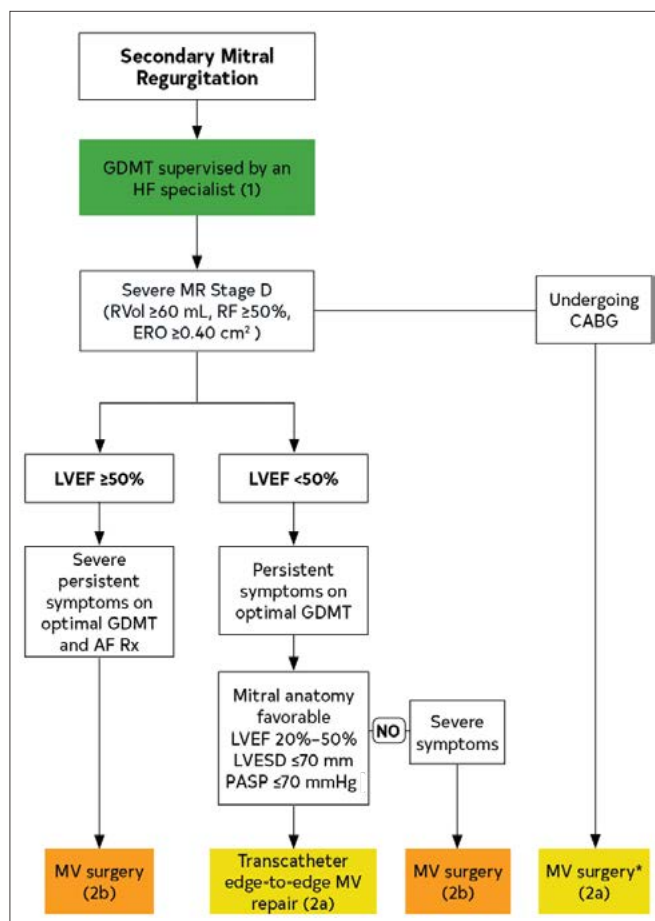


Figure 1. ACC/AHA guideline for the management of patients with secondary mitral regurgitation (Circulation 2021;143:e72-e227)

veloped and expected to overcome limitations of TEER.

## Surgeon's Perspective (Treatment Options for Severe TR)



Jae Woong Choi,  
MD, PhD  
Seoul National  
University Hospital,  
Korea

As transcatheter aortic valve implantation (TAVI) and transcatheter mitral valve replacement (TMVR) showed good clinical outcomes, transcatheter tricuspid valve intervention (TTVI) is gradually developing for tricuspid valve

(TV) diseases. Although there are concerns about long-term performance, TTVI has shown good results with a mortality rate of nearly 0%.

The biggest reason why such percutaneous treatment has begun to be in the spotlight is that the early results of surgery for severe tricuspid regurgitation (TR) are unsatisfactory. The mortality rate of surgery for severe TR is reported to be about 10%. However, even though considering that most patients requiring TV surgery for severe TR had a history of previous heart surgery, TV surgery is technically a simple operation for a surgeon. **Therefore, unsatisfactory surgical results of TV surgery are generally**

thought to be due to the problem of the underlying status related to right heart function. Considering this, if surgery is performed before right heart failure through early referral, the early results of TV surgery will be expected to improve significantly. According to the Korea Heart Valve Registry, the mortality rate of isolated tricuspid surgery from 2017 to 2020 was 3.9%. This low mortality might be affected by the early referral or early surgery before occurring the right heart dysfunction.

If early results of TV surgery can improve, the next issue to overcome will be the long-term perfor-

mance. Although the long-term performance has not yet been reported for TTVI, there was a study which reported that the occurrence of TR more than moderate developed by 30% for one year. In addition, in situations where additional surgery is required after TTVI, the condition of the leaflet will likely be impossible to perform tricuspid repair. It has been confirmed in many studies that the long-term survival rate of TV replacement is significantly worse than that of tricuspid repair.

In conclusion, TTVI could be a good option for high-risk patients. However, efforts for early referral to improve the performance of surgery should precede before expanding the indication of TTVI. In addition, the fact that TV replacement will be inevitable after TTVI should be considered in the selection of treatment methods for TV disease.

Cross Specialty 5: Intervention & TS  
Optimal Management in Structural Heart Disease: MV & TV

» Saturday, Sep 24, 16:10-17:40, 325CD

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# Heart Failure

## Medical Treatment Update



Hyemoun Chung,  
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Kyunghee  
University Hospital,  
Korea

In July 2022, a new guideline was published by the Korean Society of Heart Failure (KSHF). The new guideline includes updated treatment strategies for people with heart failure to include sodium-glucose co-transporter 2-inhibitors (SGLT2i)

(Figure 1). Pharmacological treatment for people with heart failure with reduced ejection fraction (HFrEF) includes **four classes of medications; angiotensin receptor-nephtrilysin inhibitor (ARNi) or angiotensin-converting-enzyme inhibitors (ACEi) (or angiotensin receptor blocker [ARB] if intolerable with ARNi/ACEi), beta blockers, mineralocorticoid receptor antagonists (MRA) and SGLT2i to reduced cardiovascular mortality and**

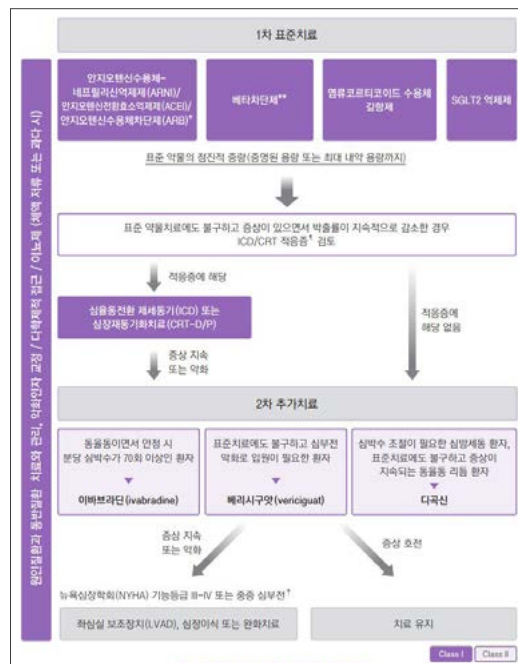


Figure 1. Treatment strategies for patients with HFrEF (2022 KSHF Guideline for the Management of Heart Failure)

**HF hospitalization (IA).** These drugs should be started as standard of care in

patients with HFrEF, unless there are contraindications or patient acceptance is unacceptable. SGLT2i is recommended for patient with symptomatic HFrEF regardless of the presence of Type 2 diabetes. There are no randomized prospective studies that can prove the preferred use of ARNi/ACEi, beta blockers, MRA, or SGLT2i in the treatment of newly diagnosed patients with HFrEF. Although data on SGLT2i's are limited in acute-stage patients, in patients with stable heart failure, they can be used without increasing the dose in a wider patient group, and early use is recommended. In patients with heart failure with improved ejection fraction (HFimpEF), guideline-directed medical therapy should be continued even in patients who may become asymptomatic (IB). Individuals with heart failure with mildly reduced ejection

fraction (**HFmrEF**), those with left ventricular ejection fraction (LVEF) of 41-49% should be treated first with an **SGLT2i regardless of the presence of Type 2 diabetes (IB).** ARNi and MRA are **also recommended to reduce cardiovascular mortality or HF hospitalization (IIaB).** ACEi or ARB, and beta blockers are considered weaker recommendations in this population (IIbC). For patients with heart failure with preserved ejection fraction (**HFpEF**), **SGLT2i is recommended to reduce HF hospitalization and cardiovascular mortality (IB).** ARNi is **also recommended to reduce cardiovascular mortality or HF hospitalization (IIaB).** MRAs, ACEi or ARB, and beta blockers may be considered in patients with HFpEF (IIbC).

### Heart Failure 1

#### 2022 KSHF Guideline – What's New?

» Saturday, Sep 24, 12:50-14:20, 324

# Myocardial Infarction

## Challenging Scenarios in AMI: High-bleeding Risk Patient with Complex PCI



Kwan Yong Lee,  
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Dual antiplatelet therapy (DAPT) is crucial in preventing ischemic complications in acute coronary syndrome (ACS) patients. The 2020 ESC NSTEMI-ACS guidelines define high thrombotic risk patients as follows: complex coronary artery disease (CAD)

and at least one criterion of clinical risk enhancers (diabetes mellitus, recurrent myocardial infarction, multivessel CAD, polyvascular disease, premature CAD, systemic inflammatory disease, and chronic kidney disease). This high thrombotic risk can be reduced in two ways: 1) extend DAPT usage beyond one year, 2)

use the potent P2Y12 inhibitor instead of clopidogrel. However, these strategies can increase major bleeding. Because patients with high bleeding risk (HBR) have often been excluded from existing studies, there was little data about HBR patients, but interest in them has been increasing recently. Particularly, DAPT strategy is an unresolved problem in patients with high thrombotic and high bleeding conditions.

The standard DAPT duration for ACS patients is  $\geq 12$  months in recent guidelines, and the duration may be modified depending on perceived ischemic or bleeding risk. Current guidelines present DAPT score as a tool for assessing the risk: benefit ratio of  $\geq 12$  months DAPT. In one trial, the benefits of extending DAPT for reducing future ischemic risk were similar in subjects with and without complex lesions. Additionally, several scores have been suggested to predict HBR. However, standardization is difficult due to genetic differences in the cohorts,

post-percutaneous coronary intervention (PCI) timing, and ethnicity. In 2017, a simple five-item risk score called "PRE-CISE-DAPT score" was generated as a standardized tool from post-PCI DAPT on large randomized controlled trial datasets. More recently, HBR Academic Research Consortium (ARC-HBR) criteria have been proposed to standardize the definition of HBR under consensus from expert panels. If the one major or two minor criteria of ARC-HBR are satisfied, the DAPT duration can be reduced. Recently, Urban et al. introduced the ARC-HBR trade-off model (two prognostic models to evaluate the trade-off between two quantifiable risks [thrombotic or bleeding]), and it can help clinicians adjust antithrombotic treatments based on each individual's estimated thrombotic and bleeding risk. Still, their value in improving patient clinical outcomes remains unclear.

Concerning the use of potent P2Y12inhibitor, guidelines recommend one-year

DAPT use with prasugrel or ticagrelor, preferably for patients receiving PCI in ACS conditions, unless there are no exclusion criteria. Recently, there has been some data regarding the de-escalation of antiplatelet therapy. In cohorts with complex PCI, de-escalation compared with conventional therapy was not associated with an increased risk of ischemic outcomes but may reduce the risk of bleeding events in one year. In the HBR subgroup analyses from the TWILIGHT-HBR and TICO trials, de-escalation from DAPT with potent P2Y12 inhibitors usage showed clinical benefit on net adverse clinical events and major bleeding event rates. However, to apply this result to our daily clinical practice, well-designed dedicated trials enrolling patients with high ischemic and bleeding risk are essential.

### Myocardial Infarction 3

#### Challenging Scenarios in AMI

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# 유한양행

## Smart Health

### What a Cardiologist Can Do for Patients with Smart Solutions Out of Clinic



Hak Seung Lee  
Medical AI, Korea

Artificial intelligence (AI) is being applied in various fields of cardiology. In particular, deep learning (DL), a subset of machine learning (ML) in AI, enables the diagnosis and prediction of cardiac diseases using neural networks with more neurons at their layers as well as their interconnectivity. During the session, Dr. Lee emphasized that the primary advantage of DL is its ability to discover features of specific data that cannot be discovered from the human perspective. For example, by learning an implicit repre-

sentation, the DL model effectively discovers various features based on subtle electrocardiogram (ECG) changes and creates an algorithm from complex and non-linear ECG data. DL enables a model to be created using only data, i.e. without the restrictions of human ideas. Furthermore, new insights can be acquired by comparing the findings obtained using DL from data only with existing medical knowledge.

