Deciding between single vs dual-chamber ICD in the absence of a pacing indication

6TH UPDATE İN CARDİOLOGY AND CARDİOVASCULAR SURGERY CONGRESS İN CONJUNCTİON WİTH THE 59TH ESCVS INTERNATİONAL CONGRESS

16 APRIL 2010, IZMIR

Presented by
Hakan DİNÇKAL, MD
Bağcılar Education Hospital, Istanbul.

DİSCLOSURES

None .

BACKGROUND

- ✓ICD improves survival for most patients with life-threatening ventricular arrhythmias. Two points are important.
  - ✓The effectiveness of ICD therapy was established using single-chambered ICDs
  - ✓In AVID Trial the need for bradycardia pacing was overtly required in only 4% of the patients.
- ✓Despite a paucity of evidence for need or benefit, most implanted ICDs were dual-chamber devices until 2002 (DAVID trial).

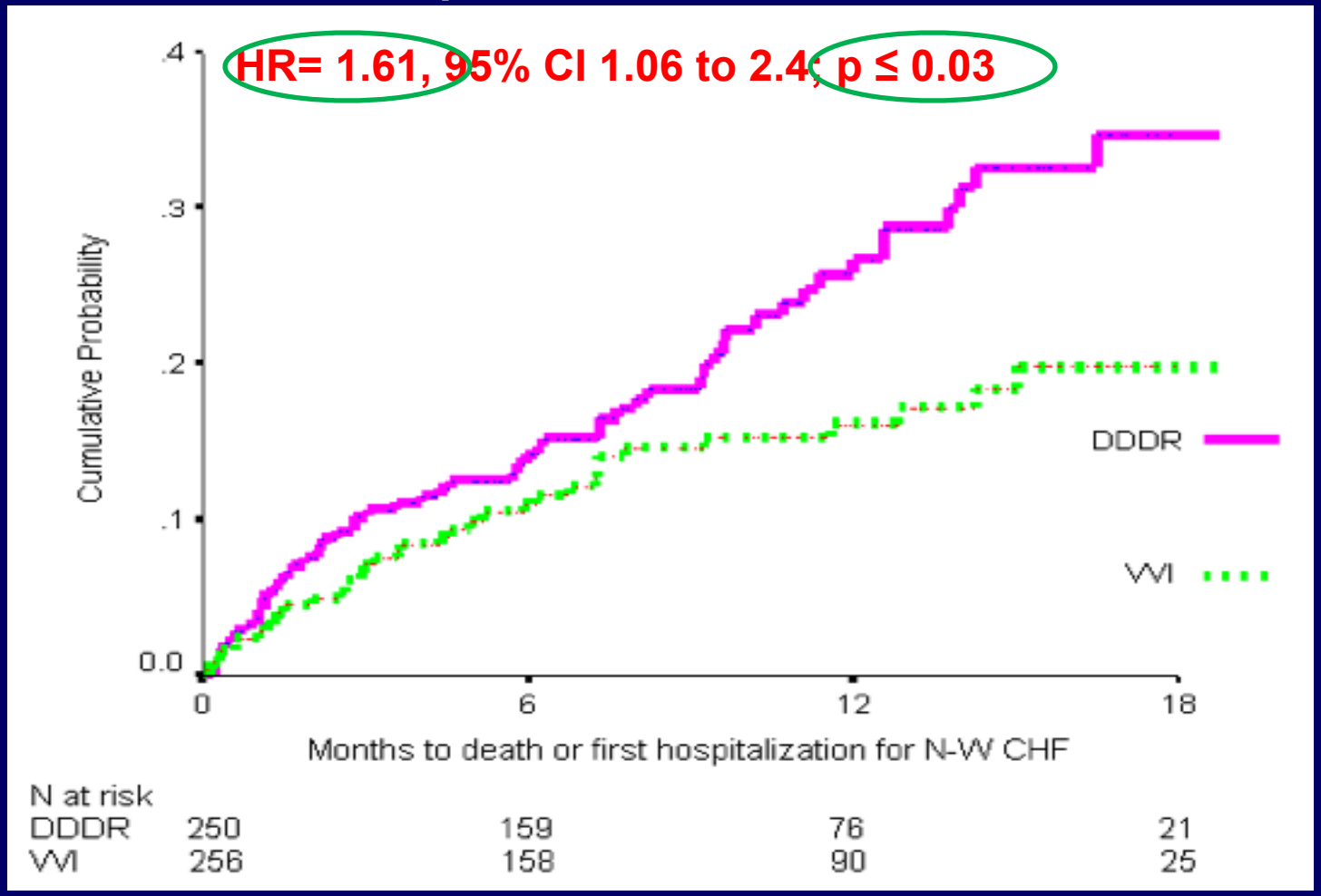
Dual Chamber and VVI Implantable Defibrillator (DAVID) Trial

