CIED Treatment in HF patients
: At the view point of HF physicians

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Severance Cardiovascular Hospital,
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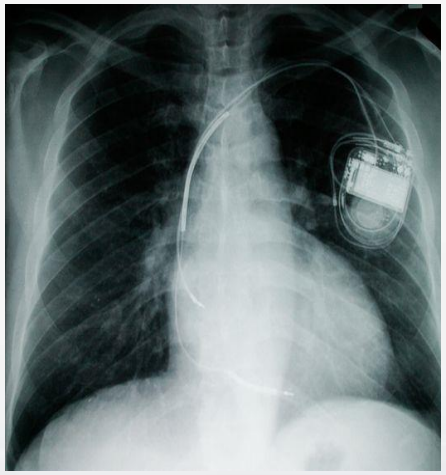
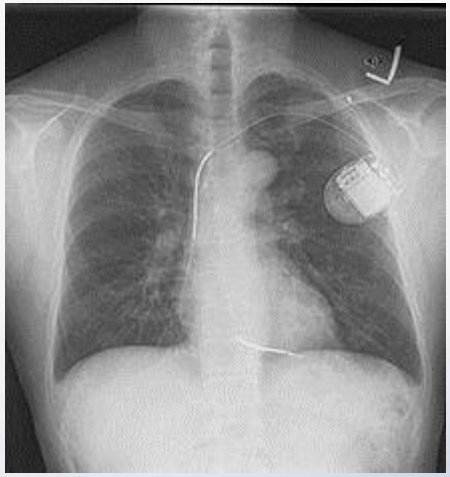
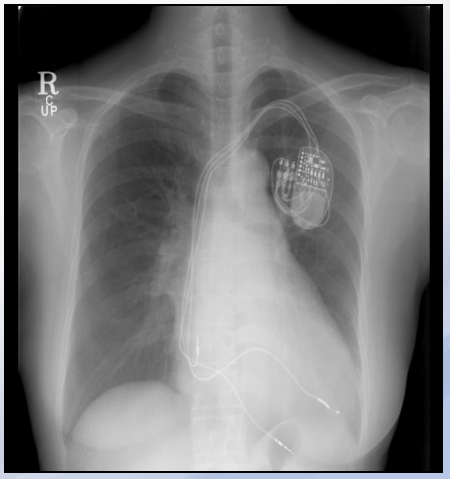
Seoul, Korea

CIED

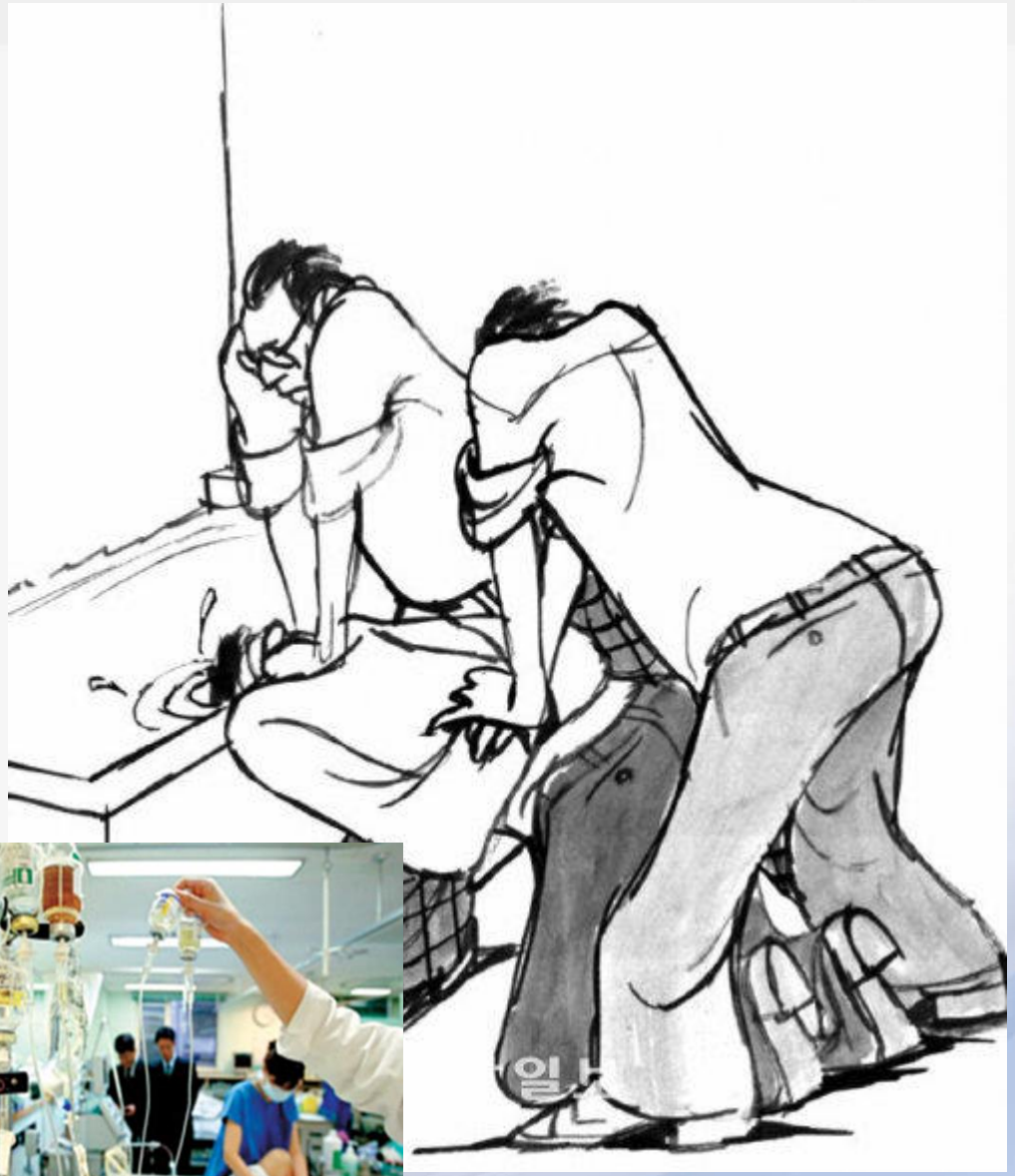
- **Pacemaker**
- **Implantable cardioverter-defrillator (ICD)**
- **Cardiac resynchronization device (CRT)**
- **Implantable cardiovascular monitor (ICM)**
- **Implantable loop recorder (ILR)**







HF specialists



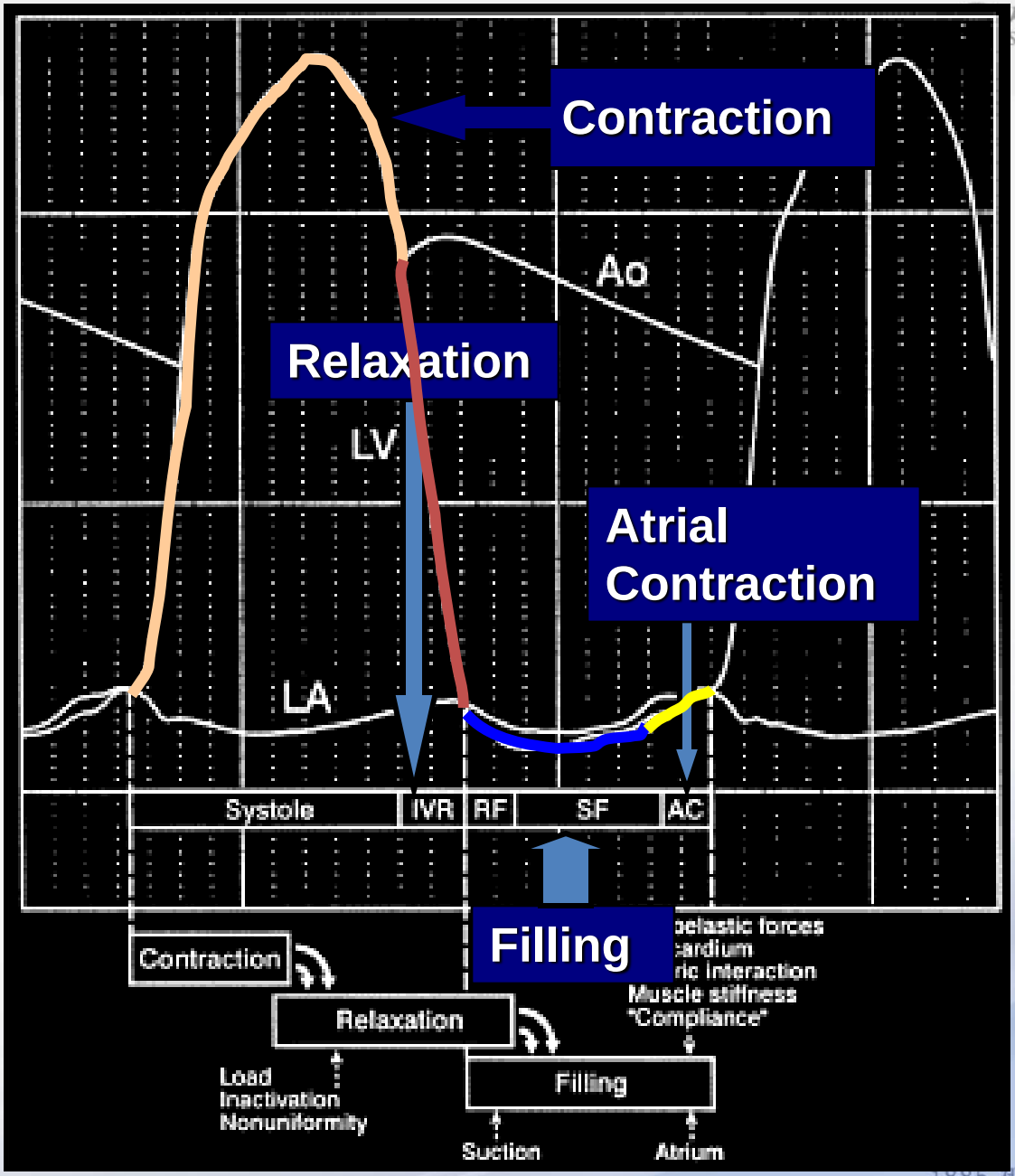
Contents

- What is heart failure ?
  : at the view point of HF physician
- CIED data in Severance CV Hospital
- Clinical HF Cases treated by CIED
- Indications of CIED in HF patients
- Major concerns of CIED treatment in HF patients

Cardiac cycle:

- Contraction
- Relaxation
- Filling
- Atrial

  Contraction

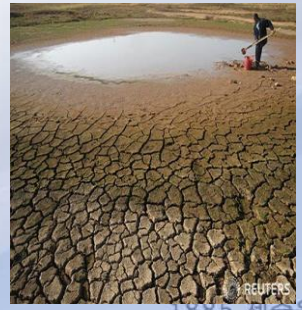


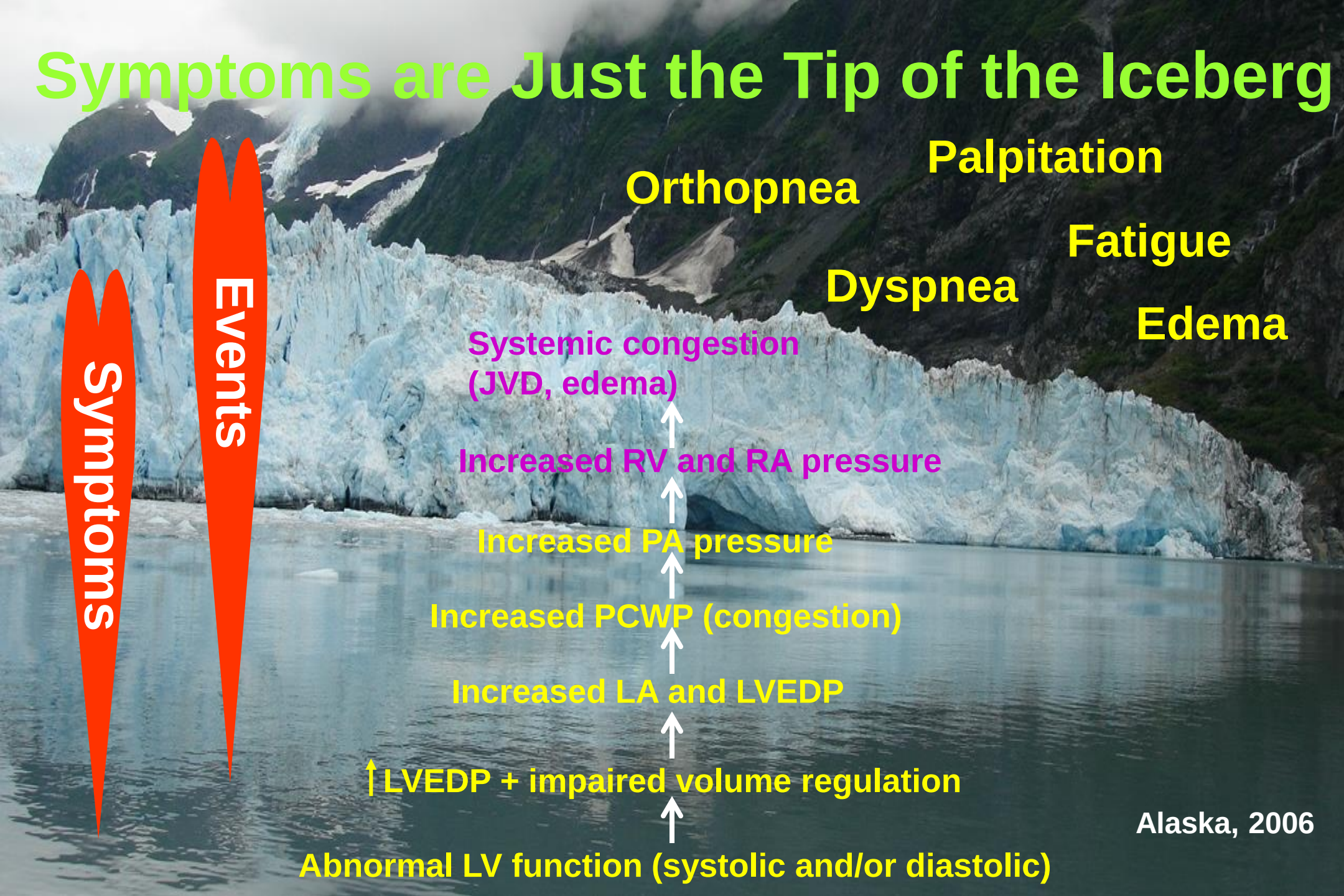
Three Pathophysiological Causes of Heart Failure

- Increased work load (pre & afterload)

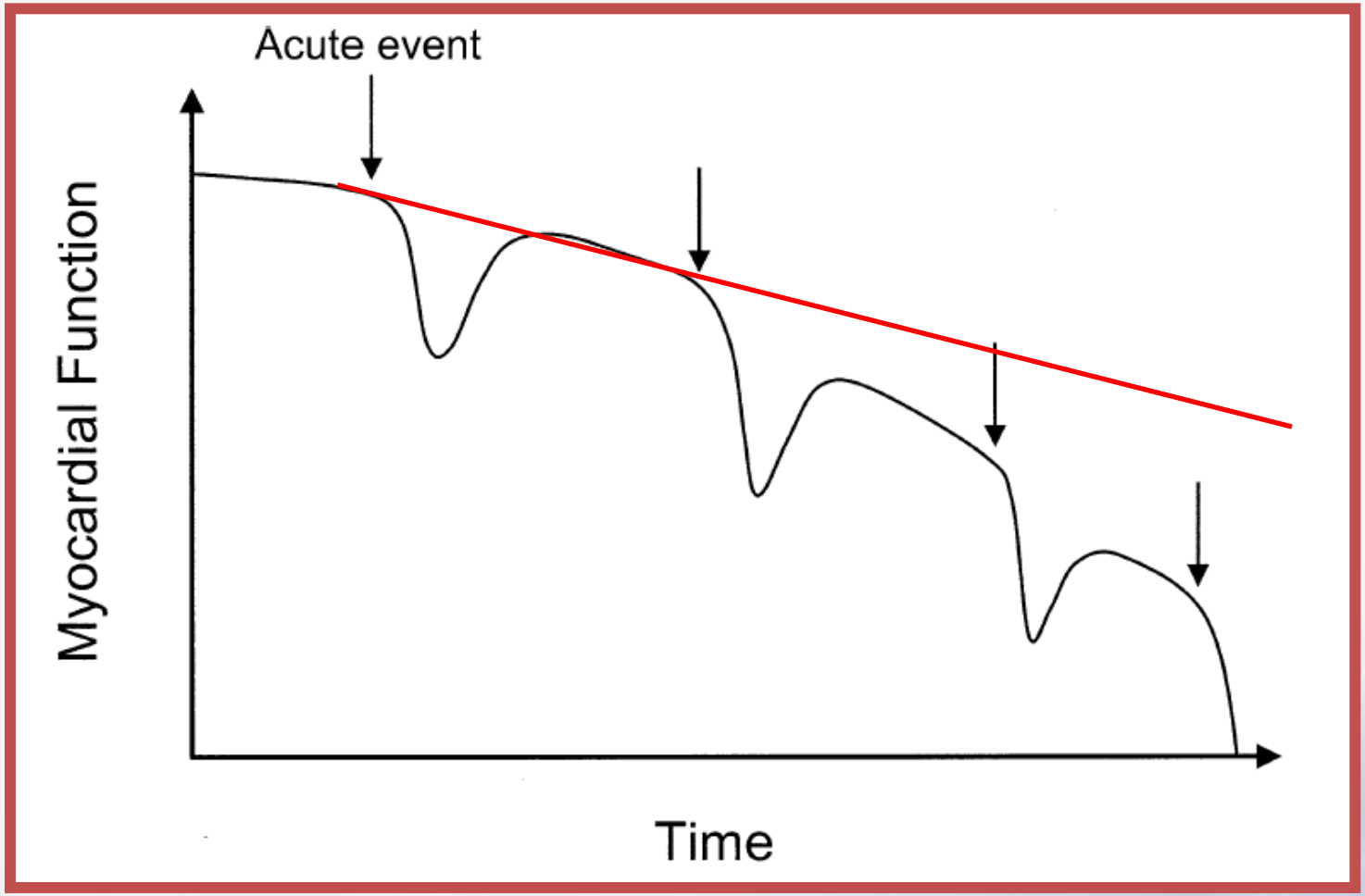
- Myocardial Dysfunction (systolic and/or diastolic)

- Decreased Ventricular Filling



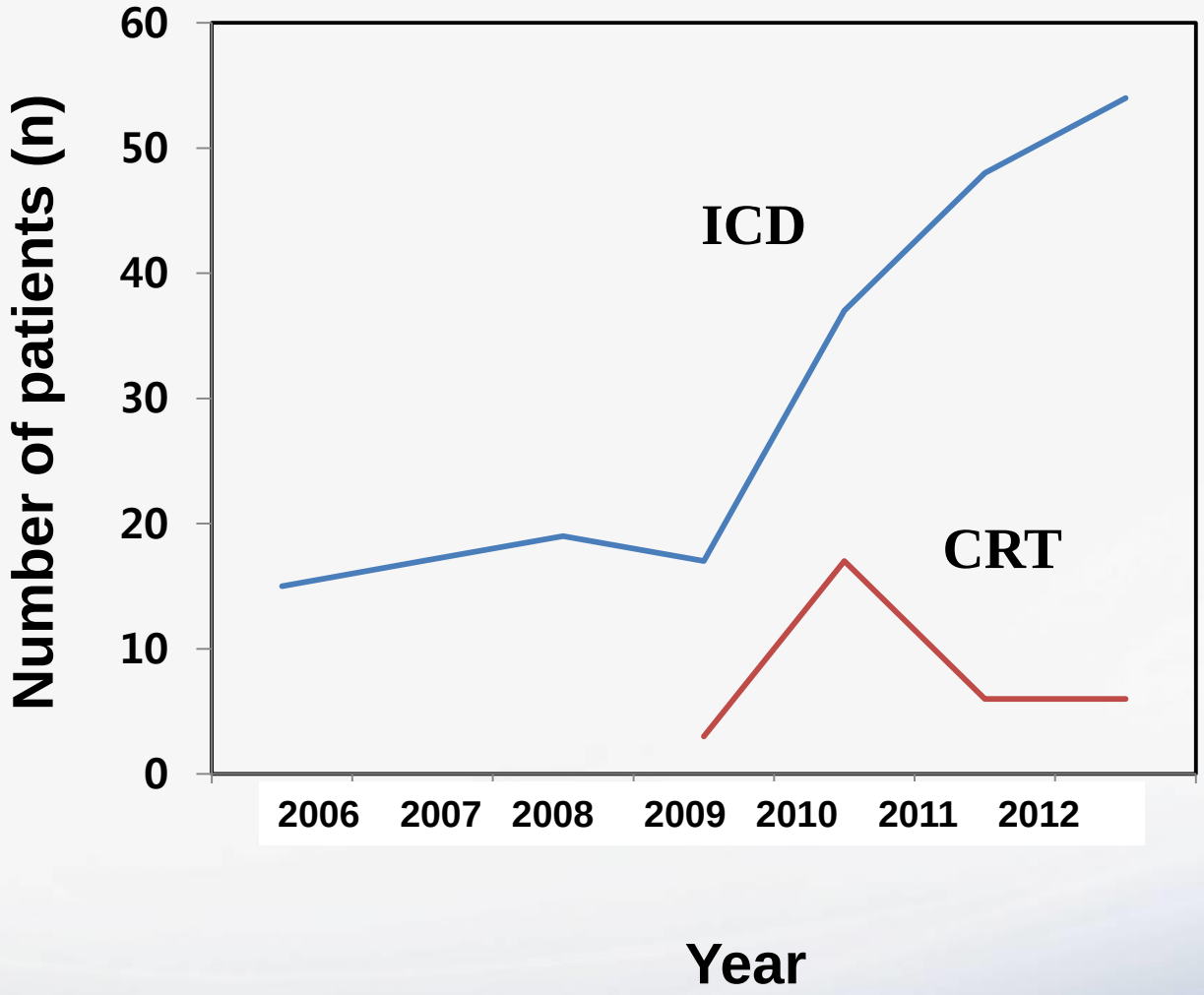

Symptoms are Just the Tip of the Iceberg
Palpitation
Orthopnea
Fatigue
Dyspnea
Edema
Events
Symptoms
Systemic congestion
(JVD, edema)
Increased RV and RA pressure
Increased PA pressure
Increased PCWP (congestion)
Increased LA and LVEDP
↑ LVEDP + impaired volume regulation
Abnormal LV function (systolic and/or diastolic)
Alaska, 2006

Acute Exacerbations May Contribute to CHF Progression



Gheorghiade M, et al. Am J Cardiol. 2005;96:11G-17G.