Dr. Lee, however, also pointed out apparent limitations. Ethics and overfitting AI models are definite disadvantages and require sufficient external validation in different environments. Wolpert and Macready explained the 'no free lunch' theorem: if AI is optimized for a specific situation, then it cannot yield favorable results in a different situation. For accurate validation, the data should be split by hospital or region. The other disadvantage of DL is that, currently, it cannot unveil the DL decision process, i.e. the black box. Also, it is not possible to determine why the DL model used a particular ECG feature to determine. As the DL model might make an unreasonable decision, the lack of interpretability of the DL model hinders its clinical use significantly. Because the process and reason related to the wrong decision of the DL model can not be determined, we are unable to not monitor or rectify the model risk that might cause medical errors.

Because of this, a safety net is required when using DL in clinical applications. Conventional methods and DL models must be used simultaneously to detect critical errors of the DL model. These shortcomings cause serious opposition from most doctors or researchers who are not close to AI research. The so-called realm of engineers is far from reality or the perception that it is a party only for those involved.

Finally, Dr. Lee summarized that the significant paradigm shift of AI and DL is already a big trend that cannot be avoided. As an independent researcher and clinician, the task to solve in this era is to increase the benefits to the patient, while at the same time solidifying the foundation for users to use data transparently and rationally. It's a familiar and yet another cliché, but we shouldn't make the mistake of losing something we shouldn't lose because of the hurdle of getting used to it.

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#### Smart Health

##### How to Apply Smart Solutions in Clinical Practice

» Saturday, Sep 24, 12:50-14:20, 322

## Imaging

### Application of AI in Cardiovascular Imaging: Cardiac CT and MRI



Hongyoon Choi, MD  
Seoul National University Hospital, Korea

인공지능은 심장 CT/MRI 업무에 다양하고도 깊은 영향을 미칠 수 있으며, 최근 5년간 많은 연구결과가 발표되었다. 또한 관련기업이 창업하거나 기존의 기업들도 인공지능 기술을 적극 도입하는 등 산업적으로도 큰 영향을 미치고 있다. 인공지능

기술은 영상 진단만이 아니라 환자 스케줄링, 영상의 획득시간 감소, 방사선량 저감, 후처리, 정량화, 예후 예측 등 다양한 분야에 적용될 수 있다. 인공지능을 적용하면 훨씬 낮은 방사선량으로 진단 가능한 영상을 획득하거나 조영제의 사용량을 줄일 수 있다. 심장 MRI의 경우는 영상획득 시간을 절반 이하로 낮출 수 있는 기술이 연구되거나 상용화되고 있다. 이러한 영상획득 단계의 기술들은 별도의 소프트웨어로 출시되거나 촬영기기에 내재화되기도 하여 눈에 띄지는 않지만 환자 진료의 개선에 큰 도움을 주고 있다.

기준에 시간이 많이 걸리던 심장의 구역별 분할도 이제는 상용화 단계로 접어들었다. 초기에는 좌심

실, 우심실 등의 분할이 목표였으나 심방, 대혈관, 좌심방, 관상동맥 등 자동분할의 영역이 점점 넓어지고 있다. 관상동맥 석회화 점수계산(coronary artery calcium scoring)은 상대적으로 단순한 작업임에도 불구하고 관상동맥의 석회화와 관상동맥벽의 석회화를 사람이 일일이 확인하는 작업을 30년 이상 해왔다. 그러나 최근에는 인공지능 기술의 급격한 발전으로 숙련된 전문가와 비슷한 수준의 관상동맥석회화 자동계산 분석프로그램이 상용화되었고, 서울아산병원에서는 2020년부터 관상동맥석회화 점수를 인공지능 프로그램이 정량화하고 있다. 향후에는 기술의 보완으로 관상동맥석회화뿐만 아니라, 판막석회화의 정량화까지 영역이 넓어지기를 기대하고 있다. 또한, 인공지능 기술이 더 정교해지면 심장의 주요 구조물에 대한 분할/정량화를 통해 심장 CT/MRI의 'quantitative reporting'이 가능해질 것으로 기대한다. 인공지능은 3D 프린팅이나, 혈류 시뮬레이션과 같이 심장구조물 분할이 선행되어야 하는 진료/연구에 큰 기여를 할 수 있다.

인공지능 기술은 심장구조물의 분할/정량화의 단계를 넘어서서 병변의 진단/정량화의 단계로 나아가고 있다. 예를 들어, 관상동맥경화반을 자동으로 진단하고 정량화하는 분야는 도전적이지만 많은 연구가 이루어지고 있고 관련분야의 창업도 이루어지고 있다. 심장 MRI는 심근내부의 지연성 조영증강병변을 정량화하는 연구가 활발하다. Radiomics는 영상이 내재하고 있는 다양한 특징을 수학적으로 정량화하여 인간의 직관을 넘어서서 질환을 진단하거나 예후를 예측하는 분야이다. 이 기술은 심근병증의 진단이나 예후 예측, 고위험 관상동맥경화반의 진단에 연구되고 있다.

결론적으로 인공지능은 심장 CT/MRI 관련 업무 전반에 지대한 영향을 미칠 것이며 관련분야의 연구 및 진료를 획기적으로 개선할 것으로 기대된다.

### Application of AI in Cardiovascular Imaging: Nuclear Imaging



Hongyoon Choi, MD  
Seoul National University Hospital, Korea

With the recent advances in deep learning (DL), several DL techniques have been developed to enhance or (semi-) automatize diagnostic accuracy of nuclear imaging. Although DL shows remarkable performance in image

classification, there are several hurdles that need to be addressed for what we really need clinically. In particular, the application of artificial intelligence (AI) needs to concentrate on precise quantification of functions with the ultimate purpose of predicting prognosis and guiding treatment strategy. For example, the AI application to myocardial perfusion imaging needs to focus on quantitative measurements for predicting prognosis, rather than estimating the structural stenosis itself. This means that the final goal of nuclear cardiology should be more than mere diagnostic accuracy. By defining the severity of key pathophysiology represented by complex patterns on nuclear imaging, AI is expected to help the field of nuclear cardiology to be a robust quantitative imaging biomarker. As nuclear medicine imaging can quantitatively measure the key (patho)physiology of disease, the aim of AI has recently moved to considering the clinical application, focusing on the precise measure-

ment of pathophysiologic biomarkers and stratification that was previously assessed qualitatively. The focus of the session will be to discuss **the ultimate goal of the medical application of DL in nuclear cardiology, which will not be simply to improve the diagnostic accuracy, but to accurately map the health status of a person.** When dealing with AI in nuclear cardiology, it will be necessary to think about AI models that can provide new prognostic information rather than simply supporting conventional practices. Hence, the session will further discuss an AI model for nuclear cardiology that can provide feasible quantitative measurements, thereby helping the clinical decision.

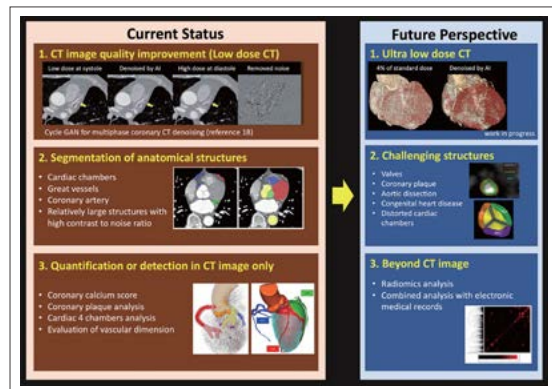


Figure 1. Application of artificial intelligence in cardiovascular CT

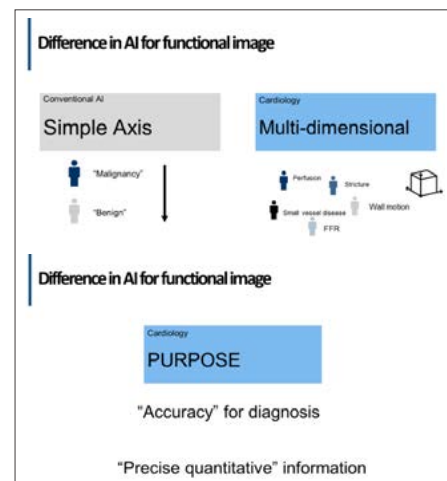


Figure 2. Difference in AI for functional image

#### Imaging

##### Application of AI in Cardiovascular Imaging

» Saturday, Sep 24, 16:10-17:40, 321



# Cardiogenic Shock

## Multiple Complications during VA ECMO in Patients with AMI with Cardiogenic Shock



김진진 교수  
가톨릭의대 서울성모 병원

체외막산소요법(extra-corporeal membrane oxygenation, ECMO)은 환자의 생명을 유지하고 end organ perfusion을 향상시키기 위해 필요한 장비이나, ECMO를 유지하는 동안 수많은 합병증을 마주하게 된다.

2016년 Patel JK 등이 발표한 논문에 정리된 표(Table 1)에 나열된 합병증은 무려 12가지에 달하며 이외에도 AKI로 인해 renal replacement therapy가 필요한 경우가 많으며, ECMO cannulation 과정에서 retrograde aortic dissection, IVC tear가 발생할 수 있다. 심근 손상이 매우 심하여 LV의 수축력이 현저히 떨어져 있는 경우 VA ECMO의 arterial flow에 의해 afterload가 증가하며 이로 인해 LV distension과 intracardiac thrombus 위험이 증가한다.

급성 심근경색으로 인한 cardiogenic shock이나 VF arrest로 ECMO를 삽입하는 경우 primary revascularization이 가장 중요한 치료이므로 PCI와 ECMO 삽입을 함께 시행하게 되며, 따라서 DAPT (dual antiplatelet therapy)와 heparin을 모두 투여하므로 bleeding 위험이 훨씬 높다. 이번 증례에서도 bleeding, DIC로 인해 ECMO 삽입 후 초기 상당기간 동안 DAPT와 heparin을 모두 투여하지 않았고, ECMO weaning 후 신경학적 이상 소견을 발견하여 stroke이 발생했음을 알 수 있었다.

또한 최근 ECMO cannula를 제거하면서 closure device를 사용하는 경우가 증가하고 있으며 본원에서도 TAVI 시술 후나 ECMO cannula 제거 시 closure device를 사용해왔다. ECMO를 유지하는 동안 관찰되지 않던 lower extremity ischemia 소견이 ECMO cannula 제거 후 발생하였으며 closure device로 인한 femoral artery injury로 판단하고 수술적 치료를 시행하였다.

Cardiogenic shock 환자에서 적절한 ECMO 삽입 시기를 결정하는 것도 어려운 문제이지만, **ECMO 삽입 이후 최대한 합병증이 생기지 않게**

유지하고 만약 합병증이 발생했다면 빠르게 대처하여 후유증을 남지 않도록 하는 것 역시 중요하다 고 생각한다. ECMO 유지 도중 발생한 다양한 합병증 사례를 공유하여 cardiac intensivists의 진료 활동에 도움이 되는 것이 이번 증례 발표의 목표이다.