- 506 patients with indications for ICD therapy
- All patients had LVEF ≤ 40%, no indication for antibradycardia pacing and no persistent atrial arrhythmias
- All patients prescribed medical Rx for LV dysfunction, incl ACE inhibitors and β-blockers
- Randomized to ICD with ventricular backup pacing @ 40/min (VVI-40; n=256) or dual-chamber rate-responsive pacing @ 70/min (DDDR-70; n=250)

Wilkoff BL et al. JAMA 2002;288:3115-23.

DAVID – Results

Death or First Hospitalization for New or Worsened CHF



Wilkoff BL. *JAMA* 288: 3115–3123, 2002

The Dual Chamber and VVI Implantable Defibrillator (DAVID) Trial: Rationale, Design, Results, Clinical Implications and Lessons for Future Trials

Bruce L. Wilkoff and the DAVID Trial Investigators
The Cleveland Clinic Foundation, Cleveland, OH 44195, USA

"However, considering the large magnitude of the deleterious effects associated with dual chamber pacing in the DAVID trial future studies should explore the possibility that *left ventricular* stimulation may be the only pacing mode capable of preventing bradycardia without increasing death and congestive heart failure"

Card Electrophysiol Rev. 2003 Dec;7(4):468-72

EDITORIAL COMMENTARY

Right ventricular pacing: Has DAVID slain this Goliath?

Jeffrey J. Goldberger, MD

From the Division of Cardiology and Department of Medicine, Northwestern University-Feinberg School of Medicine, Chicago, Illinois USA.

"DAVID has not yet slain the Goliath of right ventricular pacing, but he is wounded. Further research efforts are needed to determine the outcome."

Heart Rhythm. 2005 Aug;2(8):835-6

CLİNİCAL CONSEQUENCES OF CARDİAC REMODELİNG DUE TO VENTRİCULAR DESYNCHRONİZATİON

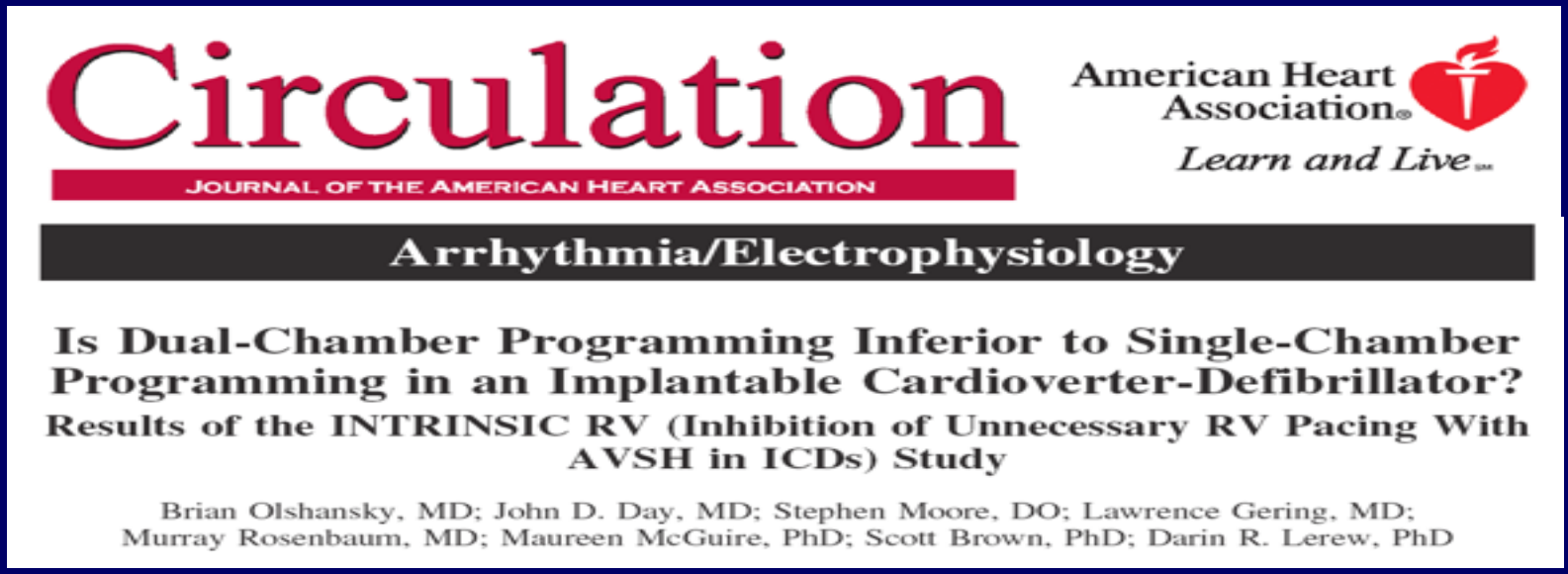
- ✓Increased atrial fibrillation[12]
- ✓Increased heart failure worsening/hospitalization[26]
- ✓Increased ventricular arrhythmias[6]
- ✓Increased mortality[56]