Severance Cardiovascular Hospital



ICD (n=207)

2006-2012년
Age 51.5 ± 17.6 years
M:F = 160:47

CRT (n=32)

2009-2012년
Age 65.4 ± 11.6 years
M:F = 17:11

F/64

CC : Dyspnea on exertion, NYHA III

PHx : HTN/DM (-)

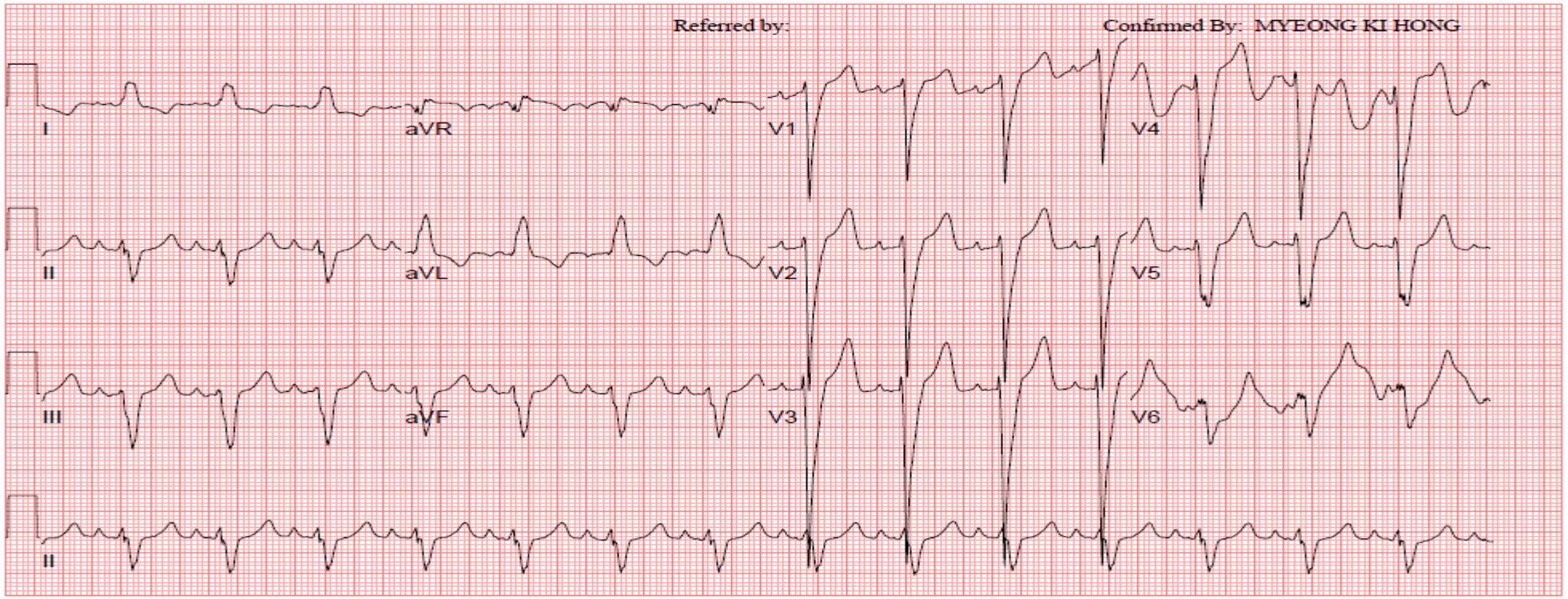
64 yr
Female Oriental

Room:98W
Loc:14

Vent. rate	89	BPM
PR interval	168	ms
QRS duration	170	ms
QT/QTc	444/540	ms
P-R-T axes	60 -62	106

Normal sinus rhythm
Possible Left atrial enlargement
Left axis deviation
Left bundle branch block
Abnormal ECG

Technician:
Test ind:



Pre

Post CRT-P

ECHOCARDIOGRAPHY LABORATORY, YONSEI CARDIOVASCULAR CENTER

YONSEI UNIVERSITY COLLEGE OF MEDICINE, SEOUL KOREA

Exam Date: 2010/02/04 16:29 Echo No.: 10 - 2503 Referring Dr.: 강석민

Patient ID: [redacted] Name: [redacted] Sex/Age: F 64

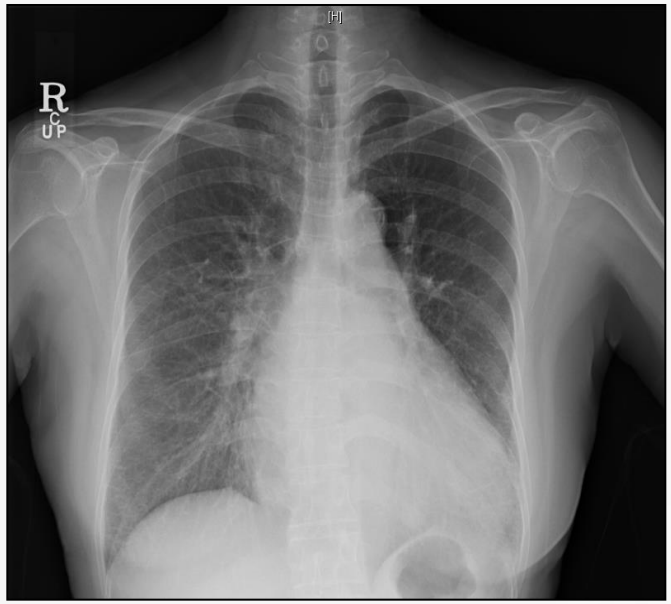
Location: Ward Referral Reason: Myocardial disease

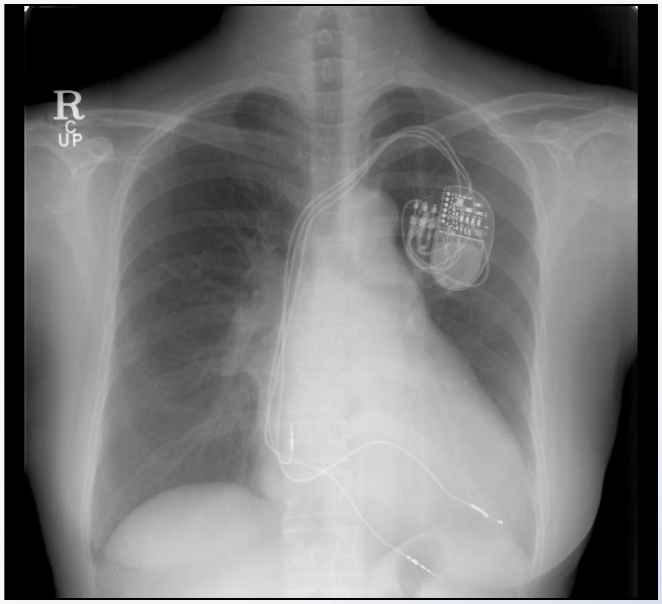
Height : 159.0 cm Weight : 54 kg BSA : 1.54 m2 BP: 100 / 60 mmHg

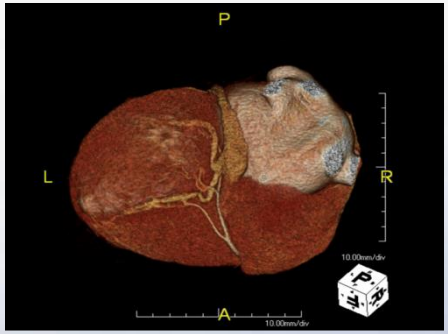
1. Comments:

* Limited echo for CRT candidate evaluation *

1. RWMA as described at next page without significant interval change.
2. Still enlarged LV (LVEDD: 73-->72mm) and still reduced global LV sys. Fx. (EF: 21-->18%).
3. Dysnchrony index: septal to posterior wall motion delay - 144 ms (기준치 >130ms)
   TSI 12 SD - 46.1 (기준치 > 34.4)



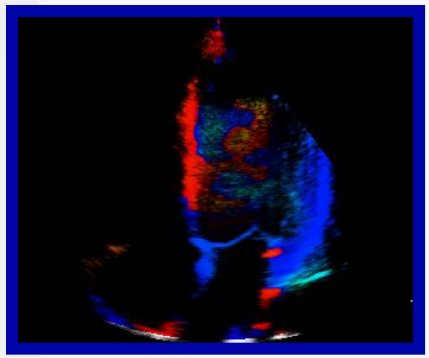


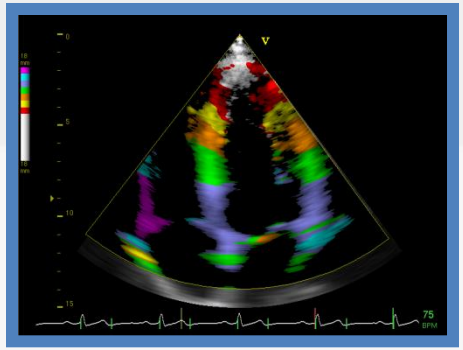


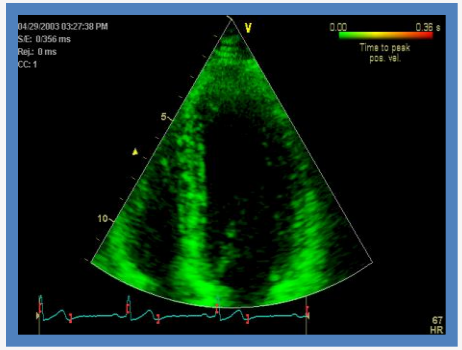
Meta-analysis of CRT in HF

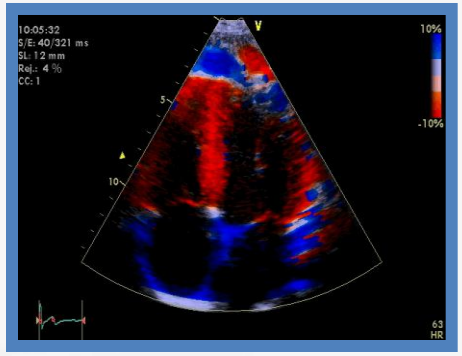
세브란스 SEVERANCE

- Improve EF
- Improve QOL
- Improve functional status
- Reduce hospitalization
- Reduce all-cause mortality by 21 %









Heart Failure

Results of the Predictors of Response to CRT (PROSPECT) Trial

Eugene S. Chung, MD; Angel R. Leon, MD; Luigi Tavazzi, MD; Jing-Ping Sun, MD; Petros Nihoyannopoulos, MD; John Merlino, MD; William T. Abraham, MD; Stefano Ghio, MD; Christophe Leclercq, MD; Jeroen J. Bax, MD; Cheuk-Man Yu, MD, FRCP; John Gorcsan III, MD; Martin St John Sutton, FRCP; Johan De Sutter, MD, PhD; Jaime Murillo, MD

Background—Data from single-center studies suggest that echocardiographic parameters of mechanical dyssynchrony may improve patient selection for cardiac resynchronization therapy (CRT). In a prospective, multicenter setting, the Predictors of Response to CRT (PROSPECT) study tested the performance of these parameters to predict CRT response.