### Cardiogenic Shock 1

Learn from Mortality Case in Patients with Cardiogenic Shock

» Saturday, Sep 24, 08:30-10:00, 321

## Heart Transplantation: Best Timing for Better Outcome



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Heart transplantation (HTx) has become the standard treatment for selected patients with advanced heart failure. Improvements in immunosuppressant, donor procurement, surgical techniques, and post-HTx care have resulted in a substantial decrease in acute allograft rejection, which had previously significantly limited survival of HTx recipients. However, limitations to long-term allograft survival exist, including rejection, infection, coronary allograft vasculopathy, and malignancy. Careful balance of immunosuppressive therapy and vigilant surveillance for complications can further improve long-term outcomes of HTx. Generally, HTx evaluation aims to determine whether patients meet the following conditions (Figure 1): 1) “sick enough,” such that their cardiac status is sufficiently limited on optimal therapy in order to benefit from HTx; 2) “well enough” such that they do not have comorbidities that would preclude HTx; and 3) “can adapt to new transplant lifestyle” such that they demonstrate compliance with therapy and possess adequate social support.

Although these indications are generally well-accepted, it is challenging to list optimal cardiogenic shock patients who can benefit from HTx. **Cardiogenic shock patients who are truly refractory to maximal medical therapy with**

veno-arterial extra-corporeal membrane oxygenation (VA-ECMO) by about 7-14 days and who could be benefitted by HTx surgery must be listed early for better outcome. In the

presence of (i) failure of multiple weaning trials, (ii) severe left ventricular dysfunction, (iii) moderate to severe right ventricular dysfunction and valvular abnormalities, and (iv) prolonged ECMO duration (>14 days), HTx should be considered early, in the absence of contraindications. However, it is well-known that ECMO bridged HTx recipients have poor clinical outcome mainly due to high 30-day mortality related to renal impairment, infection and needs for mechanical ventilation. In the era of severe organ shortage, the decision to transplant a patient directly of ECMO needs to be made on a case-by-case basis. Potential gain in decreasing the wait list mortality of these

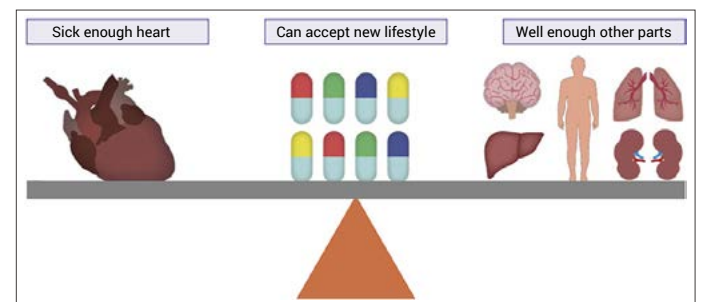


Figure 1. Balanced heart transplant listing strategy in cardiogenic shock (Korean Circ J 2018;48:565-590)

critically ill patients needs to be weighed against poorer post-HTx mortality and mid- and long-term outcomes.

### Cardiogenic Shock 2

End Stage Heart Failure & Cardiogenic Shock – Bridging and Destination Therapy

» Saturday, Sep 24, 10:10-11:40, 321

Table 1. Complications associated with venoarterial ECMO use

- Major or significant bleeding
- Rethoracotomy for postcardiotomy bleeding or tamponade
- Significant infection
- Lower extremity ischemia
- Lower extremity amputation
- Compartment syndrome or fasciotomy
- Stroke
- Air embolism
- Thrombocytopenia
- Acquired von Willebrand syndrome
- Disseminated intravascular coagulopathy
- Hemolysis

ECMO, extracorporeal membrane oxygenation

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# Hypertension

## Hypertension in the Elderly



김상일 교수  
분당서울대학교병원

고혈압 환자를 진료할 때 권고되는 목표혈압은 치료로 인한 심뇌혈관질환 예방효과를 반영한 환자의 예후 개선 이득뿐 아니라, 약제 사용으로 인한 약물이상반응의 위험성과 비용대비 효과 등 여러 요소를 고려해서 결정되어야 한다. 최근 대다수 국가의 고혈압 진료지침에서 보다 강력한 혈압조절을 권고하며, 이전보다 낮은 목표혈압치를 제시하고 있다. 특히 65세 이상의 노인 환자군에서도 고위험군에 대해서는 보다 적극적인 강압을 강조하고 있다(**Figure 1**). 이는 Systolic Blood Pressure Intervention Trial (SPRINT) 및 Strategy of Blood Pressure Intervention in the Elderly Hypertensive Patients (STEP) 연구결과가 발표되면서 노인 고혈압 환자의 목표혈압에 대한 논란이 해소된 것이 영향을 미쳤을 것이다.

혈압 증가에 따른 심혈관질환의 위험성은 115/75 mmHg에서부터 증가되기 시작하며, 혈압이 높아질수록 그에 비례하여 증가된다. 하지만 혈압으로 인해 위험도가 증가하기 시작하는 혈압수치와 고혈압 환자에서 혈압을 낮췄을 때 이득이 기대되는 목표혈압값은 같은 의미가 아니다. ACCORD 연구에서 보다 강력한 혈압조절이 환자의 예후를 개선시키지 못했고, INVEST 및 ONTARGET 연구의 후향적 분석에서 J-curve 현상을 뒷받침하는 결과들이 보고되면서, 당뇨병 및 만성콩팥병을 동반한 고혈압 환자에서 혈압을 130-135/80-85

mmHg 미만으로 조절하는 것이 타당한지 논란이 있었다. 이러한 이유로 2013년 유럽고혈압학회/심장학회에서 수축기 목표 혈압은 140 mmHg으로 통일하였고, JNC8에서는 60세 이상에서 수축기 혈압 150 mmHg 이상인 경우 약물치료를 시작하여, 수축기 혈압 150 mmHg 미만으로 조절할 것으로 권고하였다.

목표혈압에 대한 논란을 해결하기 위해 미국 국립보건원에서 주도하여 당뇨병 및 뇌졸중 병력이 없는 고위험군 고혈압 환자에서 수축기 목표혈압(<120 mmHg vs. <140 mmHg)을 비교한 SPRINT 연구가 진행되었다. 이 연구는 초기에 종료되었고 심부전 발생(38% 감소), 심혈관질환 사망률(43% 감소), 전체사망률(25% 감소) 모두에서 강력한 혈압조절군에서 유의한 이득이 관찰되었다. 특히 75세 이상 노인 환자들을 대상으로 하위 분석을 수행한 결과, 고령의 환자군에서도 보다 강력한 혈압조절이 효과적인 것으로 나타났다.

STEP 연구는 중국에서 수행되었고 60-80세 환자를 대상으로 하였다. 연구자들은 수축기 혈압을 110-130 mmHg로 조절하는 적극적 치료군에서 130-150 mmHg로 조절하는 통상적 치료군에 비해 급성관동맥증후군, 심부전, 뇌졸중 등의 일차 종결점 발생이 26% 감소함을 보고하였다. 이러한 연구 결과로 노인 고혈압 환자에서도 강력한 강압 치료가 보다 효과적이라는 사실을 확인할 수 있었다. 하지만 초고령자, 노쇠한 노인, 시설 입소 노인의 고혈압에 대한 목표 혈압은 추가적인 연구가 필요하며, 환자의 상태를 고려하여 치료 방침을 결정해야 한다. 또한 **노인 환자의 경우 개인차가 매우 크며, 임상적인 특성이 다양하다는 점을 고려할 때 일관된 목표 혈압을 적용하기 보다는 개별화된 치료를 적용하는 것이 보다 안전하고 효과적일 수**

있으며 항고혈압치료에 잘 적응하는 고위험군의 노인 고혈압 환자에서는 이전보다 적극적인 강압 요법을 적용하는 것이 적절할 것으로 생각한다.

## Hypertension 1 Hypertension in the Elderly

» Saturday, Sep 24, 14:30-16:00, 320

## Hypertension and Heart Failure: Pathophysiological Link



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Hypertension remains the most common comorbidity in patients with heart failure (HF). **Overall, the pathophysiology of HF in hypertensive patients is complex and multifactorial.** The classic paradigm is that poorly controlled hypertension results in left ventricle (LV) hypertrophy, left atrial remodeling, diastolic dysfunction, and eventually HF. Whereas LV hypertrophy and myocardial overload can lead to cardiac dysfunction, it is important to note that some patients with isolated hypertension do not manifest adverse myocardial remodeling, such as

increased stiffness due to higher collagen deposition or titin hypophosphorylation, which are characteristically seen in the myocardium of patients with hypertension-induced HF. Despite the high prevalence of hypertension in HF clinical trials, analyses from the I-PRESERVE (Irbesartan in Heart Failure with Preserved Ejection Fraction Study), CHARM-Preserved (Candesartan Cilexetil in Heart Failure Assessment of Reduction in Mortality and Morbidity), and TOPCAT (Treatment of Preserved Cardiac Function Heart Failure With an Aldosterone Antagonist Trial) found that one-third to two-thirds of patients with HF did not have LV hypertrophy. Hypertension induces vascular changes, including increases in arterial stiffness that can also lead to ventricular-vascular uncoupling, afterload mismatch, and cardiac dysfunction, in the absence of LV hypertrophy. The variable contribution of these pathophysiological processes such as the degree of diastolic dysfunction, type of cardiac remodeling, and extent of neurohormonal activation, may in turn also lead to different hypertension-associated HF phenotypes, possibly requiring distinct therapeutic approaches (**Figure 2**).

Target BP: intensive BP lowering for high-risk patients						
	KSH 2018	ACC/AHA 2017	ESC/ESH 2018	JSH 2019	ISH 2020	
Age	<65 yrs	140/90	130/80 <sup>a</sup>	130/80 <sup>a</sup>	130/80	
	≥ 65 yrs	130 (SBP)	130-139/70-79	≥ 75 yrs: 140/90	140/90	
CKD	CKD (proteinuria+)	130/80		130/80		
	CKD (proteinuria-)	140/90	130-139/70-79	140/90		
High-risk / CVD		130/80			< 130/80 (< 140/80, ≥ 65 yrs)	
DM	With CVD <sup>a</sup>	130/80	130/70-79 (< 65 yrs) (not < 120)	130/80		
	Without CVD <sup>a</sup>	140/85	130-139/70-79 (≥ 65 yrs)			
Secondary stroke prevention		140/90		130/80 <sup>b</sup>		

<sup>a</sup><10 y-ASCVD risk 10% to initiate medication at 140/90 mmHg. <sup>b</sup>Antihypertensive medication starts at ≥140/90 mmHg in low- to middle-risk patients. <sup>c</sup>50 years and older CAD, PAD, aortic disease, HF, LVH patients. <sup>d</sup><140/90 mmHg for bilateral cervical arteries stenosis, main cerebral artery occlusion or not-evaluated cases.

ACC indicates American College of Cardiology; ASCVD, atherosclerotic cardiovascular disease; AHA, American Heart Association; BP, blood pressure; CKD, chronic kidney disease; DM, diabetes mellitus; ESC, European Society of Cardiology; ESH, European Society of Hypertension; JNC-8, Eighth Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure; JSH, Japanese Society of Hypertension Guidelines for the Management of Hypertension; and SBP, systolic BP.