•1 Nielsen J Am Coll Cardiol 2000;6:14531461
•2 Sweeney Circulation 2003;23:29322937
•3 Shukla Heart Rhythm 2005;2:245251
•4 Sweeney Circulation 2006; 113(17):2082-8
•5 DAVID Trial Investigators JAMA 2002;288(24):31153123
•6 Steinberg J Cardiovasc Electrophysiol 2005;16(4):359365.

ALTERNATİVE PACİNG MODES

- ✓AAI(R)
- ✓DDD(R) with long AV delay or Search Hysteresis
- ✓DDI(R)
- ✓AAIR<->DDDR (MVP/AAI safe R)

INTRINSIC RV Trial



Circulation
JOURNAL OF THE AMERICAN HEART ASSOCIATION

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Arrhythmia/Electrophysiology

Is Dual-Chamber Programming Inferior to Single-Chamber Programming in an Implantable Cardioverter-Defibrillator?

Results of the INTRINSIC RV (Inhibition of Unnecessary RV Pacing With AVSH in ICDs) Study

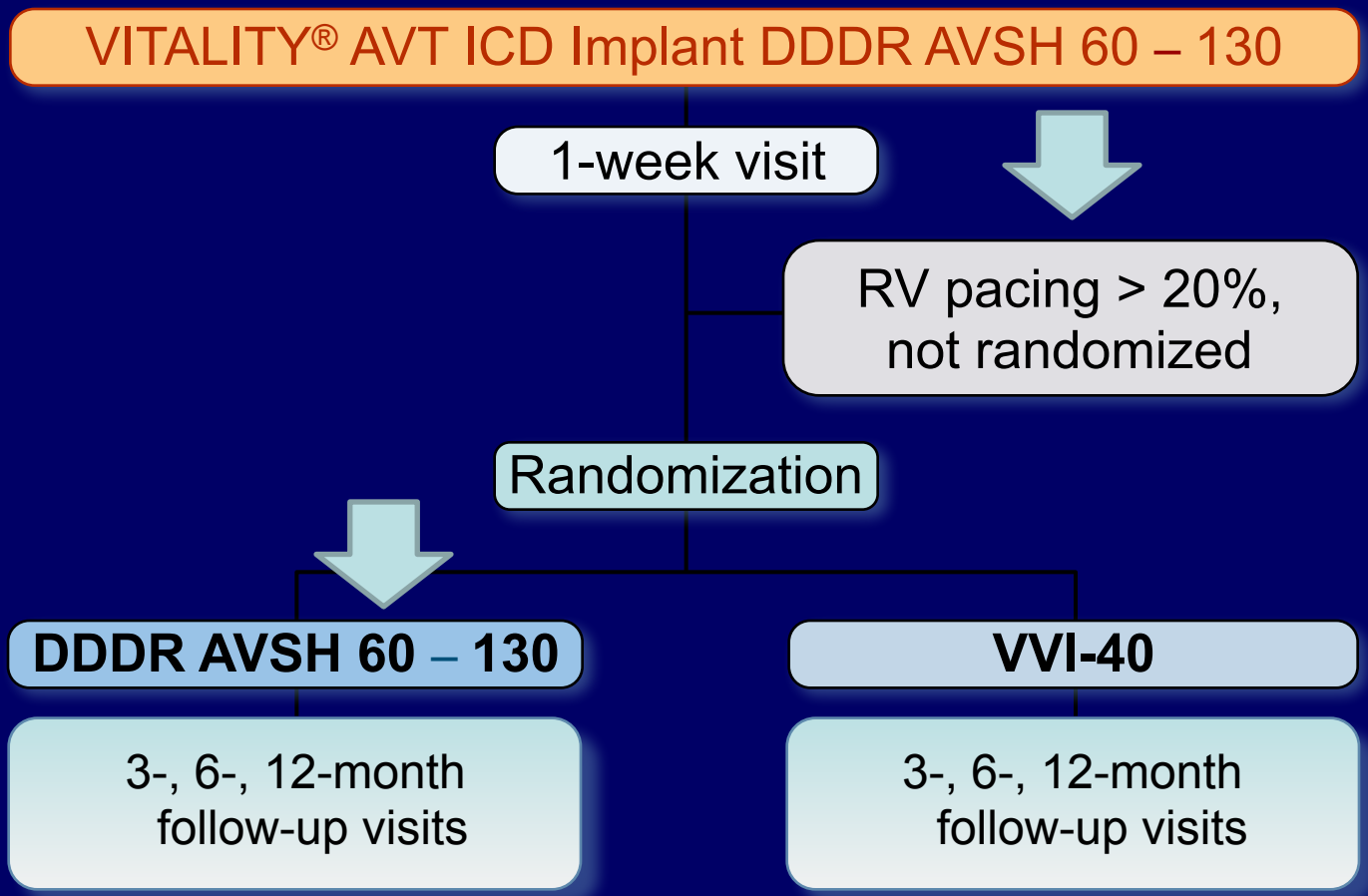
Brian Olshansky, MD; John D. Day, MD; Stephen Moore, DO; Lawrence Gering, MD; Murray Rosenbaum, MD; Maureen McGuire, PhD; Scott Brown, PhD; Darin R. Lerew, PhD