Methods and Results—Fifty-three centers in Europe, Hong Kong, and the United States enrolled 498 patients with standard CRT indications (New York Heart Association class III or IV heart failure, left ventricular ejection fraction ≤35%, QRS ≥130 ms, stable medical regimen). Twelve echocardiographic parameters of dyssynchrony, based on both conventional and tissue Doppler–based methods, were evaluated after site training in acquisition methods and blinded core laboratory analysis. Indicators of positive CRT response were improved clinical composite score and ≥15% reduction in left ventricular end-systolic volume at 6 months. Clinical composite score was improved in 69% of 426 patients, whereas left ventricular end-systolic volume decreased ≥15% in 56% of 286 patients with paired data. The ability of the 12 echocardiographic parameters to predict clinical composite score response varied widely, with sensitivity ranging from 6% to 74% and specificity ranging from 35% to 91%; for predicting left ventricular end-systolic volume response, sensitivity ranged from 9% to 77% and specificity from 31% to 93%. For all the parameters, the area under the operating characteristics curve for positive clinical or volume response to CRT was ≤0.62. There was large

...dyssynchrony parameters.

...multicenter setting despite training and central analysis,

...patient selection for CRT

...ors may

...008;117:

improve the pre...

2608-2616.)

No single echocardiographic measure of dyssynchrony may be recommended to improve patient selection for CRT in HF patients !

입원기록-공통 [2010-02-03]

입원일자 2010-02-03

입원과 심장내과 입원주치의 강석민

주호소 또는 입원사유

for CRT

현재질병상태 본 61세 여환은 13년전 HTN, ischemic HF 진단받고 [redacted] 선생님 f/u 하던 중 2007년 pul.edema 로 입원하여 시행한 heart MRI, Echo상 MR (GIV), severe LV failure (EF=20%) 진단받고 op recommend 받았으나 refuse 하고 이후 강석민 선생님 f/u 하는 중으로 2010년 1월경부터 dyspnea 심해져 일상 생활에도 증상 지속되고 Lt. chest discomfort 있어 CRT 위해 금일 입원함.

과거력

Hypertension	○ No	◉ Yes
Pul. Tbc	◉ No	○ Yes
DM	◉ No	○ Yes
Hepatitis	◉ No	○ Yes
Smoking	◉ No	○ Yes

금연교육 여부 ○ 시행 ○ 미시행 ◉ 해당없음

Alcohol	◉ No	○ Yes
Drug Allergy	◉ No	
	○ Yes	- ** Yes선택시 구체적인 항생제 계열도 선택해주세요.

☐ Penicillin
☐ Sulfonamide
☐ Cephalosporin
☐ Other

Others

가족력

언니 : 당뇨
오빠 : 식도암

계통문진

Generalized Weakness	◉ No	○ Yes
Easy Fatigue	◉ No	○ Yes

3. 외래경과기록[C:공통][12.09.24~13.03.31](M3)

[2013-02-08]

[BF]외래재진기록-SOAP (최종저장일:2013-02-08 강석민) [전자서명]

진료과	심장내과
주치의	강석민
BP(S)	128 mmHg
BP(D)	82 mmHg
HR	/min
Subjective	Good/No interval change NYHA I 실버 댄스 한다...
Objective	n-c
Assessment	Intractable CHF s/p CRT-P : DDD(2010.2) DCMP(EF=18=>22=>28=>32%), MR (IV)->(II-III) : OP refused Normal coronary (2010.2) r/o anxiety disorder Hallux valgus, left s/p OP(2010.12) Acute pharyngotonsilitis CSAG, GE(2012.4.2 EGD)
Plan	Repeat med 3개월 후 OPD EKG/CXR/LAB 감기약..(3일치)
기록자명	강석민

자200 심박기거치술 [2008년 5월 1일 신설]

심장재동기화치료 (CRT, Cardiac Resynchronization Therapy)의 인정기준

1. 수가산정방법

좌심실 또는 양심실을 전극으로 자극하여 좌심실의 심박출량 및 심구출률을 증가시키는 심장재동기화치료(CRT, Cardiac Resynchronization Therapy)는 CRT-P (CRT-Pacemaker)를 실시하는 경우에는 자200나 (1) 경정맥체내용심박기거치술로, CRT-D (CRT-Defibrillator)를 실시한 경우에는 자200-2 심율동전환제세동기거치술 [경정맥]로 산정함.

2. 인정기준

심장재동기화치료는 심실을 재동기화 함으로써 심부전을 개선시킬 수 있는 근거가 있는 경우에 시행함을 원칙으로 하되, 다음에 해당하는 경우에는 요양급여 (일부본인부담)를 인정하며, 동 기준 이외에 시행한 경우에는 시술료 및 치료재료 비용은 전액본인이 부담함.

세부인정사항

가. CRT-P (CRT-Pacemaker) :

3개월 이상의 적절한 약물치료에도 불구하고 증상이 지속되는 심부전 환자 중 아래의 사항에 모두 해당되는 경우

– 아 래 –

(1) 심구혈률 ≤ 35%
(2) QRS 간격 ≥ 120ms
(3) Sinus Rhythm
(4) NYHA class III 또는 거동이 가능한 class IV 환자

※ 적절한 약물치료
(ACE inhibitor/Angiotensin Receptor Blocker + Diuretics ± Beta-blocker)

나. CRT-D (CRT-Defibrillator) :

CRT-P와 ICD 기준에 모두 적합한 경우

Non-responders to CRT : a view from HF physicians

세브란스 SEVERANCE

Non-cardiac issues

- Real CHF aggravation ?
- Medication change ?
- Evaluate co-morbidities
  - OSA, anemia
  - thyroid diseases
  - anemia
  - amiodarone toxicity (lung injury)
- Deconditioning

Non-device issues

- Residual ischemia
- Hemodynamic VHD
- Right side HF
- Rhythm disturbance
  - A. fib
  - V. tachy

Issues of CRT in HF patients : a view from HF physicians

세브란스 SEVERANCE

- Ideal optimization method ?
  - Echo parameters ?
  - AV or VV optimization ?
- Optimization schedule ?
  - LV remodeling ?

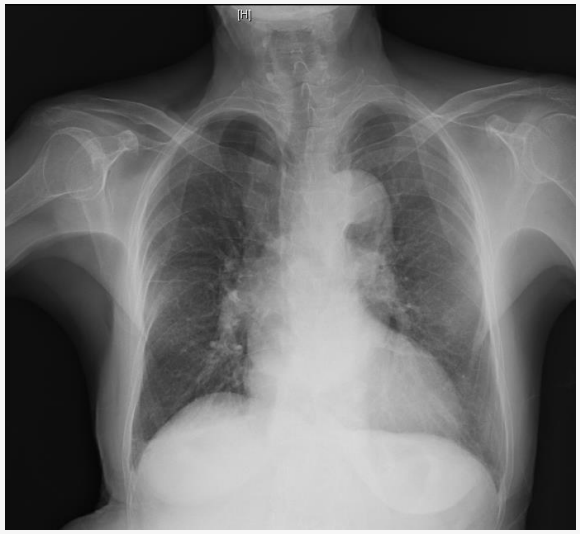
F/83

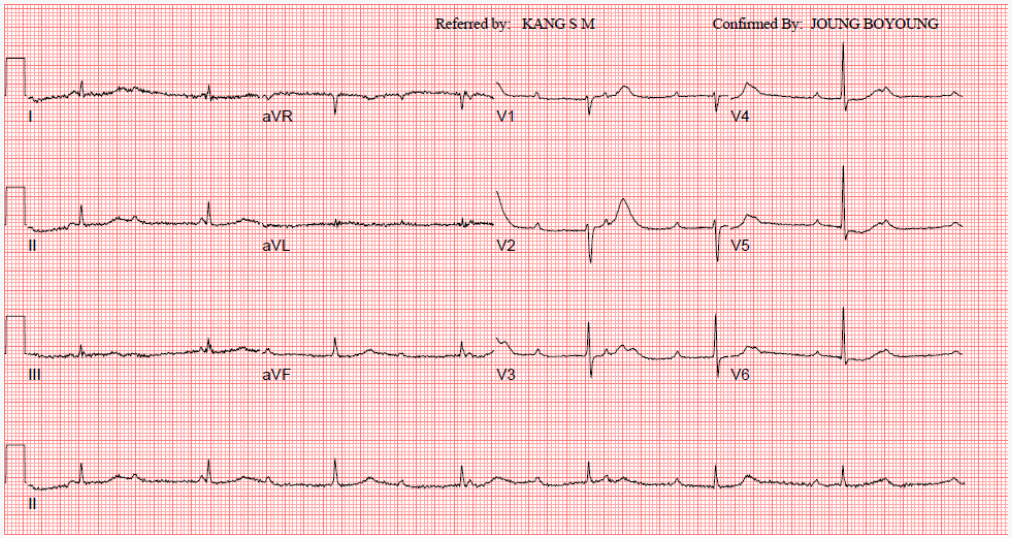
CC : Dyspnea on exertion, NYHA III

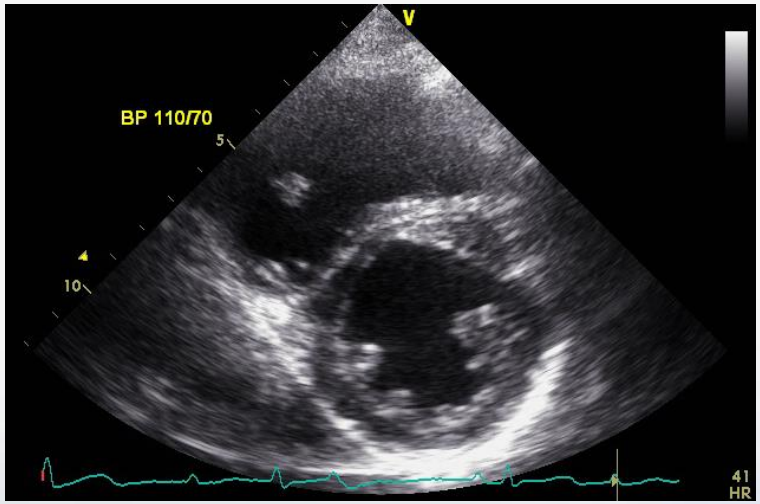
PHx : HTN(+) on medication
Old CVA(+) on medication