Figure 1. 고위험군 고혈압 환자의 목표혈압

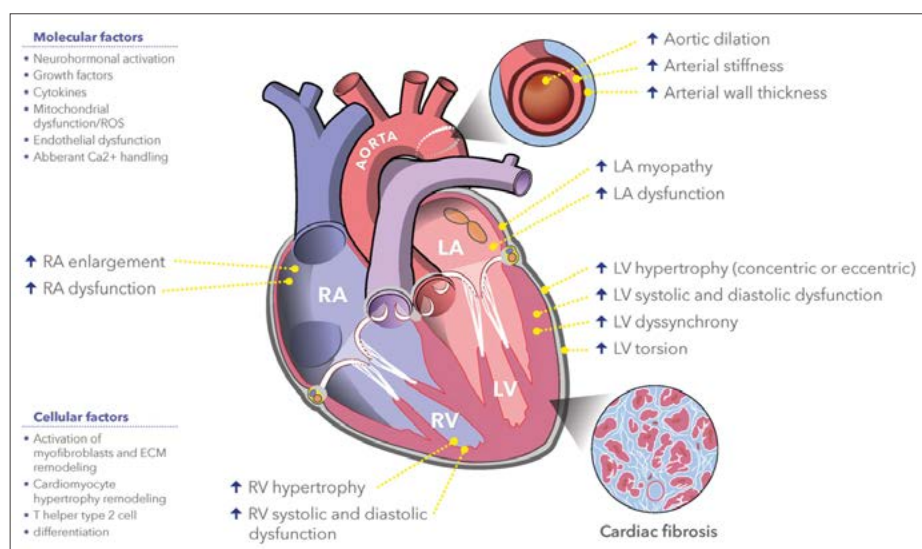


Figure 2. Overview of the pathophysiological alterations present in hypertensive heart disease (Curr Hypertens Rep 2020;22:11)

Continued on page 9

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# JCS-KSC Joint Session

## Optimal Dose of NOACs in JAPAN



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Tokyo Women's  
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East Asian patients have reduced anti-ischemic benefits and increased bleeding risk during anti-thrombotic therapies compared with Caucasian patients, so-called "the East Asian paradox." As direct oral anticoagulants (non-vitamin K antagonist oral anticoagulants; NOACs) are commonly used for atrial fibrillation (AF) patients in contemporary practice, the unique risk-benefit trade-off in East Asians has been a topic of emerging interest.

Previous studies have shown that East Asians with AF have a low risk of atherothrombotic events, including cardiovascular mortality and different active metabolite levels of direct oral anticoagulants compared to Caucasians. Complex interactions between these findings could make a separate therapeutic window of antithrombotic treatment among East Asian versus Caucasian patients. Accordingly, the ethnicity-tailored antithrombotic strategy would be essential to minimize

severe complications in East Asian patients.

In the ROCKET AF study, Japanese AF patients were not enrolled because of the following two reasons: 1) Pharmacokinetic modeling data indicated that the distribution of both the maximum concentration and area under the curve from 0 to 24 h of rivaroxaban in Japanese patients with AF who received a 15 mg once-daily dose of rivaroxaban would be comparable to those in Caucasian patients with AF who received a 20 mg once-daily dose; 2) Japanese physicians tend to favor lower levels of anticoagulation, resulting in lower anticoagulation targets in clinical practice. Then, the phase 3 J-ROCKET AF trial was conducted. Also, another phase 3, multicenter, randomized, double-blind, placebo-controlled, event-driven trial was conducted to compare the once-daily 15-mg dose of edoxaban with a placebo in elderly Japanese patients ( $\geq 80$  years of age) with nonvalvular AF who were not considered to be appropriate candidates for oral anticoagulant therapy at the doses approved for stroke prevention.

On the contrary, in the real-world setting, a significant proportion of AF patients receive NOACs at doses inconsistent with the drug labeling (based on the AFIRE

sub-analysis from Japan/Data from Korean National Health Insurance Service database). Those studies suggested that NOAC under-dosing was not significantly associated with an increased risk of stroke. However, there also might be no safety benefit compared to label-adhered NOAC dosing.

In this session, we will review the recent evidence on this intriguing topic and propose future directions for antithrombotic treatment in East Asian patients.

## Low Dose NOACs for the Very Elderly with High Bleeding Risk



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Japan

Oral anticoagulant treatment for stroke prevention in the very elderly patients with atrial fibrillation is challenging due to concerns regarding bleeding. Indeed, the proportions of patients receiving oral anticoagulants (OAC) decline with advancing age, despite the

fact that the risk of stroke is high. Under-dosing of direct oral anticoagulants (DOAC) is sometimes prescribed for those patients in real-world clinical prac-

tice, but the definite evidence is lacking. The ENGAGE AF-TIMI 48 trial demonstrated that the use of 15 mg edoxaban is considered off-label because of concerns regarding insufficient prevention of stroke, but it may still be beneficial in patients with a high risk of bleeding, including very elderly patients. Therefore, the ELDERCARE-AF trial was conducted to compare once-daily edoxaban 15 mg vs placebo in elderly ( $\geq 80$  years) Japanese patients with nonvalvular atrial fibrillation who were considered ineligible for oral anticoagulant therapy at approved doses for stroke prevention. Edoxaban 15 mg remarkably reduced the incidence of stroke or systemic embolism (hazard ratio 0.34, 95% confidence interval [CI] 0.19-0.61), while showing a nonsignificant increase in major bleeding (hazard ratio 1.87, 95% CI 0.90-3.89). Thus, edoxaban 15 mg was shown to be an acceptable therapeutic option in those patients with high bleeding risk. However, it should be noted that the data is based on a very selected population of patients who were eligible for the trial criteria.

## JCS-KSC Joint Session: Arrhythmia Low Dose NOACs in Asian (Insight from J-ROCKET & ELDERCARE-AF)

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## Management of Blood Pressure in Heart Failure



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고혈압은 심부전의 주요 기여인자 중 하나이다. Framingham Heart Study에서는 새롭게 진단받은 심부전 환자의 91%에서 고혈압이 선행되었으며, 고혈압 환자들에서 심부전의 발생 위험이 2-3배 높았다. 뿐만 아니라 여러 연구들을 통하

여 항고혈압제를 이용한 혈압조절이 심부전의 발생위험을 줄이는 것은 입증되어있다. 그러나 심부전 환자들에서 혈압과 심부전의 임상예후와의 관계는 여전히 논란이 되는 연구주제로서, 적정 혈압기준에 대한 근거도 미흡하다.

좌심실 박출률감소심부전(heart failure with reduced ejection fraction; HFrEF) 환자들에서는

저혈압은 안좋은 예후와 밀접한 관련을 보이는 것으로 알려져 있다. Korean Heart Failure Registry에서는, 심부전으로 치료 중인 환자들에서 진료실 수축기 혈압과 심부전 예후 사이에 명백한 J 커브 형태의 관련성을 보였다. 진료실 수축기 혈압 132 mmHg이 가장 낮은 사망 위험과 관련이 있었으며, 수축기 혈압이 132 mmHg 보다 낮으면 사망 위험이 증가했다. 그러나 수축기 혈압이 132 mmHg 보다 높은 것과 사망 위험과의 관련성은 유의하지 않았다. OPTIMIZE-HF (Organized Program to Initiate Lifesaving Treatment in Hospitalized Patients with Heart Failure) registry를 분석한 연구에서도, 심부전으로 입원 치료를 받은 환자들에서 퇴원 시 수축기 혈압 130 mmHg 미만인 경우 안좋은 예후와 관련성이 높은 것으로 보고하였다. 이런 J 커브 현상은 혈압과 좌심실 재형성 간의 관계에서도 나타난다. 심부전에서 좌심실 역 재형성은 심부전의 좋은 예후와 관련성이 높는데, 한 연구에서 심부전 치료 중 진료실 혈압이 130 mmHg 보다 높은 그룹은 그렇

지 못한 그룹에 비하여 9개월 간의 추적 관찰 기간 중 좌심실 역 재형성이 더 많이 발생하였다.

그러나 심부전에서 혈압과 예후 사이의 J 커브 관계가 인과관계가 아니라는 주장도 있다. 이런 현상이 저혈압 자체가 심부전에 예후에 악영향을 주는 것이 아니라 저혈압이 중증 심부전을 비롯한 안좋은 건강 상태를 반영하는 표지자일 수 있다는 것이다. J 커브 현상을 보고한 연구들은 관찰연구들이며, 연구 속성 상 혈압과 예후의 인과 관계를 증명했다고 할 수는 없다. 그리고 수축기 혈압은 심장의 박출량에 의해서 만들어지기 때문에 수축기 혈압은 좌심실 박출량과 밀접한 연관이 있으며, 좌심실 기능을 반영하는 척도가 될 수 있다. 이는 심부전 환자들에서 심장 재동기화 치료(cardiac resynchronization therapy)의 효과를 확인한 임상 연구들에서 확인할 수 있는데, 심장 재동기화 치료에 잘 반응하여 좌심실 기능이 회복된 환자들은 치료 전보다 혈압이 증가하였다. 또한, 심부전 환자들의 치료에서 필수적으로 사용해야 하는 약제들이 모두 혈압을 감소시킨다는 점도 저혈압과

심부전의 인과관계에 의문을 가지게 한다. 물론 그런 약제들이 혈압 감소 목적이 아니라 심부전에서 주요한 신경호르몬계를 조절하기 위한 것이라는 반론이 있기는 하다.

심부전과 고혈압 진료지침들은 심부전 환자에서 혈압 관리에 대하여 아직까지 통일된 권고안을 제시하지 못하고 있다. 아직까지 심부전 환자들에서 포 함된 목표혈압에 대한 무작위 배정 연구가 없기도 하며, 좌심실 박출률에 따라 구분되는 심부전의 종류나 환자들의 특성에 따라서 혈압과 예후에 대한 연구 결과가 매우 이질적이기 때문이다. 심부전이란 질병이 주는 부담이 더욱 커질 것으로 예상되므로, **향후 심부전에서 가장 흔한 동반 질환인 고혈압의 조절과 치료로 인한 저혈압의 관리를 어떻게 할 것인지에 대한 연구들이 앞으로 중요한 이슈가 될 것으로 보인다.**

## Hypertension 2 Hypertension and Heart Failure

» Saturday, Sep 24, 16:10-17:40, 320

ILDONG 일동제약

**텔로스톱플러스** 장

Telmisartan/Amlodipine/Rosuvastatin  
(40/5/5mg, 40/5/10mg, 80/5/5mg, 80/5/10mg)

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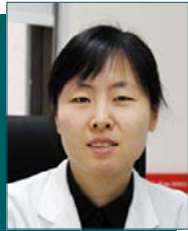
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## Echocardiography

### Echocardiography for the Elderly Population



Jin Sun Park, MD, PhD  
Ajou University  
Medical Center,  
Korea

Aging is associated with progressive changes in the cardiac structure and function. Therefore, understanding the normally expected changes with healthy aging is crucial for risk stratification and management of the elderly. **Echocardiography is of value for noninvasive assessment of cardiac aging.**

With aging, the left ventricular (LV) wall thickens progressively, and LV volumes decrease (Figure 1). Although left ventricular ejection fraction (LVEF) is not affected by age, exercise-induced LVEF augmentation is blunted. Studies using 2D strain have confirmed a reduction in global LV strain with aging. The prevalence of LV diastolic dysfunction increases significantly with age, as shown by the changes in LV myocardial relaxation and chamber stiffness. This is presumably because of impaired sarcoplasmic reticulum function as well as age-related LV fibrosis. As for the left atrial (LA), decreased LA emptying volume with aging has been shown. Studies analyzing the changes in the atrial function with aging showed a reduction in both systolic and diastolic strain and strain rates with aging, reflecting changes in atrial reservoir, conduit and contractile phases.