VVI 40 ICD vs. DDDR w/ AV Search Hysteresis

Olshansky B, et al. Circulation 2007;115:9-16

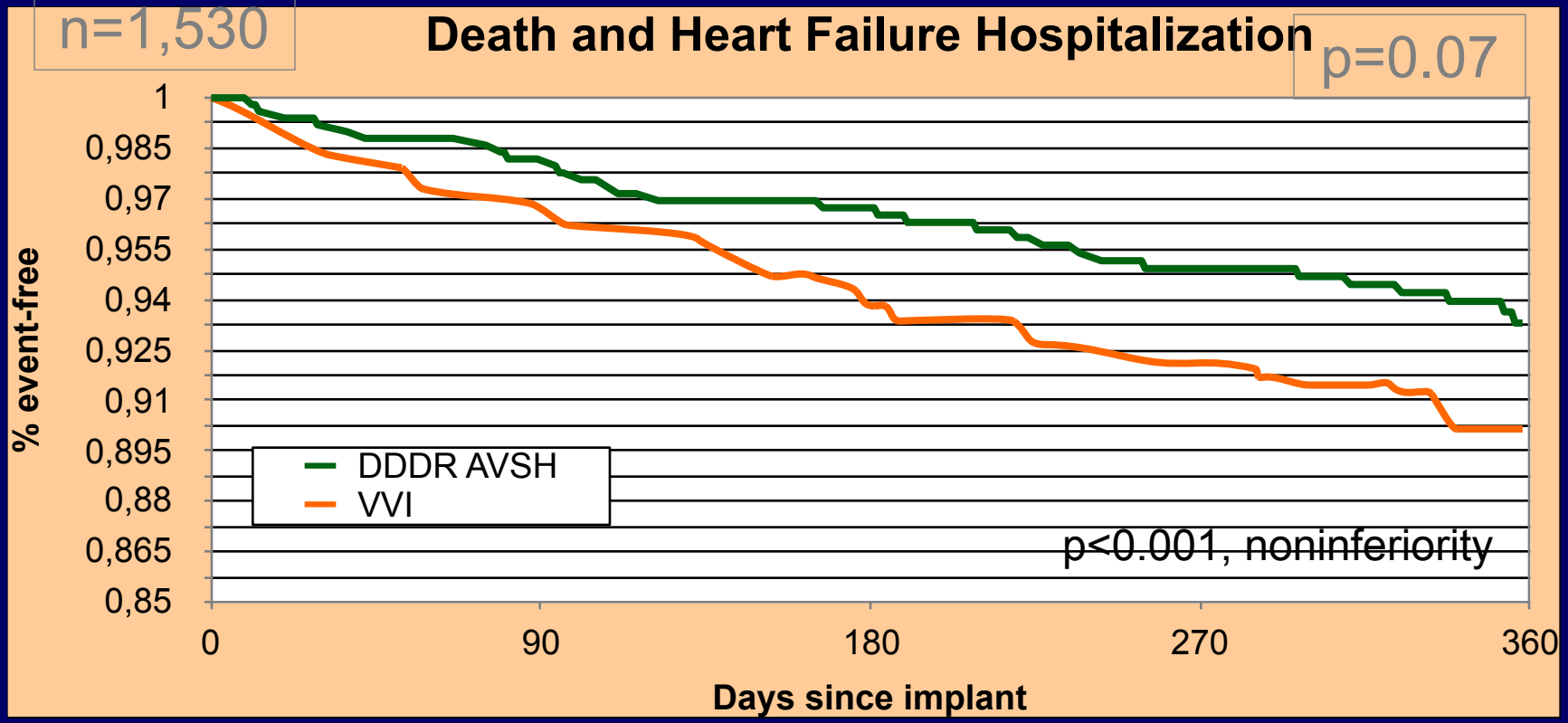
STUDY DESIGN

INTRINSIC RV STUDY



Olshansky, B, et al. PACE 2005:28, 63.