DM(-)
Syncope(-)
Dizziness(-)
Palpitation(-)

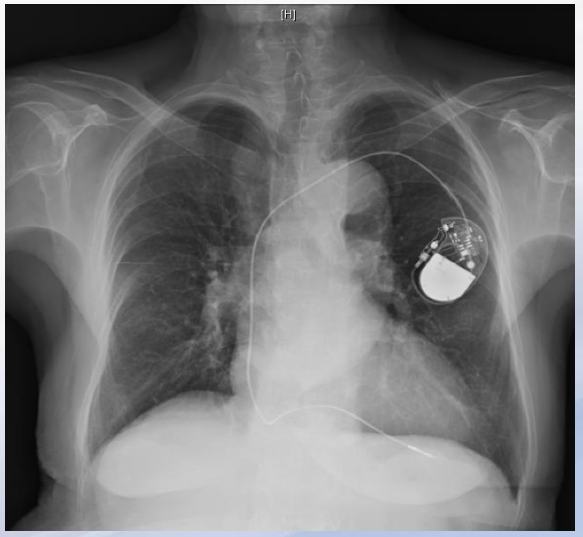
BP : 159/68
HR : 44/min




Referred by: KANG S M
Confirmed By: JOUNG BOYOUNG
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
II


V
BP 110/70
5
10
41
HR

s/p VVIR



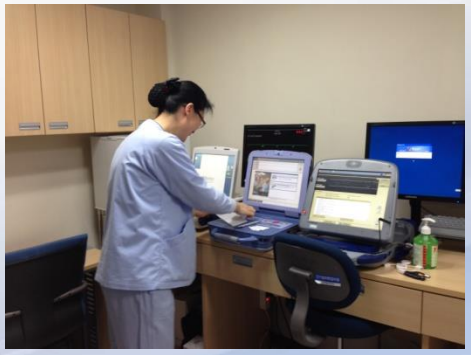
3. 외래경과기록[C:공통][05.11.01~13.03.31](M3) ×

[2013-03-05]

[BF]외래재진기록- 부정맥 (최종저장일:2013-03-05 [redacted]) [전자서명]

진료과	심장내과
주치의	[redacted]
BP(S)	mmHg
BP(D)	mmHg
HR	/min
Subjective	진도 - 병원 직원 어머님
Objective	VP 60 bpm
Assessment	** Pacemaker insertion 2013-01-24 VVIR for CAVB
Plan	dichlozid 25 mg #1 diovan 80 mg #1 astrix 100 mg #1 x 95 days, EKG, 박동기
기록자명	[redacted]

No record and monitoring about performance measure !



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doi:10.1016/j.jacc.2005.07.012

ACC ... ERFORMANCE MEASURES

AC... ...mance Measures
for ... ...eart Failure
A R... ...rdiology/American H... Association
Tas... ...Vriting Committee t...
Fail...
End... ...nerica

Treatment Performance Measures Affect Clinical Outcomes in Patients With Acute Systolic Heart Failure

– Report From the Korean Heart Failure Registry –

Young Jin Youn, MD; Byung-Su Yoo, MD, PhD; Jun-Won Lee, MD; Jang-Young Kim, MD, PhD;
Seong Woo Han, MD, PhD; Eun-Seok Jeon, MD, PhD; Myeong-Chan Cho, MD, PhD;
Jae-Joong Kim, MD, PhD; Seok-Min Kang, MD, PhD; Shung Chull Chae, MD, PhD;
Byung-Hee Oh, MD, PhD; Dong-Ju Choi, MD, PhD; Myung Mook Lee, MD, PhD;
Kyu-Hyung Ryu, MD, PhD on behalf of the KorHF Registry

Background: There is a paucity of data on the effects of adherence to treatment on outcomes for patients with acute heart failure (HF) in Korea. We used HF performance measures to evaluate overall adherence and whether this affects clinical outcomes.

Methods and Results: Among 3,466 patients in the Korean Heart Failure Registry, 1,527 patients with left ventricular systolic dysfunction (LVSD) who survived hospitalization were evaluated. Modified validated performance measures were defined as follows: use at discharge of angiotensin-converting enzyme inhibitor (ACEI), angiotensin-receptor II blocker (ARB), β-blocker or aldosterone receptor antagonist. Adherence to performance measures were as follows: ACEI or ARB at discharge, 68.0%; β-blocker at discharge, 40.9%; aldosterone receptor antagonist at discharge, 37.5%. On multivariate analysis, adherence to the measure of ACEI or ARB use at discharge was significantly associated with mortality (odds ratio (OR), 0.344; 95% confidence interval (CI), 0.123–0.964), readmission (OR, 0.180; 95%CI, 0.062–0.522) and mortality/readmission (OR, 0.297; 95%CI, 0.125–0.707) at 60 days and that for β-blocker with mortality (OR, 0.337; 95%CI, 0.147–0.774) at 1 year.

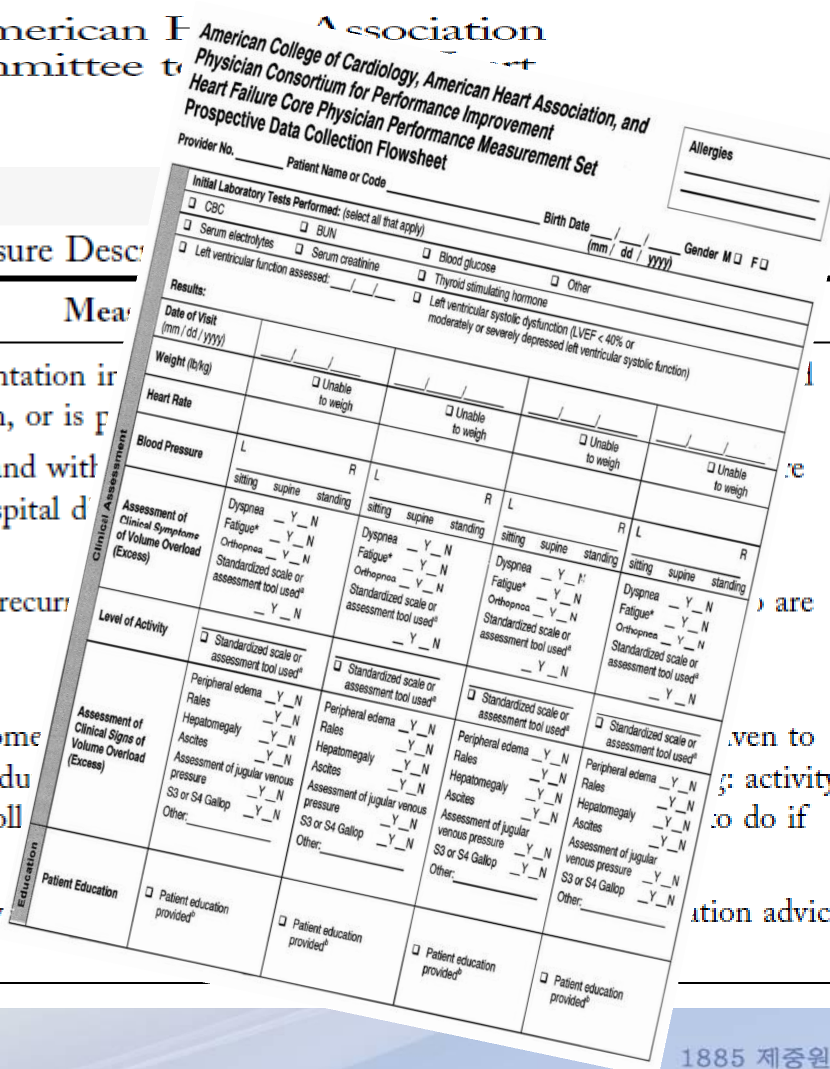
Conclusions: For patients with LVSD in Korea, adherence to treatment performance measures, including prescription of an ACEI/ARB and β-blocker use at discharge, is associated with improved clinical outcomes. (*Circ J* 2012; 76: 1151–1158)

Key Words: Left ventricular systolic dysfunction; Mortality; Performance measures

Table ... : Inpatient Measure Desc...

Perfo... Mea...

1. Eval... ents with documentation ir...
systo... ing hospitalization, or is p...
2. ACI... ents with LVSD and with...
angi... EI or ARB at hospital d...
(AR...
3. Ant... ents with chronic/recurr... are
for I... n at discharge.
fibri...
4. Disc... ents discharged home ...ven to
er at discharge or du... activity
rge medications, foll... o do if
...
5. Adu... ents with a history ...ation advice or
advi... hospital stay.



Performance measures in CHF

만성 심부전 환자의 Medication Adherence
(Medication Adherence in Patients with Chronic Heart Failure)

Only 30 % !

Nurse-led ongoing Follow-Up Program

Schedule	OPD F/U schedule, 30-50 minutes
Method	HF Guidebook
Subjects	HF patients and their families
Contents	• Importance of medication adherence and regular follow up • Self-Care ➢ Aggravation of HF symptom monitoring ➢ Monitoring BW everyday ➢ Restricted sodium diet ➢ Non-smoking, Alcohol Moderation • Flu vaccination periodically • Comorbidity management • Emotional support • Telephone counseling

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Cardiovascular Nursing Sy

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Control/Tracking Number: 2012-SS-A-15980-AHA
Activity: Abstract
Current Date/Time: 6/11/2012 6:21:57 AM

Effectiveness Of Heart Failure Clinic On Clinical Outcomes After Discharge in Patients with Acute Decompensated Heart Failure