A sigmoid-shaped interventricular septum is generally considered a normal aging process and is of little clinical significance. However, certain patients with sigmoid-shaped septum may experience clinical symptoms, such as exertional dyspnea and a variety of arrhythmias. Basal-septal hypertrophy may occur in a subset of the elderly population and is considered an age-related anatomic variant. As for the valves, aortic stenosis and mitral regurgitation are the most common valve lesions encountered in the elderly. Senile calcific disease is common and represents a spectrum of pathological changes from hemodynamically insignificant aortic sclerosis to severe, symptomatic aortic stenosis. The prevalence of abdominal aortic aneurysm also increases with aging. Consistently screening the abdominal aorta during echocardiography is beneficial and should be a part of every standard echocardiographic examination in the aging population. Functional or anatomical changes in the cardiovascular system with aging, which can be accelerated by various clinical factors, are associated with increased risk of future clinical events. **Understanding the common findings of the aging heart might be useful to mitigate the escalating burden of cardiovascular disease.**

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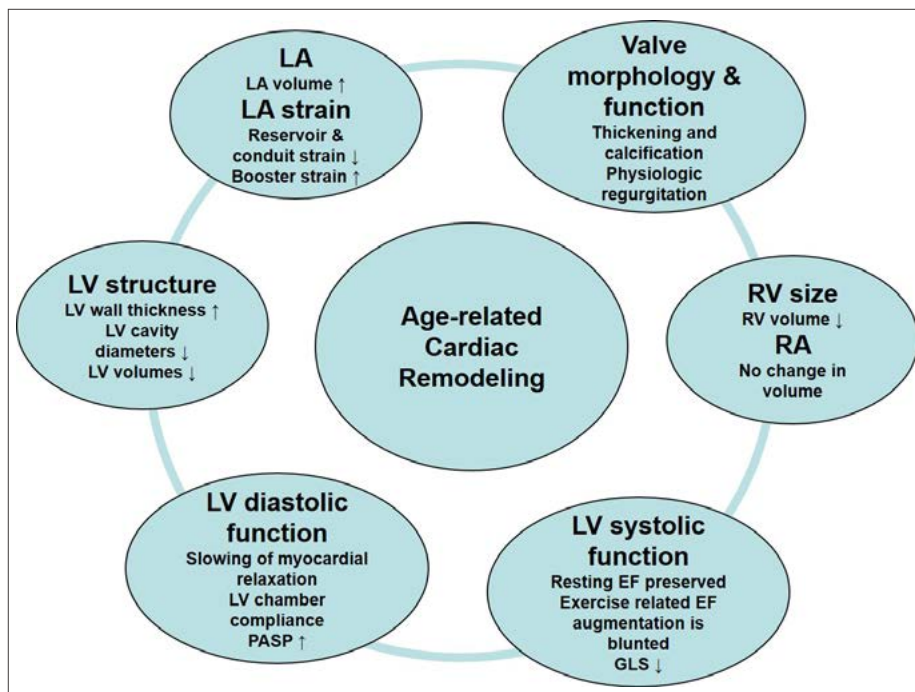


Figure 1. Changes in cardiac structure and function with aging

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#### Echocardiography 3 Echocardiography for Special Populations

» Saturday, Sep 24, 08:30-10:00, 323

### Aortic Root in Aortic Regurgitation



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Korea

**Aortic regurgitation (AR) can result from the primary disease of the aortic valve (AV) and/or abnormalities of the aortic root and ascending aorta. For better understanding and management of AR, we must look beyond the AV to the**

**aortic root.** Aortic root dilatation, especially at the sinotubular junction, can cause malcoaptation of the AV cusps, leading to significant AR. In some cases, both the valvular and aortic root component contribute to AR, such as the bicuspid AV with its associated aortopathy. Causes of aortic dilatation range from degenerative or hypertensive causes to non-syndromic disorders, such as the bicuspid AV disease and rare syndromic genetic disorders like the Marfan syndrome. The pathogenic mechanisms of thoracic aorta dilatation vary and differ from abdominal aorta dilatation in that the role of arteriosclerosis is less significant and the

role of genetic factors are more significant. The research to date suggests that the disruption of extracellular matrix synthesis/assembly of the aorta wall underlie the formation of aneurysm in the thoracic aorta, whereas factors that trigger proteolytic degradation of the extracellular matrix contribute to the formation of abdominal aortic aneurysm. This is consistent with the observation that genetic disorders, which disrupt collagen or elastin synthesis/assembly, are associated mostly with thoracic aortic aneurysms but only to a smaller extent with abdominal aortic aneurysms.

Genetic syndromes associated with aortic aneurysm include Marfan syndrome, Ehlers-Danlos syndrome, Loeys-Dietz syndrome, familial thoracic aortic aneurysms and dissections, bicuspid AV disease, and autosomal dominant polycystic kidney disease. Even in thoracic aortic aneurysm patients without known syndromic disorders, 20% had family history of thoracic aortic aneurysms and an early onset of disease. The bicuspid AV is relatively common with the prevalence around 1% of the general population and can be familial or non-familial. Bicuspid AV is often associated with dilatation of the aortic root and ascending aorta, which may be related to its common embryologic origins.

Thoracic aorta dilatation has also been linked to inflammation and inflammatory diseases. Behcet's disease and large vessel vasculitis such as Takayasu's arteritis and giant-cell arteritis have been associated with development of aortic aneurysms. Behcet's disease is more prevalent in East Asia and the Middle East, and can cause chronic aortic root inflammation with pathognomonic aneurysmal dilatation and destruction leading to severe AR. Syphilitic aortitis was once considered one of the most common causes of ascending thoracic aortic aneurysm but is extremely rare these days.

#### Echocardiography 4 Valvular Heart Disease, Look Beyond the Valve

» Saturday, Sep 24, 10:10-11:40, 323

**Hanmi 한미약품**

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# Lipid

## Air pollution and ASCVD: Need to Upgrade the Risk Status?



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College of Medicine,  
Korea

Air pollution is positively associated with atherosclerosis. In the Multi-Ethnic Study of Atherosclerosis Air Pollution Study (MESA Air), there was a direct link identified between air pollution and atherosclerosis, which is a buildup of plaque in the coronary artery that can evoke a heart attack. Also, air pollution has been recognized as a major risk factor for population health in Asian countries. In a recent study that performed analyses of disease burden for 231 diseases and injuries, and 67 risk factors or clusters of risk factors relevant to China, air pollution was estimated to cause 25,227 thousand of disability-adjusted life-years in 2010, ranking fourth after dietary risk factors, high blood pressure (BP), and tobacco exposure. In addition, extreme heat events are now more frequent because of climate change. Thus, **it is now considered that the combined effects of heat, air pollution, individual age, and socioeconomic and health status are responsible for avoidable acute events of cardiovascular disease (Figure 1).**

Since the pioneering study of Dockery et al. (1993), it has been recognized that prolonged and repeated exposures to air pollutants are associated with premature mortality due to cardio-respiratory diseases, hospital admissions for ischemic heart disease (IHD), and heart-rate variability (HRV). In studies conducted about susceptibility in patients with congestive heart failure, the effect of air pollution on daily mortality due to cardiovascular diseases appeared larger among congestive heart failure patients than among the general population (approximately 2.5-4.1 times higher depending on the pollutants). Several epidemiologic studies also reported that ambient air pollution, even at pollutant levels lower than the standards adopted by most governments, was also associated significantly with hospital admissions for cardiovascular disease among the elderly population, which suggests the insight that the elderly appear to be at particular risk from the effects of air pollution.

However, although many epidemiologic and clinical studies have consistently re-

ported adverse health effects of extreme heat events and air pollution, including fine particulate matter, underlying mechanisms are unclear. A further study should investigate the underlying mechanisms, susceptible group, and combined effects of air pollution, climate change, and health status.

## Need to Approach to Subclinical Atherosclerosis in Different Sites Differently?



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The Progression of Early Subclinical Atherosclerosis (PESA) Centro Nacional de Investigaciones Cardiovasculares (CNIC) -Santander study was launched in 2010 with the aim of harnessing the power of modern imaging technologies to map the progression of atherosclerosis from its earliest stages, and in 2019, PESA was extended for 10 additional years (PESA-HEALTH). PESA is an ongoing longitudinal cohort study integrating serial imaging, and biological and behavioral parameters associated with the progression of subclinical atherosclerosis in a large, middle-aged, asymptomatic population.

PESA recruited 4,184 participants (mean age of enrollment 46 years; 37% women). In the baseline evaluation of the PESA cohort, 63% of the asymptomatic participants (mean age 46 years) showed evidence of atherosclerosis (Figure 2), defined as the presence of atherosclerotic plaque in any of the screened territories by ultrasound (carotids, iliofemorals, aorta) or evidence of coronary arterial calcium (CAC) in the coronary tree by CT (CACS  $\geq 1$ ). Atherosclerosis was more prevalent in men (71% vs. 48% in women). Plaques were more frequent in the iliofemoral territory (44% of subjects), followed by the carotids (31%) and the aorta (25%). Given that the femoral territory is seldom explored in patient screenings, these data have implications for strategies in this area. Indeed, the absence of disease in the iliofemoral territory was strongly associated with the absence of atherosclerosis at other vascular sites.

Imaging modalities, such as 3-dimensional vascular ultrasound (3DVUS) to measure plaque burden and (hybrid) PET/MR to measure vascular inflammation, can play an important role in screening subclinical atherosclerosis. The PESA data show that CACS = 0 should

not be considered an indicator of the absence of atherosclerotic disease, since  $\approx 60\%$  of PESA participants without CAC had plaques at other vascular sites, evaluated by other imaging modalities. In addition, sub-analysis in the advanced imaging sub-cohort revealed that brain hypometabolism assessed by 18-FDG PET was an indicator of cerebrovascular deficiency. This offers a unique possibility to evaluate the association between cognitive dysfunction and atherosclerosis in asymptomatic individuals. According to the PESA study, **comprehensive serial multimodality imaging of multiple vascular territories provides detailed characterization of the extent and regional distribution of early asymptomatic atherosclerosis before and during transition to clinical events.** The PESA cohort has provided data supporting guideline recommendations for plaque detection and primary prevention, but because these are derived predominantly from Caucasian Spanish participants, caution is necessary in generalizing findings to other populations.

### Lipid 1

Under-studied Factors for ASCVD

» Saturday, Sep 24, 08:30-10:00, 320

## How Much Would Cost Effectiveness Be Important for New Lipid Lowering Agents?



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임상의의 입장에서는 개개의 환자들이 모두 중요하지만, 특히 치료방법이 없거나 치료법을 그 환자에게 적용할 수 없을 때 더 안타깝게 느끼게 된다. 치료법이 있는 데 사용하지 못하게 되는 흔한 이유 중 하나가 경제적인 이유일 것이다. 경제적 이유, 특히 비용-효과성이란, 단지 보험급여에 뿐 아니라 치료를 결정하는 매 순간 결정에 영향을 주는 요인이다. 특히 우리나라처럼 국민이 의료보험에 가입되어 있고, 의료비용이 다른 선진국에 비해 상대적으로 낮은 경우에는 보험급여가 되는지 여부가 치료법 선택에 매우 큰 영향을 주게 된다. 개별적인 환자에 대한 치료법 선택이 비용-효과성 분석을 근간으로 하는 경제성 평가에 의해 직접적으로 영향을 받고 있는 것이다.