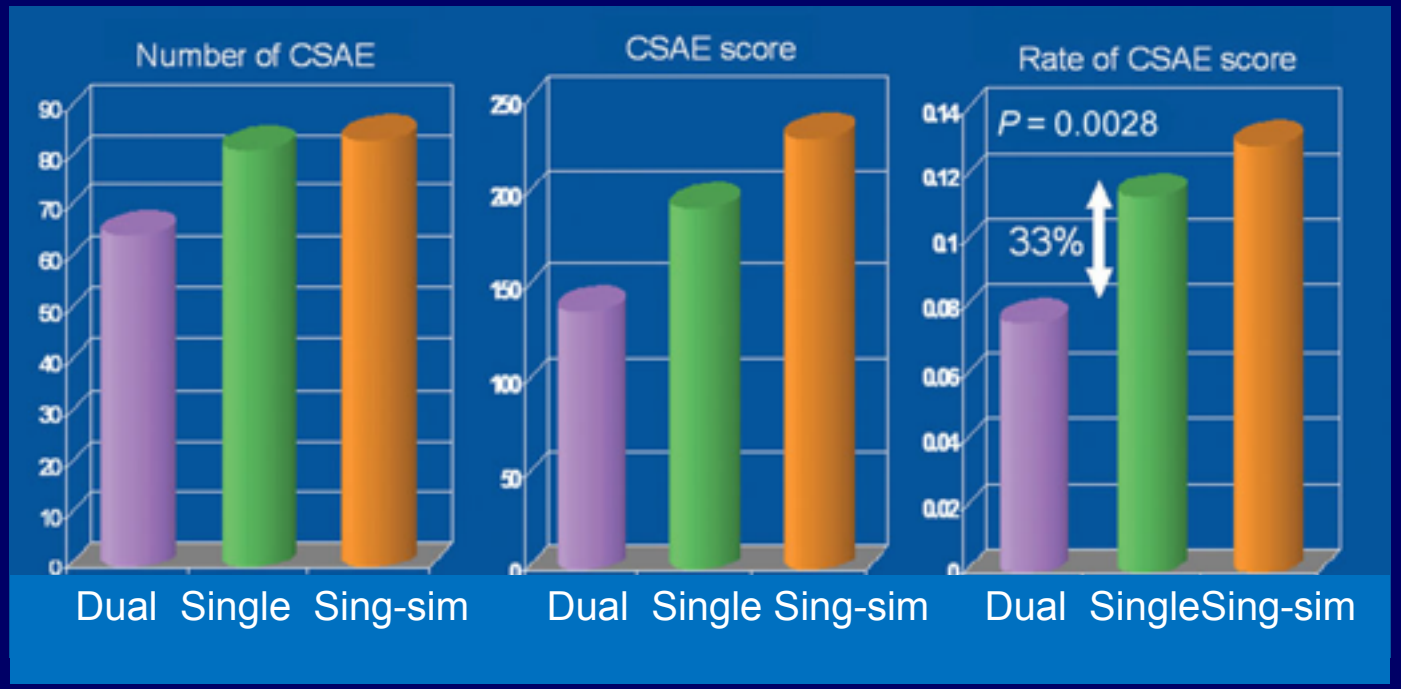
Primary End-Points



Olshansky B, et al. Circulation 2007;115:9-16

DATAS TRIAL