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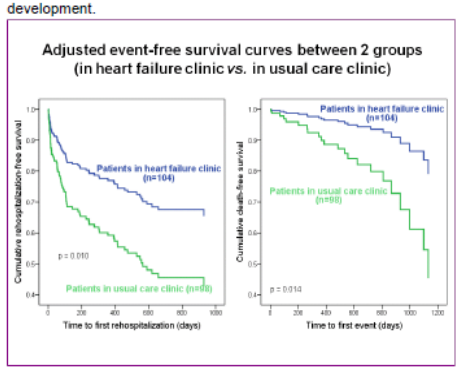
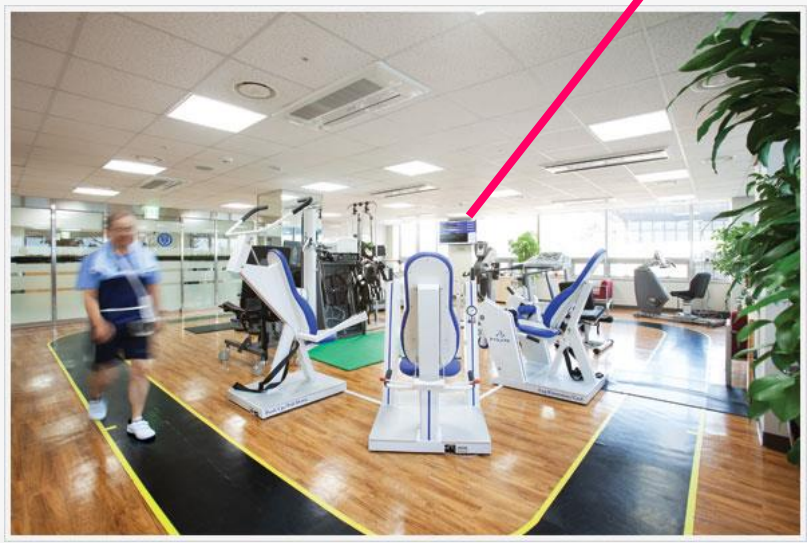
Abstract:
Background. Management of heart failure needs multidisciplinary approach to provide optimum quality of life. Previous researchers reported clinical outcomes of chronic ambulatory heart failure outpatients via heart failure clinic. However, there is a lack of evidence to support clinical effectiveness of heart failure clinic after discharge in patients with acute decompensated heart failure.
Purpose. We hypothesized that patients followed by heart failure clinic would have less rehospitalizations and mortality than those followed by the usual care clinic.
Methods. A total of 202 patients with acute decompensated heart failure consist of 104 patients (age 65±14 years, 39% female) with heart failure clinic and 98 patients (age 66±13 years, 39% female) with usual care clinic were investigated. The heart failure clinic provided comprehensive non-pharmacological interventions as well as pharmacological education by a nurse with expertise in heart failure. Cox proportional hazard regression model was used to compare the time to first event of rehospitalization and all-cause mortality between patients with heart failure clinic and those with usual care clinic.
Results. There were 68 heart failure rehospitalizations and 28 deaths in the heart failure clinic, as compared with 93 heart failure rehospitalizations and 34 deaths in the usual care clinic during the mean follow-up period of 420 days. Patients in usual care clinic had significantly higher rehospitalization rate (hazard ratio [HR] = 2.01, 95% CI 1.18-3.41, $p = 0.010$) and all-cause mortality (HR = 3.37, 95% CI 1.28-8.87, $p = 0.014$) after controlling for age, gender, body mass index, ejection fraction, etiology of heart failure, comorbidities, and medications.
Conclusions. Our study suggested a clinical usefulness of heart failure clinic after discharge in patients with acute decompensated heart failure. Further studies are in need incorporating evidence-based heart failure management program development.



운동 전에 Telemetry 부착

운동 전,후에 인바디,혈압, 혈당 측정

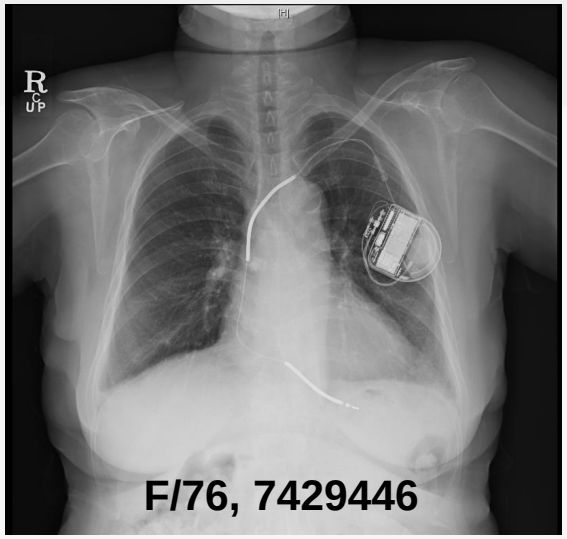
Warming-up



Cool-down

복약 및 영양 상담

운동 교육/처방 및 상담



F/76, 7429446

02.2 dypsnea- TTE : EF38%, anteroseptal hypokinesia,

02.2.10 외부병원 내원- CAG :normal, TTE: 35%, Increased LV cavity and decreased LV contractility

08.9.20 syncope 발생 - 당시 ECG V-Tac

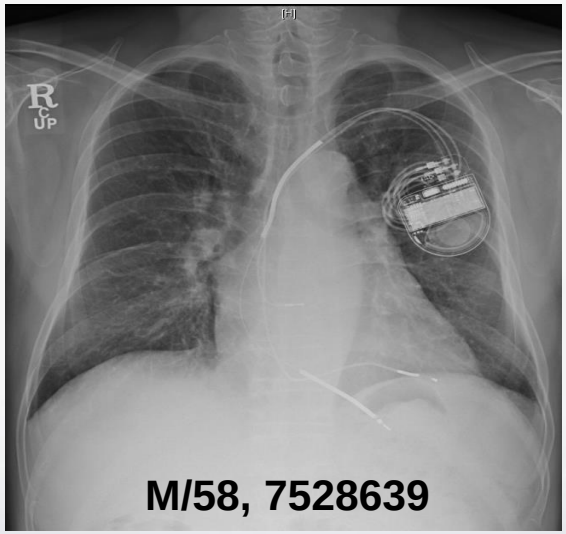
➔ DC cardioversion & IV cordarone

08.9.24 새벽 short run VT 10차례, K replace후 감소

08.9.25 7:30 12초동안 nonsustatined VT 발생 저절로 멈춤

08.10.1 DCMP, (EF38%), sustained monomorphic VT

➔ ICD insertion



M/58, 7528639

2009.11 s/p AF ablation (외부)

2010.04.27 s/p redo AF ablation (외부)

2012.06.29 trido ablation 하려 했으나 LAA Thrombus 있어 시행못함.

2010.04.27 CRT-D insertion (외부) for HF (EF=30%)

2013.03.13 Echo : EF= 30% (본원), amiodarone 200 mg, NYHA II-III

자200-2심율동전환제세동기삽입술 [경정맥]

[2005년 1월 1일 신설] [2008년 5월 1일 개정 (붉은색)]
심율동전환제세동기삽입술(ICD) [경정맥]의 인정기준

돌연사 위험(Sudden death risk)이 있는 환자에서 심장돌연사(Sudden cardiac death)의 위험을 줄이면서 생존(Survival)을 증가시켰다는 근거가 있는 경우에 시행함을 원칙으로 하되, 다음에 해당되는 경우에는 요양급여(일부본인부담)를 인정하며, 동 기준 이외 시행한 경우 시술료 및 치료재료 요양급여비용은 전액 본인이 부담함.

세부인정사항

가. 일시적이거나 가역적인 원인에 의한 것이 아닌 심실세동이나 심실 빈맥에 의한 심정지

나. 기질적 심질환이 있는 자발성 지속성 심실빈맥환자

다. 기질적 심질환이 없는 자발성 지속성 심실빈맥환자에서 다른 치료 방법으로 조절되지 않는 경우

라. 실신에 대한 충분한 평가(Evaluation)로도 원인을 알 수 없는 실신에서 임상적으로 연관되고 혈역동학적으로 의미있는 심실빈맥이나 심실세동이 임상전기생리학적검사(EPS)에 의해 유발되고 약물치료는 효과가 없거나 복용을 못하는 경우

마. 심부전 (Heart Failure)

(1) 심근경색 발생 후 40일 경과한 허혈성 심부전으로 적절한 약물치료에도 불구하고 NYHA class II, III의 증상을 보이고 1년 이상 생존이 예상되는 환자의 경우

(가) 심구혈률(EF) ≤ 30%

(나) 심구혈률(EF) 31~35%로 비지속성 심실빈맥이 있으며 임상전기생리학적검사(EPS)에서 지속성 심실빈맥이 유발되는 경우

(2) 비허혈성 심부전으로 3개월 이상의 적절한 약물치료에도 불구하고 NYHA class II, III의 증상을 보이고 1년 이상 생존이 예상되는 환자의 경우

(가) 심구혈률(EF) ≤ 30%

(나) 심구혈률(EF) 31~35%로 비지속성 심실빈맥이 있으며 임상전기생리학적검사(EPS)에서 지속성 심실빈맥이 유발되는 경우

바. 실신이 있는 Brugada syndrome 환자에서, 충분한 평가(Evaluation)로도 실신의 원인을 알 수 없거나, 임상전기생리학적검사(EPS)에서 심실세동 또는 심실빈맥이 유발되는 경우

사. 비후성 심근병증 환자로서 아래의 ①~⑤ 중 두 가지 이상에 해당되는 경우

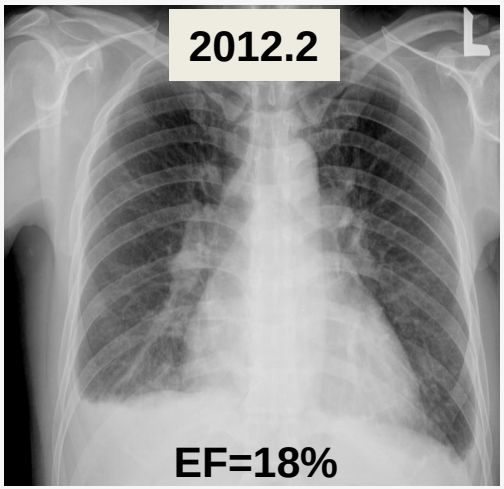
① 실신의 증상
② 급사의 가족력
③ 좌심실중격의 과도한 비후 (≥30mm)
④ 24시간 활동 중 심전도에서 나타난 비지속성 심실빈맥
⑤ 운동부하검사 상 이상 혈압증가 반응이 없는 경우 (충분한 운동부하에도 혈압상승이<20mmHg인 경우)

아. Long QT syndrome환자로 실신에 대한 충분한 평가(Evaluation)로도 원인을 알 수 없는 실신의 경력이 있고 베타차단제 치료에도 재발하거나 약물치료를 지속할 수 없는 경우

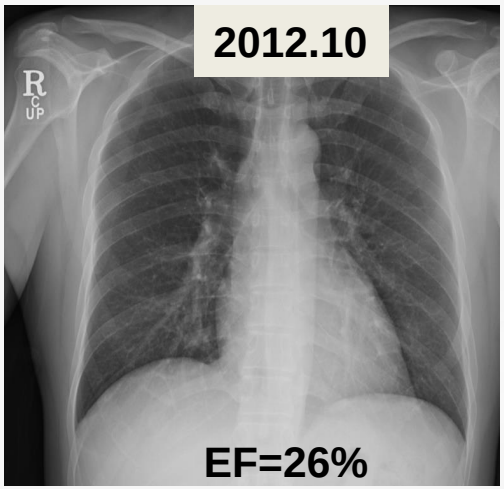
Reversible LV dysfunction ?