치료법을 적용할 것인지의 결정은 개개인 환자에 대한 의학적인 판단에서 시작하게 된다. 그러나, 치료법의 실제적용은 의료인과 환자 개개인의

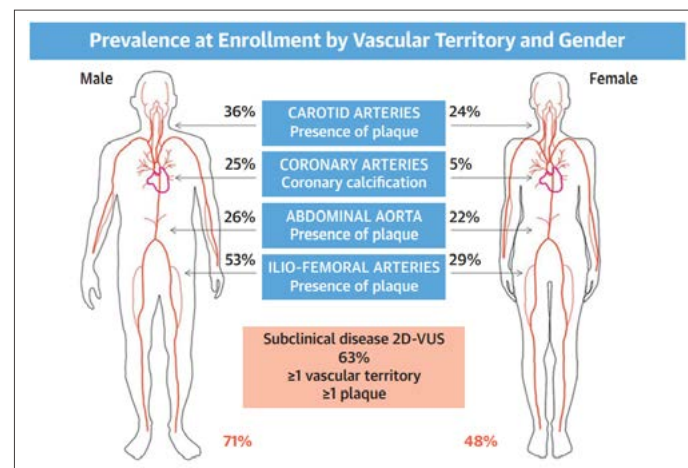


Figure 2. Prevalence and territorial distribution of subclinical atherosclerosis in middle-aged individuals (J Am Coll Cardiol 2021;78:156-179)

사회경제적 여건을 감안하여 안전성, 편의성, 치료비용을 포함하는 광범위한 비용-효과성을 판단하는 과정을 거쳐서 이루어지게 된다. 특히 새로운 치료법의 경우는 고가의 비용이 드는 경우가 많아 경제적 요인이 더 중요한 고려사항이 되고 한다. 일반적으로 비용-효과성에 대한 객관화된 판단은 경제적 가치로 직접 환산이 어려운 생존의 연장, 삶의 질, 질환의 발생 또는 악화와 같은 의학적, 사회적 현상을 화폐 단위로 전환하여 도출된 지표를 근거로 이루어지게 된다. 그러므로, 자연히 사회적, 의학적 가치와 비용을 화폐로 전환하는 과정에서 흔히 갈등과 논란이 발생하게 된다. 공공기관이나 보험자에 의한 비용-효과성의 평가는 흔히 일률적으로 전체 국가경제수준을 기반으로 해당 질병이 없는 일반 국민을 기준으로 이루어질 수 밖에 없다. 따라서 특정 질병을 앓고 있거나 진료하고 있는 의료인의 입장과는 새로운 치료법에 대한 필요성이나 효과에 대한 가치를 낮게 평가하는 경향이 생길 수밖에 없다. 또한 국민의 전체적인 소득 수준이나 의료 경제적 비용에 따라 영향을 크게 받게 되므로, 사회경제적 환경이 다른 개개인의 입장에서는 불만족스러운 경우가 많을 수 밖에 없는 구조이다.

이상지질혈증 치료제 중 경제성 평가에서 최근 언급되었던 약제는 PCSK9 저해제와 REDUCE-IT 연구에서 평가된 omega-3 지방산 제제이다. 이들 두 약제에 대한 비용-효과성을 평가한 다수의 연구들은 비교적 일관되게 상반된 결과들을 보여 주고 있다. 그러나 실제 임상의의 두 가지 약제의 비용-효과성에 대한 판단은 이들 연구결과들과 일치하는 않는 경우가 드물지 않을 것이다. 이는 임상의의 고려대상이 되는 개개인의 질환 상태 및 그 약제의 기대효과 및 가치 평가, 대체치료의 존재 여부에 대한 판단 등에 차이가 있을 수 있기 때문이다. 국내에서도 기존의 협의의 단순 정량화된 비용-효과성 평가에 대한 비판이 있고 새로운 치료나 약제에 대한 사회적 관심과 요구가 커짐에 따라 최근에는 보험급여 여부에 치료의 대체 가능성, 사회적 요구도 등을 고려하고 있다. 예를 들면 출전스마나 CAR-T치료 등의 보험급여 결정 등이 그 예로 생각되는데, 이처럼 객관화가 쉽지 않은 사회적 요구도 등의 요소가 급여여부 결정에 반영이 되면서, **현재 방식의 협의의 보험공급자 입장의 비용-효과분석이 아닌 광의의 비용-효과성에 대한 이해와 사회적 논의의 필요성이 커지고 있다.**

### Lipid 2

Personalize or Aggressive Lipid Lowering for Net Benefit?

» Saturday, Sep 24, 10:10-11:40, 320

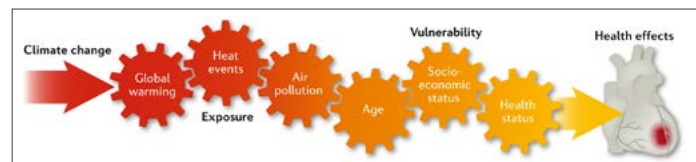


Figure 1. Factors contributing to the cardiovascular risks of climate change (Nat Rev Cardiol 2021;18:1-2)

## Pediatric Cardiology

### Pacemaker Follow Up and Programming



Ji-Eun Ban, MD, PhD  
Ewha Womans University Mokdong Hospital, Korea

The method of **cardiovascular implantable electronic devices (CIEDs) follow-up assessment depends on clinical, technical factors, and type of CIEDs**. Currently, CIEDs are capable of remote interrogation and monitoring (RIM), as well as in-person

evaluation (IPE), but until now, there are no established guidelines for CIED follow-up in the pediatric population. However, a recent expert consensus statement has been published on the indication and management of CIEDs in pediatric patients (Figure 1).

Ancillary testing is also important to evaluate the impact of CIED-related problems. It consists of 12-lead electrocardiogram (ECG), echocardiogram, ambulatory rhythm monitoring, chest X-ray, and exercise stress testing. Additionally, the annual IPE should evaluate the patient's underlying rhythm (Class I). In patients who have >40% paced ventricular rhythm, it is reasonable to assess systemic ventricular function by echocardiogram every 1-3 years (Class IIa). It is also reasonable to consider lead surveillance with chest X-ray in the acute post-implant period and to consider repeating every 1-3 years according to growth (Class IIa). Ambulatory rhythm monitoring and/or exercise stress testing may be useful in patients with arrhythmia concerns or symptoms related to activity and to assist with device optimization (Class IIb).

It is also noted that the device should be interrogated using the appropriate programmer and software. Pacing lead impedance, sensed P/R wave amplitude, pacing threshold, and battery voltage and impedance should be evaluated and recorded and considered as minimum essential data for follow-up. In the first analysis, endocardial or epicardial electrograms will be performed followed by pacing lead integrity. In the majority, this will be presented with a calculated impedance value. The adequate pacing and sensing parameters should be recorded. And this will be compared with previously recorded values and then an analysis of trends of potential problems may be predicted. Therefore, during routine follow-up, specific problems should be identified with adequate pacemaker system programming.

#### Pediatric Cardiology 1 Cardiac Implantable Electronic Devices (CIED) in Children

» Saturday, Sep 24, 08:30-10:00, 322

### Epidemiology and Etiologies of SCD in the Young



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Sudden cardiac death (SCD) is defined as a rapid and unsuspected death due to a cardiovascular cause, typically within 1 hour from the onset of symptoms and usually occurring in a patient previously considered healthy. SCD in children and adolescents are relatively rare, with reported incidence of approximately 2 per 100,000 person-years. Approximately 60%

to 75% of childhood SCD victims are male. However, SCD can be differentiated in the pediatric population based on age, with variable etiologies (Table 1). **General etiologic categories of SCD include heritable and acquired cardiomyopathies and arrhythmia syn-**

**Table 1.** Cardiac Disorders Predisposing to Pediatric and Young Adult SCA. (Adapted from Pediatric sudden cardiac arrest. Pediatrics 2012;129:e1094-1102)

#### Structural/functional

Hypertrophic cardiomyopathy  
Coronary artery anomalies  
Aortic rupture/Marfan syndrome  
Dilated cardiomyopathy or restrictive cardiomyopathy  
Myocarditis  
Left ventricular outflow tract obstruction  
Mitral valve prolapse  
Coronary artery atherosclerotic disease  
Arrhythmogenic right ventricular cardiomyopathy  
Postoperative congenital heart disease

#### Electrical

Long QT syndrome  
Wolff-Parkinson-White syndrome  
Brugada syndrome  
Catecholaminergic polymorphic ventricular tachycardia  
Short QT syndrome  
Complete heart block

#### Other

Drugs and stimulants  
Primary pulmonary hypertension  
Commotio cordis

### dromes (channelopathies), structural congenital heart diseases, myocarditis, and coronary abnormalities.

Population-based studies suggest that while the majority of SCD from identifiable morphologic abnormalities are found during autopsy, one-third and perhaps as many as half of sudden deaths involving previously healthy children and adolescents are autopsy-negative sudden unexplained death. Other studies involving the evaluation of relatives and molecular autopsy investigations of the decedent show that identifiable and potentially treatable cardiac channelopathies account for approximately one-third of autopsy-negative SUD in the young. Preventive strategies to reduce SCD include primary screening to identify and intervene in high risk individuals. It has been reported that 4.5% of children with SCD had a positive family history of SCD in a first-degree relative. Screening of first-degree relatives after cardiac arrest of a young person may identify cardiac pathology in 15-40% of cases.

### Workup and Risk Stratification for SCD in CHD



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Sudden cardiac death (SCD) is indeed a catastrophic situation. The underlying vulnerability of cardiac structural problems, various genetic predispositions, eclectic hemodynamic factors, and arrhythmic sub-

strates contribute to the situation. Surveillance planning and screening through the electrocardiogram, echocardiography, and several imaging modalities can determine the potential cardiovascular risk. In addition, a meticulous history taking and detailed family history check can lead to clues to predict the risk of SCD.

SCD with congenital heart disease (CHD) is reported to be relatively rare. CHD is classified as simple heart disease or

complex heart disease according to the severity and complexity of the condition. The higher the complexity of abnormal heart structure, the higher the skill is needed for surgical correction, which can increase the risk of SCD. Based on several studies, high-risk candidates are tetralogy of fallot, transposition of great arteries, cyanotic heart disease, congenital corrected transposition of great arteries, and Fontan patients. Factors exposed to the fetus, postnatal hemodynamic instability, myocardial scars, ischemia, and fibrosis after correction operation, decreased pump function, and predisposition to primary arrhythmias can cause SCD in CHD patients.

Although research on the genetic factors is still in progress, there have been remarkable achievements. Based on several studies, genes which are related to the syndromes associated with CHD, involved in the neurohormonal factors, and associated with the fragile pump function such as cardiomyopathy are being revealed. Additionally, there are cardiogenic causes and non-cardiogenic causes of SCD in CHD patients.

It is absurd to prevent all with perfect predictions of SCD. However, **future research, identifying risk factors, and timely intervention with multifaceted aspects can reduce SCD events in CHD patients and save lives.**

#### Pediatric Cardiology 2 SCD in Pediatric Population

» Saturday, Sep 24, 10:10-11:40, 322

CIED Follow-up Recommendations	
I	In-person evaluation (IPE) and the establishment of remote interrogation and monitoring (RIM) are recommended within 2-4 weeks post CIED implantation.
I	At least one annual IPE of all CIEDs is recommended.
I	RIM is recommended for all patients with a CIED that has been recalled or has an advisory to enable early detection of actionable events and confirm proper device function.
I	RIM of CIEDs is recommended every 3-12 months for pacemakers and 3-6 months for ICDs. Frequency should be increased (every 1-3 months) for CIEDs approaching elective replacement indicators.
I	It is recommended that allied health care professionals possess International Board of Heart Rhythm Examiners certification or equivalent experience if they provide RIM and are involved in patient management decisions.
CIED Ancillary Testing Recommendations	
I	Evaluation of the intrinsic cardiac rhythm evaluation is recommended during CIED interrogation at the annual IPE.
IIa	A standard 12-lead ECG is reasonable at annual in-person evaluation.
IIa	Two-view chest X-ray is reasonable at the first post-implant IPE and every 1-3 years based on patient-specific considerations.
IIa	An echocardiogram is reasonable for assessment of ventricular function in patients who have >40% ventricular paced rhythm every 1-3 years.
IIb	Exercise stress testing and ambulatory ECG monitoring may be considered in patients with symptoms suggesting possible device malfunction or to assist with device programming.