Dual vs. Single vs. Single simulated

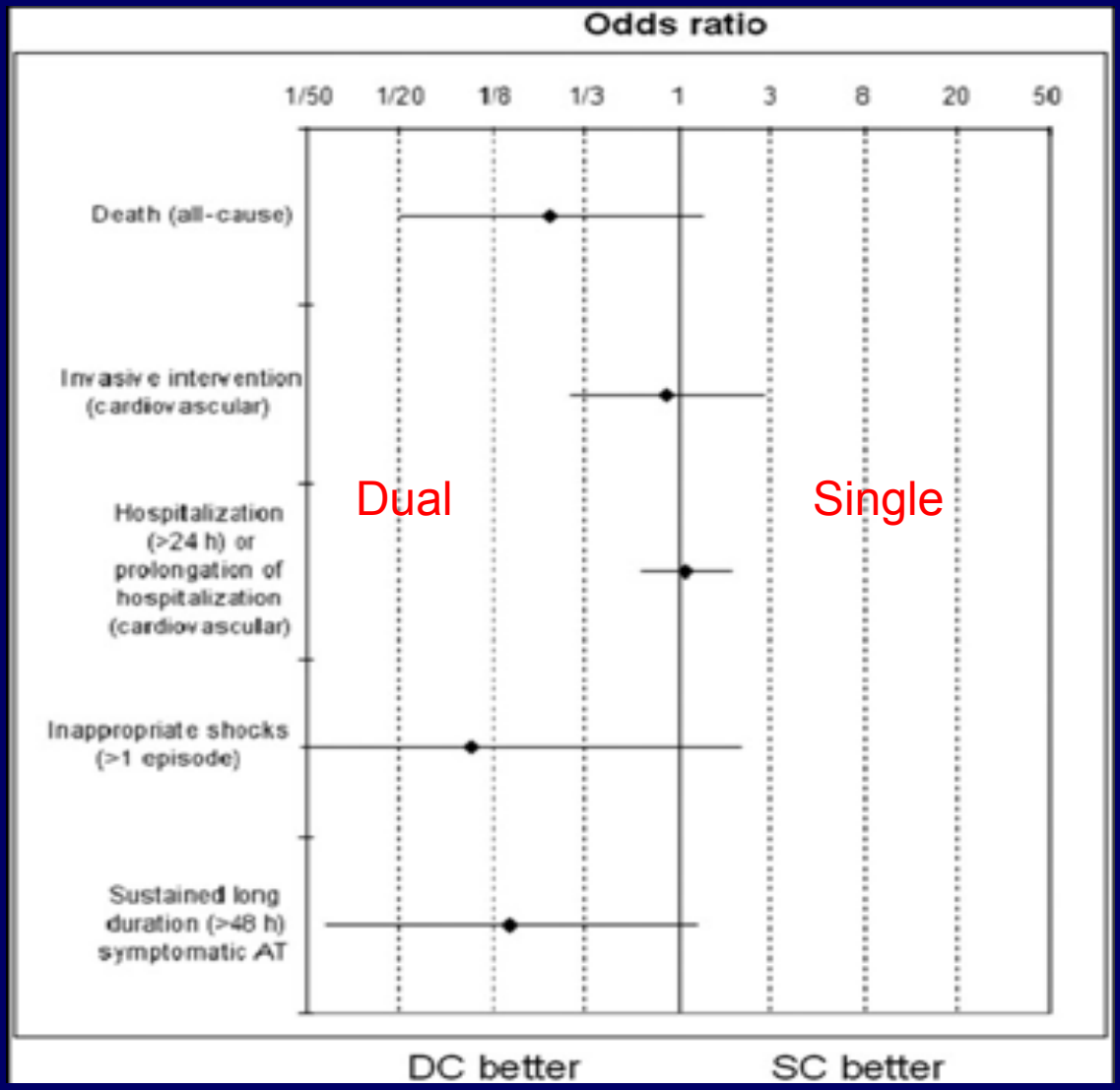


CSAE: clinically significant adverse events.