- **Hypertensive, alcoholic, transient myocarditis, idiopathic ?, etc…**

Case 1

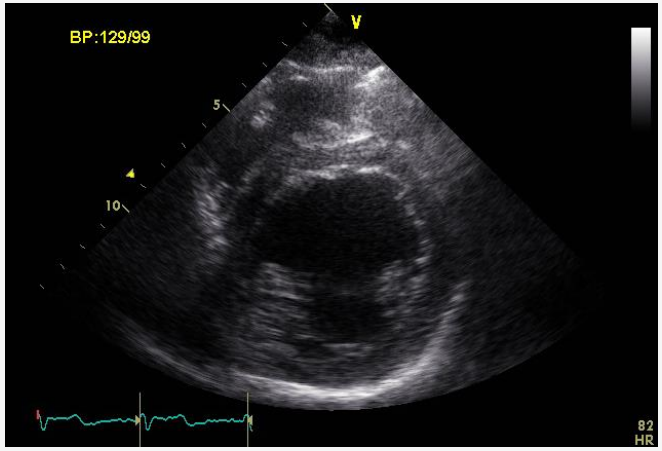


8 개월 후



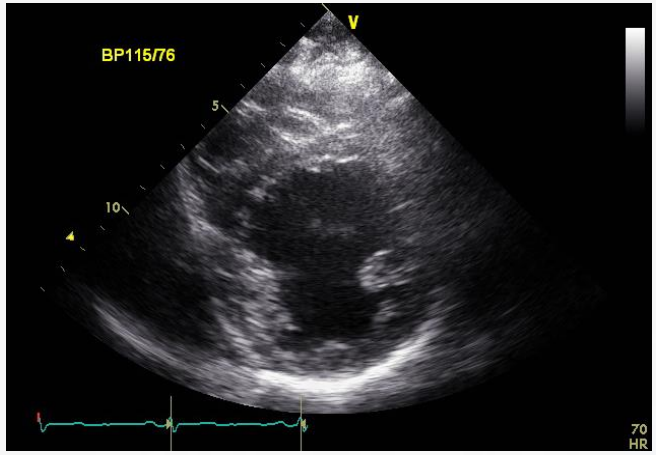
Case 2

2007.8



EF= 15 - 20 %

2013.03



	측정 값	% 예측값
최대산소섭취량 운동 시간	40.03ml/kg/min 16분 40초	103% 예측 값의 84%이상 정상인 체력
대 사 당 량	11.4 METs	7 METs 이상 유병률/사망률 낮음
무산소성(젖산) 역치 무산소성역치 도달시간	31.27 ml/kg/min 11분 20초	무산소성 역치 시간/전체 운동시간 X 100% = 66.6% 40% 이상 일반 수준 60% 이상 상위 체력 수준
VE/VCO2 (V-slope)	28.3	30 이하 정상 60 이상 비정상
Peak RER	1.23	1.1 이상 최대 노력

Cardiac MRI

Cine: Global moderate hypokinesia with LV enlargement. No evidence of regional wall motion abnormality. No RV dysfunction. Mild TR.

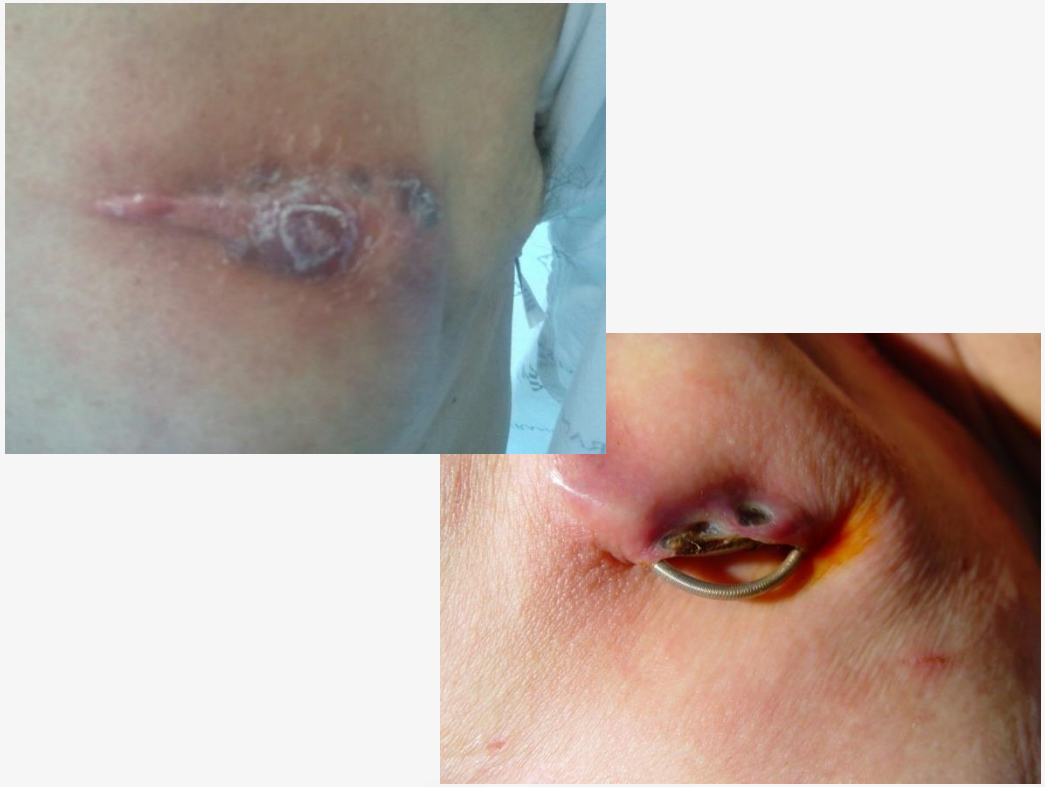
Perfusion: No evidence of resting perfusion defect in this study.

Viability: Subtle enhancement at basal septum.

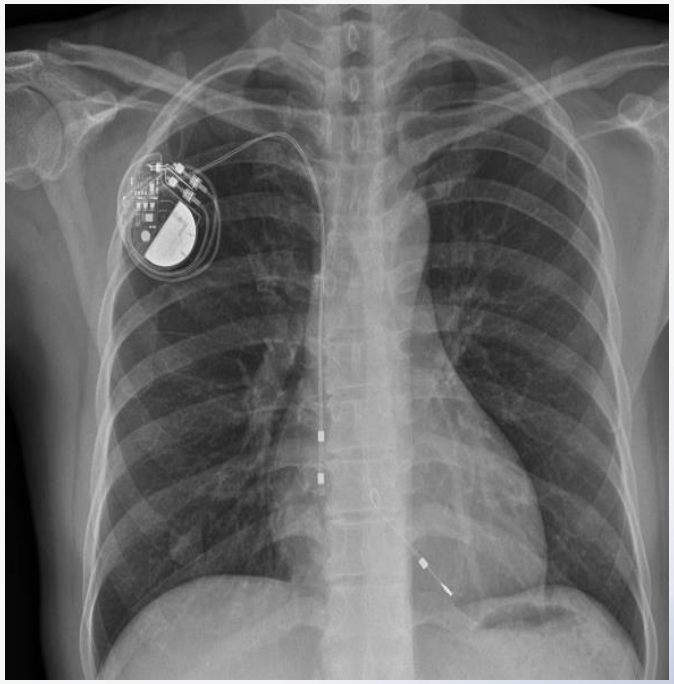
CIED related complications

세브란스 SEVERANCE

Infection



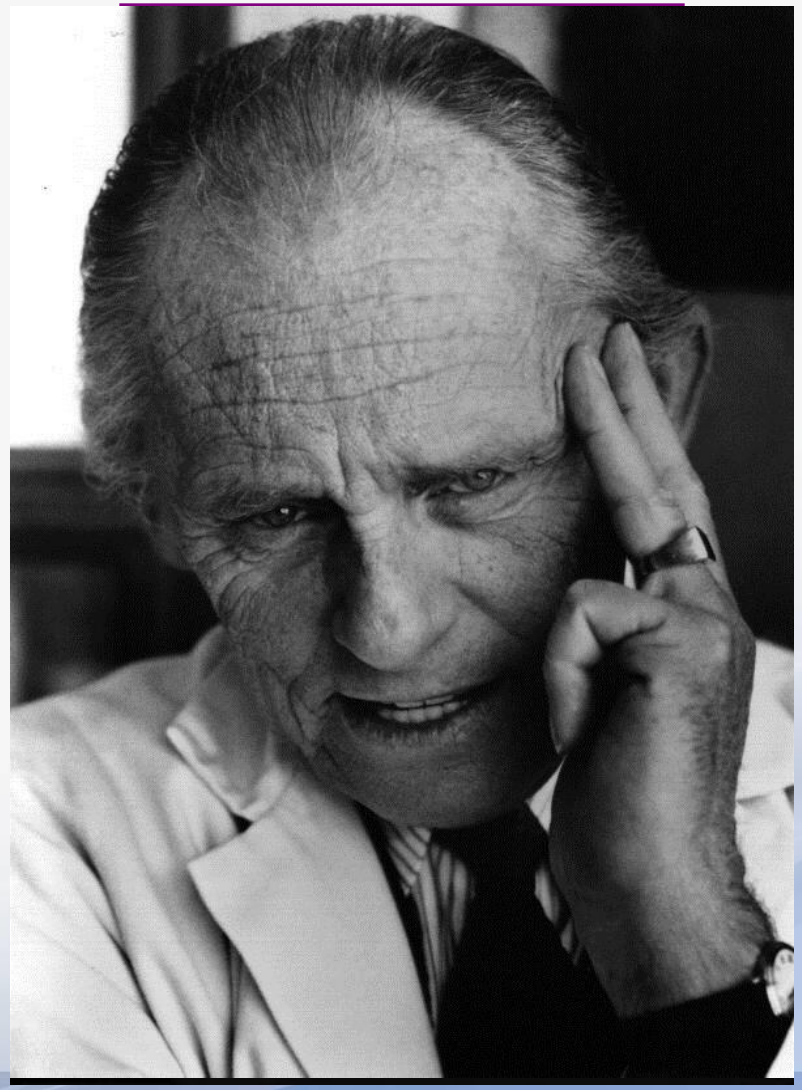
Lead fracture



Preoperative treatment with an antibiotic that has in vitro activity against *Staphylococci* is recommended for infection prophylaxis

When it comes to heart failure patients..
: at the view point of HF physicians

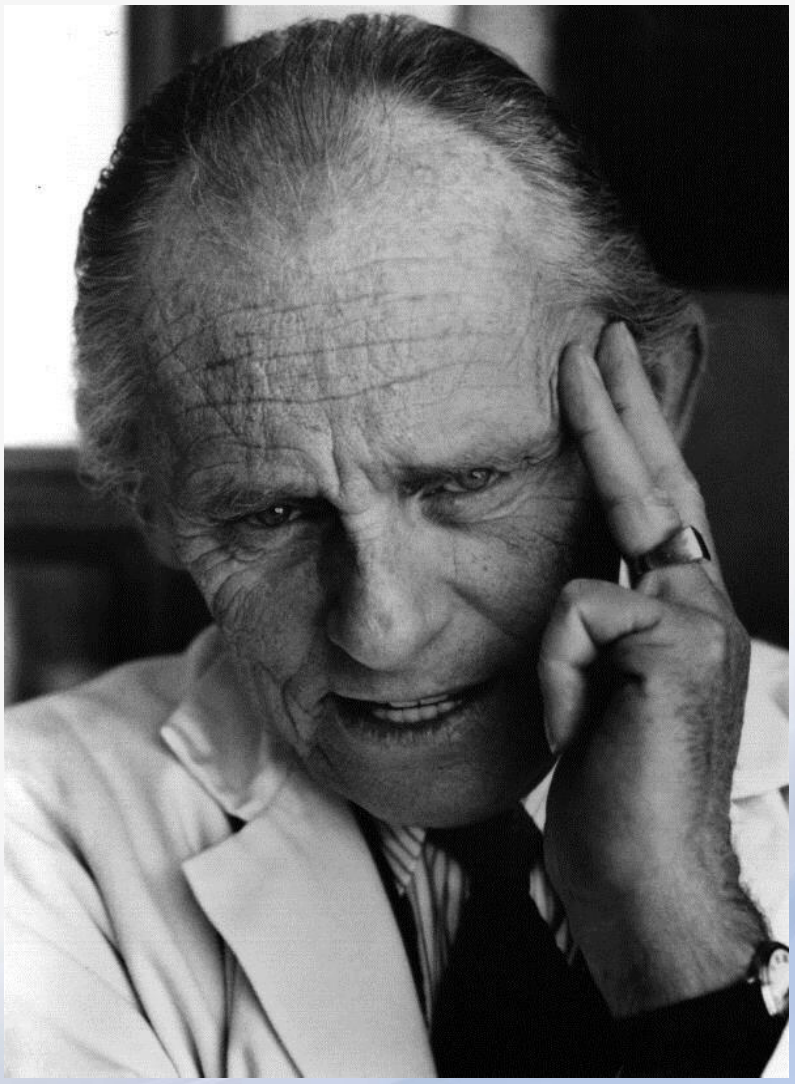
- ***Etiology ?***
- ***Aggravating factors ?***
- ***Reversible ? vs. Irreversible ?***
- ***Prognosis ?***
- ***Treatment Modality ?***