**Figure 1.** 2021 PACES Expert Consensus Statement on the Indications and Management of Cardiovascular Implantable Electronic Devices in Pediatric Patients (Heart Rhythm 2021;18:1888-1920)



## ACHD

### Recent Guideline Update for Heart Failure in ACHD



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University Hospital,  
Korea

**Heart failure (HF) is a common problem affecting 20-50% of the adult congenital heart disease (ACHD) population and an important cause of death. The incidence is increasing and is probably underestimated. The patho-**

**physiology of cardiac dysfunction in ACHD is often different from non-congenital heart disease, in those with a systemic right ventricle (RV), failing sub pulmonary ventricle, single ventricle, surgery-related injury, chronic pressure/volume overload in systemic and sub-pulmonary ventricles,**

and those with hypertrophy or non-compaction induced by gene mutations. Therefore, **extrapolation of current HF treatment guidelines to ACHD patients is not always appropriate.**

**Therapeutic recommendations should follow the general HF guideline.** Patients with an impaired systemic left ventricular (LV) function in the biventricular circulation or failing systemic right ventricle (RV) are generally treated with the conventional HF therapy. But **the effect of long-term use of RAS blockers or beta blockers on the clinical outcome remains unknown.** Due to availability of **only a few small studies looking at sacubitril/valsartan, there is no treatment recommendation for ACHD HF patients.** Treatment of symptomatic patients with a single failing ventricle in the Fontan circulation or a persistent right-to-left shunt should al-

ways be carefully initiated, taking the labile balance of the ventricular preload and systemic afterload into account. Cardiac resynchronization therapy (CRT) may be a therapeutic option in ACHD HF patients, despite little evidence on indications and outcomes. **Efficacy of CRT in CHD may vary with the underlying structural and functional substrate.** Treatment of acute HF in ACHD patients should be considered with ACHD expertise and timely evaluation for transplantation by ACHD HF specialists. **Ventricular assisting devices can bridge patients to transplantation, or in a subgroup of patients, and may be an option as destination therapy.**

#### ACHD 1

Trend in Cardiovascular Issues in ACHD

» Saturday, Sep 24, 14:30-16:00, 321

### Cone repair. Do Not Be Too Late in Adults with Ebstein Anomaly



Chang Ha Lee  
Bucheon Sejong  
General Hospital,  
Korea

Ebstein anomaly is a malformation of the tricuspid valve (TV) and right ventricular (RV) dysplasia with extreme anatomical variability. Adults with Ebstein anomaly and significant tricuspid regurgitation (TR) should be treated with

a more aggressive surgical approach because cone repair produces excellent short- and medium-term results. Though cone repair requires a certain learning curve, Ebstein anomaly can be repaired reproducibly by bringing the TV leaflets to the true

Continued on page 15

Continued from page 12

### Newer Drugs in Chronic Heart Failure & Current Practice - Which Drug for Which Patient?



Joowon Lee, MD  
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University Bundang  
Hospital, Korea

Heart failure (HF) can occur in children with various diseases, including congenital heart disease, myocarditis, and cardiomyopathy. Since limited data on pediatric HF are available, the medical therapy for HF in pe-

diatric patients is occasionally extrapolated from adult HF studies. Studies on HF management for patients with single ventricle physiology or with systemic right ventricle are also sparse. Standard HF treatments are composed of blocking the renin-angiotensin-aldosterone system and reducing prolonged neurohormonal activation (**Figure 2**). In addition, diuretics are useful for patients with fluid retention, and digoxin might be used in symptomatic patients after standard HF treatments.

Angiotensin receptor neprilysin inhibitor (ARNi) and sodium-glucose co-transporter 2 (SGLT-2) inhibitor have been proven to reduce mortality and HF hospitalization in adult HF with reduced ejection fraction (HFrEF) patients. The use of ARNi in HF patients aged 1 year and older was approved based on the interim data of the PANORAMA-HF trial. Clinical trials of SGLT-2 inhibitors, however, are ongoing in patients aged 10 years and older with type 2 diabetes, not in those with HF. Ivabradine, a sinoatrial node modulator, can be used in children aged 6 months and older with HFrEF and tachycardia with b-blocker therapy. Vericiguat – an oral soluble guanylate cyclase stimulator – and omecamtiv mecarbil – a direct activator of myosin – reduce HF hospitalization in adult HFrEF patients.

The goal of acute decompensated HF treatment is to address fluid overload, under perfusion, or both. Intravenous inotropic support should be used to maintain systemic perfusion. Loop diuretics, occasionally combined with thiazide, are

useful for patients with fluid overload. Vasodilators may be considered in patients without hypotension to ameliorate pulmonary congestion. Levosimendan, a calcium-sensitizing agent, provides inotropic support and reduces cardiac afterload by vasodilatation. Istaroxime, a derivative of androstenedione with both inotropic and lusitropic properties – and natriuretic peptides – carperitide and ularitide – demonstrated beneficial effects in phase II clinical trials of adult HFrEF patients. HF in children is a serious clinical condition with heterogeneous etiologies. **Ade-**

**quate selection of pharmacologic therapies for HF treatment and the introduction**

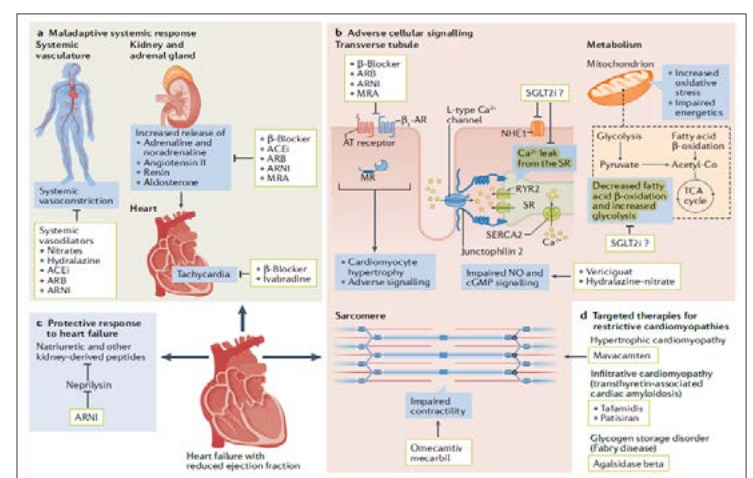


Figure 2. Heart failure therapeutics and their mechanisms of effect (Nat Rev Cardiol 2021;18:745-762)

**of new HF medications for the pediatric population are essential to improve the outcomes of HF in children.**

#### Pediatric Cardiology 3 Advance in Pediatric Heart Failure

» Saturday, Sep 24, 12:50-14:20, 321

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## Intervention

### Device Delivery in Tortuous Complex PCI



**Kook-Jin Chun, MD, PhD**  
Pusan National University Yangsan Hospital, Korea

Many techniques have evolved to overcome challenges associated with complex anatomies and lesions. Selection of an appropriate guide catheter is the single most important step that determines the success of an interventional procedure.

Larger sized catheters (7-8F) provide higher passive back-up than smaller sized catheters. The extra-backup catheters like Amplatz, EBU, PB, and SPB catheters should be prepared.

From the technical aspect, the buddy wire technique is the first to be used. The technique is especially useful in tortuous vessels where it straightens the vessel tortuosity and acts as a track that directs the stent away from the vessel wall, thereby facilitating the delivery of angioplasty equipment. The anchor balloon technique involves the use of an extra balloon for anchorage, in addition to the stent to be deployed. In most cases, the balloon should be inflated within the target lesion to minimize the risk of injury to the target artery. While a large guide catheter provides good passive support, it may not be useful for deeper intubation. A smaller catheter may be used for deep intubation but provides poor back-up support on its own. The Mother-Child technique combines the advantages of both and involves a longer "Child Catheter" introduced within a bigger and conventional length "Mother Catheter". Guideliner™ and Gudezilla™ basically function as a guide extension with a monorail design analogous to a rapid exchange balloon catheter that works based on the "Mother-Child" principle. It is a 145 cm device with a 20 cm single lumen catheter attached to a stainless-steel shaft. It can be used as a rapid exchange device over the guide-wire. It is recommended, as a precaution, not to introduce the catheter more than 10 cm beyond the tip, as Guideliner™ can get stuck in the guide catheter (generally in the second curvature of the catheter). An intubation beyond 20 cm completely externalizes the tube with the metal collar to the vessel, causing severe damage.

In summary, preferences need to be individualized, the sequence could be as fol-

lows: **extra backup guide, buddy wire, anchor balloon, rapid exchange extension catheter, monorail, Mother and Child catheter, and finally combination of these techniques.** The approach also depends upon the coronary anatomy, origin, calcification, location of lesion from ostium, previous stenosis, coronary ectasia in addition to aorta size, tortuosity of iliac and subclavian arteries.

#### Intervention 4

##### Tips and Tricks of Complex PCI Treatment

» Saturday, Sep 24, 12:50-14:20, 325CD

### STEMI Non-Culprit PCI Should Be Guided by Imaging



**Eun Ho Choo, MD, PhD**  
The Catholic University of Korea Seoul St. Mary's Hospital, Korea

The fractional flow reserve (FFR) measurement of non-culprit lesions (NCL) has been extensively and safely used in large, randomized trials to guide complete revascularization in the ST-elevation myocardial infarction (STEMI) setting, resulting in lower acute and repeat revascularization rates compared to angio-guided revascularization. However, the diminished sensitivity of the purinergic adenosine receptors associated with an increased level of endothelin-1, higher left ventricular end-diastolic pressure, and myocardial edema may all contribute to a decreased hyperemic flow in the NCL and a consequent underestimation of their FFR significance in the acute STEMI setting.

Moreover, the recently published FLOW-ER-MI trial showed that the FFR-guided strategy did not have a significant benefit over the angiography-guided strategy with respect to the risk of death, MI, or urgent revascularization at 1 year. NCL deferred percutaneous coronary intervention (PCI) by FFR guidance had a higher risk of MI and revascularization than NCL with PCI. Previous studies demonstrated that NCL in STEMI have a higher risk of major adverse cardiac event rates (MACE) than those in stable coronary disease, which is associated with a higher incidence of vulnerable plaque in NCL in STEMI.

STEMI patients may have underlying ruptured or eroded plaques also in NCL. The PROSPECT study demonstrated that non-angiographic significant NCL with a

large plaque burden, a small luminal area, or a combination of both features detected by intravascular ultrasonography imaging were associated with the same MACE rates of culprit lesions at three-year follow-up. Both systemic effects and local inflammation of NCL in STEMI patients might contribute to plaque instability. A sub-analysis from the COMPLETE trial showed that nearly half of the patients undergoing optical coherence tomography (OCT) had an obstructive non-culprit lesion (>70% visual diameter stenosis) with vulnerable plaque. These findings may explain the reduced MI rates associated with a strategy of routine PCI of obstructive NCL.

**One wonders if plaque stabilization with stenting is more important than relieving the obstructive coronary lesion as determined by angiography or FFR.** Assessment of plaque instability with intravascular imaging using markers like plaque burden, cap thickness, and lumen area could play a role in future trials to determine the outcome of complete revascularization in patients with STEMI. Besides determining plaque stability, intravascular imaging has improved PCI outcomes in patients with STEMI.

Imaging guidance for NCL may be an option to decide on PCI in STEMI with multivessel disease. Further studies are in need to address this issue.

### FFR as Good as IVUS for PCI Optimization



**Hong Seok Lim, MD, PhD**  
Ajou University Medical Center, Korea

To maximize the benefit of percutaneous coronary intervention (PCI), appropriate selection of target lesions and procedural optimization are essential. Coronary angiography (CAG) is the standard method for evaluating coronary artery disease and is always performed before PCI. However, there are several limitations to the use of angiographic measurements in evaluating the severity of coronary stenosis. Fractional flow reserve (FFR) and intravascular ultrasound (IVUS) are the most popular and useful adjunctive tools for interventional cardiologists to overcome the limitations of CAG. Treatment strategy should be determined with objective evidence of inducible ischemia to improve clinical outcomes, symptoms, and cost-effectiveness

by avoiding potential risks related with unnecessary procedures, particularly in cases of intermediate stenosis.