Almendral et al., Europace (2008) 10, 528–535

DATAS TRIAL

Odds ratio for each individual clinically significant adverse event. (CSAE)



Almendral et al., Europace (2008) 10, 528–535

The DAVID (Dual Chamber and VVI Implantable Defibrillator) II Trial

Bruce L. Wilkoff, MD, FACC,* Peter J. Kudenchuk, MD, FACC,† Alfred E. Buxton, MD, FACC,‡ Arjun Sharma, MD,§ James R. Cook, MD, FACC,‖ Anil K. Bhandari, MD, FACC,¶ Michael Biehl, MD, FACC,# Gery Tomassoni, MD,** Anna Leonen, MS,† Linette R. Klevan, RN,†† Alfred P. Hallstrom, PHD,† for the DAVID II Investigators

Cleveland, Ohio; Seattle, Washington; Providence, Rhode Island; St. Paul, Minnesota; Springfield, Massachusetts; Los Angeles, California; Paterson, New Jersey; Lexington, Kentucky; and Norfolk, Virginia

Objectives The purpose of this study was to determine whether atrial pacing is a safe alternative to minimal (backup-only) ventricular pacing in defibrillator recipients with impaired ventricular function.

Background The DAVID (Dual Chamber and VVI Implantable Defibrillator) trial demonstrated that dual chamber rate responsive pacing as compared with ventricular backup-only pacing worsens the combined end point of mortality and heart failure hospitalization. Although altered ventricular activation from right ventricular pacing was presumed to be the likely cause for these maladaptive effects, this supposition is unproven.

Methods In all, 600 patients with impaired ventricular function from 29 North American sites, who required an implanted defibrillator for primary or secondary prevention, with no clinical indication for pacing, were randomly assigned to atrial pacing (at 70 beats/min) versus minimal ventricular pacing (at 40 beats/min) and followed up for a mean of 2.7 years.

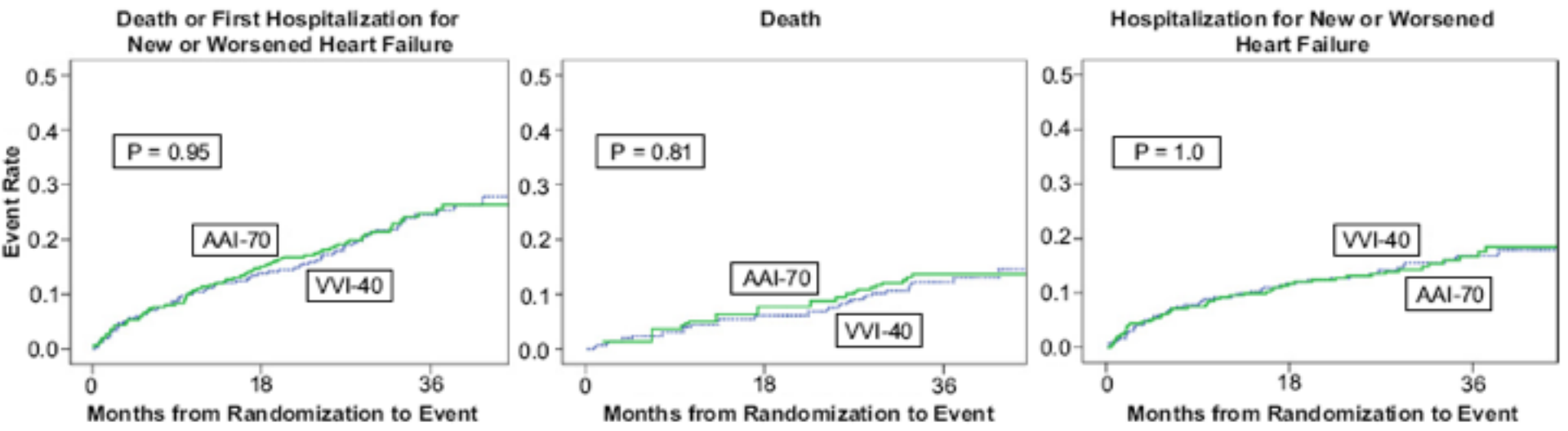
Results There were no significant differences between pacing arms in patients' baseline characteristics, use of heart failure medications, and combined primary end point of time to death or heart failure hospitalization during follow-up, with an overall incidence of 11.1%, 16.9%, and 24.6% at 1, 2, and 3 years, respectively. Similarly, the incidence of atrial fibrillation, syncope, appropriate or inappropriate shocks, and quality of life measures did not significantly differ between treatment groups.