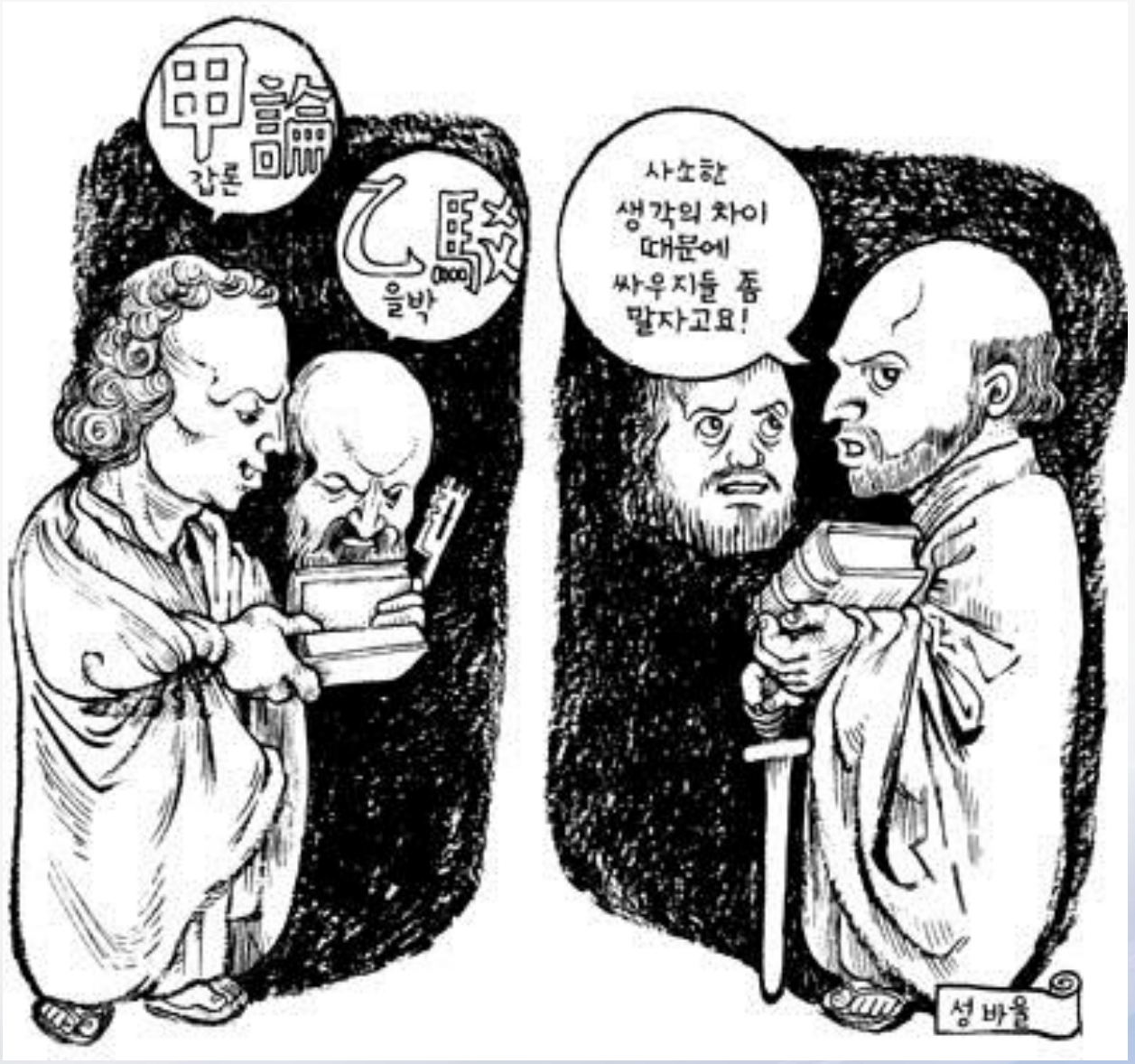
Major concerns of CIED treatment in HF patients : at the view point of HF physicians

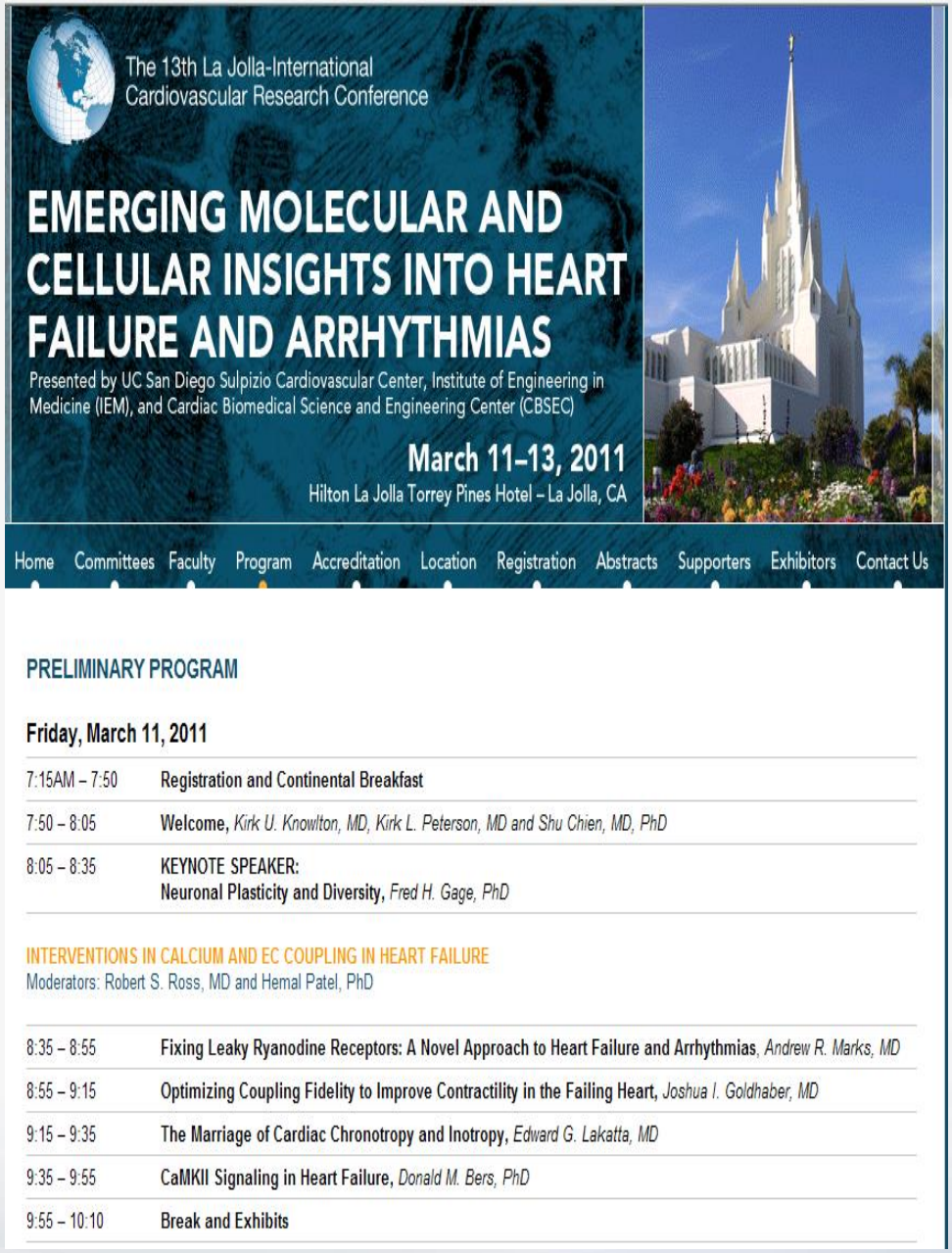
- ***When ?***
- ***Responder ? vs. Nonresponder ?***
- ***Prognosis ?***
- ***Monitoring ?***

: Sx, Echo, VO_2 peak, biomarkers,..



GAP between EP and HF physicians




The 13th La Jolla-International
Cardiovascular Research Conference
EMERGING MOLECULAR AND CELLULAR INSIGHTS INTO HEART FAILURE AND ARRHYTHMIAS
Presented by UC San Diego Sulpizio Cardiovascular Center, Institute of Engineering in Medicine (IEM), and Cardiac Biomedical Science and Engineering Center (CBSEC)
March 11–13, 2011
Hilton La Jolla Torrey Pines Hotel – La Jolla, CA
Home Committees Faculty Program Accreditation Location Registration Abstracts Supporters Exhibitors Contact Us
PRELIMINARY PROGRAM
Friday, March 11, 2011
7:15AM – 7:50 Registration and Continental Breakfast
7:50 – 8:05 Welcome, Kirk U. Knowlton, MD, Kirk L. Peterson, MD and Shu Chien, MD, PhD
8:05 – 8:35 KEYNOTE SPEAKER: Neuronal Plasticity and Diversity, Fred H. Gage, PhD
INTERVENTIONS IN CALCIUM AND EC COUPLING IN HEART FAILURE
Moderators: Robert S. Ross, MD and Hemal Patel, PhD
8:35 – 8:55 Fixing Leaky Ryanodine Receptors: A Novel Approach to Heart Failure and Arrhythmias, Andrew R. Marks, MD
8:55 – 9:15 Optimizing Coupling Fidelity to Improve Contractility in the Failing Heart, Joshua I. Goldhaber, MD
9:15 – 9:35 The Marriage of Cardiac Chronotropy and Inotropy, Edward G. Lakatta, MD
9:35 – 9:55 CaMKII Signaling in Heart Failure, Donald M. Bers, PhD
9:55 – 10:10 Break and Exhibits







Appreciate your attention ^^