FFR by pressure-wire technology is the most verified index to date in invasively evaluating lesion-specific myocardial ischemia. It provides useful guidance for determining the treatment strategy in various clinical subsets of patients and coronary lesions, thus is recommended by major guidelines to detect ischemia-producing lesions. IVUS is the most widely used intracoronary imaging method to guide and optimize PCI. It can evaluate the minimum stent area (MSA), stent under-expansion, edge problems and malapposition immediately after PCI. IVUS-guided PCI can improve clinical outcomes compared to an angiography-guided PCI. Thus, 'FFR-guide decision and IVUS-guided optimization' can be the best strategy.

What if either FFR or IVUS is used but not both? Is FFR as good as IVUS to optimize drug-eluting stent (DES) implantation? Previous studies consistently showed higher rates of adverse cardiac events in patients with low post-PCI FFR values. In addition to significant residual disease resulting in suboptimal post-PCI FFR, problematic stenting such as stent underexpansion, incomplete lesion coverage and edge dissection can be detected by post-PCI FFR values. It has been demonstrated that stent malapposition, stent symmetry, and MSA assessed by IVUS were significantly correlated with post-PCI FFR. Therefore, FFR gradient across the stented segment is associated with in-stent luminal status immediately after PCI, and possibly with clinical outcomes related to the target lesion. The recent FLAVOUR trial demonstrated noninferiority of FFR-guided PCI in terms of the composite outcome of death from any cause, myocardial infarction, or revascularization at 2 years with lower rate of PCI than in the IVUS group. In this head-to-head comparison, the suitability of FFR in determining whether a stent has been successfully implanted was reassessed and there were no apparent differences in the frequency of revascularization during the follow-up period. These results suggest that FFR is comparable with IVUS to optimize DES PCI in patients with intermediate coronary artery disease.

#### Intervention 5

##### Rethink Coronary Imaging and Physiology Collaboration

» Saturday, Sep 24, 14:30-16:00, 325CD



# Arrhythmia

## LBBAP for Heart Failure



이소령 교수  
서울대학교병원

Left bundle branch area pacing (LBBAP) is conduction system pacing (CSP)의 한 종류로 최근 다수의 관찰 연구에서 그 안전성과 효과가 발표되고 있고, pacemaker 삽입 후 심실조율 비율이 높을 것으로 예상되는 환자에서 pacemaker induced cardiomyopathy (PIC)의 위험을 감소시킬 것으로 기대되고 있다. LBBAP는 정상 심기능 환자의 pacemaker 치료 시에 PIC 위험을 감소시키기 위한 옵션으로 고려될 뿐만 아니라, inter-ventricular dyssynchrony가 있는 heart failure with reduced ejection fraction (HFrEF) 환자에서 성공적인 cardiac resynchronization therapy (CRT)를 달성하기 위한 옵션으로도 고려되고 있다. 전통적인 CRT는 biventricular pacing (BVP)이며, 이는 심부전 환자에 널리 행해지고 있는 치료이다. 하지만 BVP-CRT를 받은 환자 중 30%는 치료에 반응하지 않거나 악화 경과를 밝기도 한다. 적절한 coronary sinus branch가 없는 경우, 적절한 branch selection이 되더라도 phrenic nerve stimulation을 피할 수 없는 경우 등과 같은 해부학적 한계로 BVP가 성공하지 못할 경우가 있으며, right bundle branch block이 있는

HFrEF나 narrow QRS이면서 심실조율이 필요한 하위 집단에서는 전통적인 BVP-CRT 치료가 유의미한 이득을 가져다주지 못할 수 있다. HFrEF에서의 CSP의 역할에 대한 연구는 LBBAP에 앞서 his bundle pacing (HBP)으로 시작되었다. 다양한 관찰 연구에서 HBP가 성공적으로 QRS duration을 줄이고 심부전의 증상을 호전시키는 치료로서 유효하다는 것이 입증되었고, LBBAP는 HBP와 비교하여 시술의 편의성, 보다 높은 성공률, 보다 안정적인 V threshold를 보이며, distal conduction system disease가 있는 환자에게서 synchronized left ventricular activation을 성취하는데 있어 유리할 수 있어 HBP를 빠르게 대체하고 있다. 최근 발표된 관찰 연구에 따르면, **HFrEF에서 이미 그 효과가 입증된 BVP-CRT에 비해 CSP (HBP 34%, LBBAP 66%)가 더 좁은 paced QRS duration을 달성하였고, 더 큰 left ventricular ejection fraction (LVEF) 호전을 보였으며, 사망과 심부전으로 인한 입원 위험이 낮았다**(Vijayaraman P, et al. Heart Rhythm 2022) (Table 1). 또한, BVP에 반응하지 않았거나 coronary sinus lead 삽입이 적합하지 않은 환자를 대상으로 LBBAP를 rescue therapy로 시행하였을 때 LBBAP는 더 좁은 paced QRS duration을 달성하였고 유의미한 LVEF 호전을 보였음이 최근 발표되었다(Vijayaraman P, et al. Heart Rhythm 2022). 심부전 환자에서 LBBAP의 역할에 대한 관찰 연구 결과가 다양하게 발표되면서 이에 대한 관심이

높아지고 있으나 아직 표준 치료로 소개하기에는 넘어야 할 산이 남아있다. 대규모 무작위배정 임상 연구 데이터가 아직 없는 점, 대부분의 관찰 연구 결과가 CSP 및 LBBAP 시술의 경험이 많은 선택된 그룹의 데이터에서 도출된 결과인 점, 그리고 장기 추적관찰 결과가 없는 점을 들 수 있겠다. 최근 국내에서도 LBBAP를 필두로 한 CSP가 활발히 이루어지고 있어 향후 몇 년간 새롭게 발표될 무작위배정 임상 연구 결과 및 국내 경험을 바탕으로 한 다양한 경험의 공유가 기대된다.

Arrhythmia 4

CIED (Debate Session)

» Saturday, Sep 24, 08:30-10:00, 325AB

## Cryoballoon Ablation & Pulse-field Ablation



Kyoung-Ryul Julian Chun, MD  
Cardioangiologisches Centrum  
Bethanien, Germany

Catheter ablation of atrial fibrillation (AF) is evolving as the first-line therapy with proven benefits demonstrated in numerous randomized clinical trials. The advent of novel technologies such as the single shot cryobal-

loon has been a key driver in the field increasing safety and reproducibility of pulmonary vein isolation (PVI) worldwide. However, as with all thermal ablation energy sources, cryoballoon PVI may be related to side effects such as esophageal lesions and phrenic nerve palsy. In contrast, the recently re-discovered pulsed field ablation (PFA) energy source potentially eases single shot PVI, while increasing safety due to its non-thermal ablation. The so-called 5S strategy aims to investigate the safety and feasibility of single shot anatomic PFA ablation. Initial clinical experience in a large all-comer AF patient cohort, including mechanisms of patients with atrial tachyarrhythmia recurrence will be reported.

Arrhythmia 5

Current Management of Atrial Fibrillation

» Saturday, Sep 24, 10:10-11:40, 324

Table 1. Left bundle branch area pacing in patients with heart failure

Study	Design	Indication	N	Success rate	Follow-up (months)	Echocardiographic and hemodynamic (mean results)	ECG/QRSd	Outcomes
Vijayaraman et al. 2019	Single center Prospective Observational	LBBP for bradycardia or CRT (11%) if CS lead or HBP failed LBBB 24% RBBB 25% IVCD 8% AV block 61%	100	93%	3	n/a	QRSd 133 to 136 ms [LBBB subgroup] QRSd 162 to 137 ms	LBBP feasible Low thresholds observed
Huang et al. 2020	Multicenter Prospective Observational	Non-ICMP LBBB LVEF <50%	63	97%	12	LVEF 33 to 55% LVESV 123 to 67 mL	QRSd Baseline 169 ms LBBP 118 ms	NYHA 2.8 to 1.4 LBBP may be a reasonable therapy for patients with LBBB and non-ICMP
Wu et al. 2020	Prospective Observations Case control	CRT with BVP, HBP or LBBP in LVEF <40%, LBBB	137	100%	12	ΔLVEF 24%	QRSd Baseline 166 ms LBBP 111 ms	Echo outcomes were similar to HBP and significantly greater than BVP
Vijayaraman et al. 2021	Multicenter Retrospective Observational	CRT pacing LVEF <50%	325	85%	6	LVEF 33 to 44% LVEF 27 to 40% in patients with LVEF ≤35% Response 73% Super-response 31%	QRSd 152 to 137 ms [LBBB Subgroup] QRSd 162 to 133 ms	NYHA 2.7 to 1.8 LBBB (OR 3.96, p<0.01) LVEDD (OR 0.62, p<0.01) were independent predictors of response LBBP may be a reasonable CRT alternative
Vijayaraman et al. 2022	Multicenter Retrospective Observational	LBBAP in patients with conventional CRT indication who failed BVP because of CV lead complications or lack of therapeutic response to BVP	200	n/a (Patients with successful LBBAP were included)	12	LVEF 29% to 40%	QRSd 170 to 139 ms	n/a
Vijayaraman et al. 2022	Multicenter Retrospective Observational		477	n/a (Patients with successful CSP or BVP were included)	27	ΔLVEF 39.7% in CSP vs. 33.1% in BVP	QRSd 133 ms in CSP vs. 153 ms in BVP	Heart failure hospitalization 28.3 in CSP vs. 38.4% in BVP

Continued from page 13

tricuspid annulus level and performing longitudinal plication of the atrialized RV (Figure 1). According to the recent guidelines

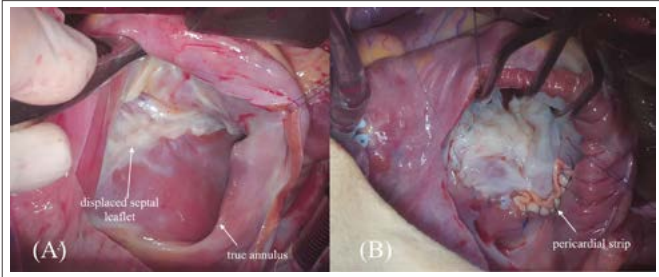


Figure 1. Cone repair in Ebstein anomaly. Before surgery, displaced septal leaflets of TV are attached at the ventricular septum far from the true annulus (A). After cone repair, TV leaflets are mobilized and reattached 360 degrees at the true annulus and reinforced with a pericardial strip (B).

for adults with Ebstein anomaly, surgical repair is recommended in patients with severe TR and symptoms or objective deterioration of exercise capacity, and should be considered regardless of symptoms in patients with progressive right heart dilation or reduction of RV systolic function. Although not reflected in the guidelines, there are a few more considerations about the

timing of the surgery. The first is that since this malformation affects not only the RV but also the LV, surgery should be considered to improve the LV function, which can be called the "LV indication." Improvements in LV stroke volume and desynchrony were observed in patients who underwent the cone repair, which contributes to better long-term morbidity and mortality. Secondly, in adults with Ebstein anomaly, RA dysfunction and RV diastolic dysfunction are associated with biventricular systolic dysfunction and impaired exercise capacity. About one-third of patients with Ebstein anomaly and severe TR had shown post-

operative improvement in aerobic capacity, and atrial function indices were the best predictors of postoperative improvement in aerobic capacity, suggesting the atrial function should also be used in determining the timing of TV surgery. **I like to conclude that given the excellent outcomes of cone repair, surgery should be considered proactively in adults with Ebstein anomaly before any maladaptive remodeling of the ventricles or atria proceeds.**

ACHD 2

Ebstein Anomaly in Adults

» Saturday, Sep 24, 16:10-17:40, 322

# 2023 춘계심혈관통합학술대회

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