Conclusions The effect of atrial pacing on event-free survival and quality of life was not substantially worse than, and was likely equivalent to, backup-only ventricular pacing. Atrial pacing may be considered a "safe alternative" when pacing is desired in defibrillator recipients, but affords no clear advantage or disadvantage over a ventricular pacing mode that minimizes pacing altogether. (Dual Chamber and VVI Implantable Defibrillator [DAVID] Trial II; NCT00187187) (J Am Coll Cardiol 2009;53:872–80) © 2009 by the American College of Cardiology Foundation

DAVID II TRİAL PRİMARY ENDPOİNTS

(AAI-70 [green lines])
(VVI-40 [blue lines]).

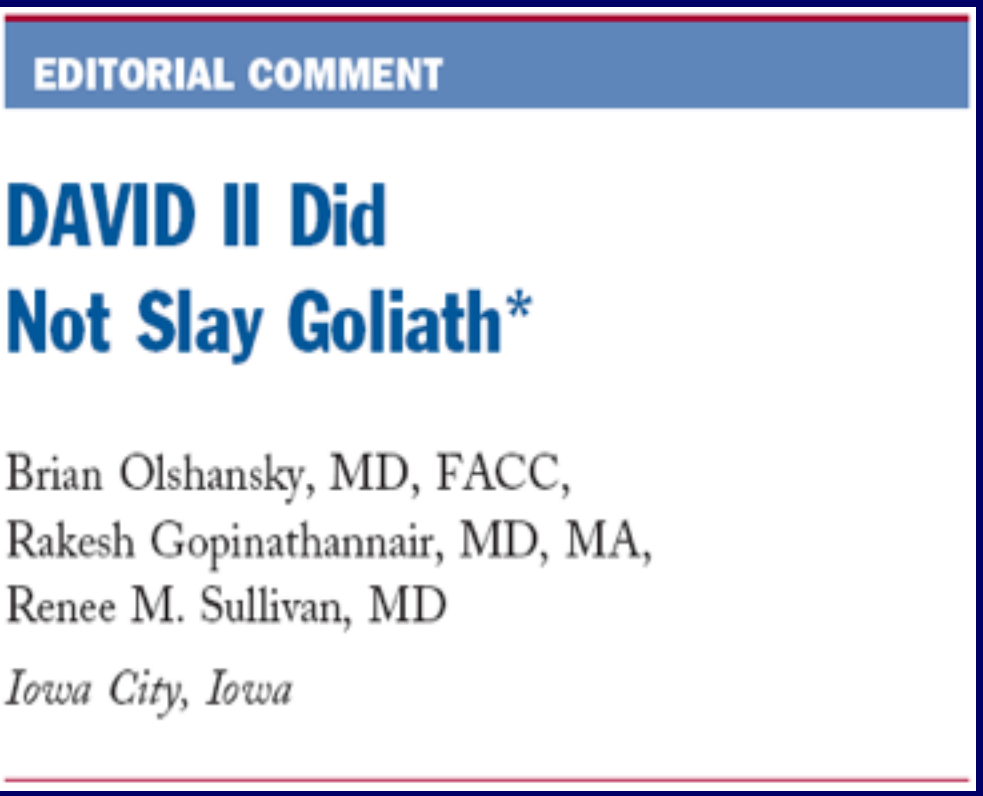
F/U: 2.7 years; n=600



Number of Patients at Risk at Month Shown			
	0	18	36
VVI-40	300	252	109
AAI-70	300	251	109

Number of End Point Events in Follow-up	
Deaths	Heart Failure Hospitalizations
36	47
38	47

Wilkoff BL. Et al., J. Am. Coll. Cardiol. 2009;53;872-880


EDITORIAL COMMENT

DAVID II Did Not Slay Goliath*

Brian Olshansky, MD, FACC,
Rakesh Gopinathannair, MD, MA,
Renee M. Sullivan, MD

Iowa City, Iowa

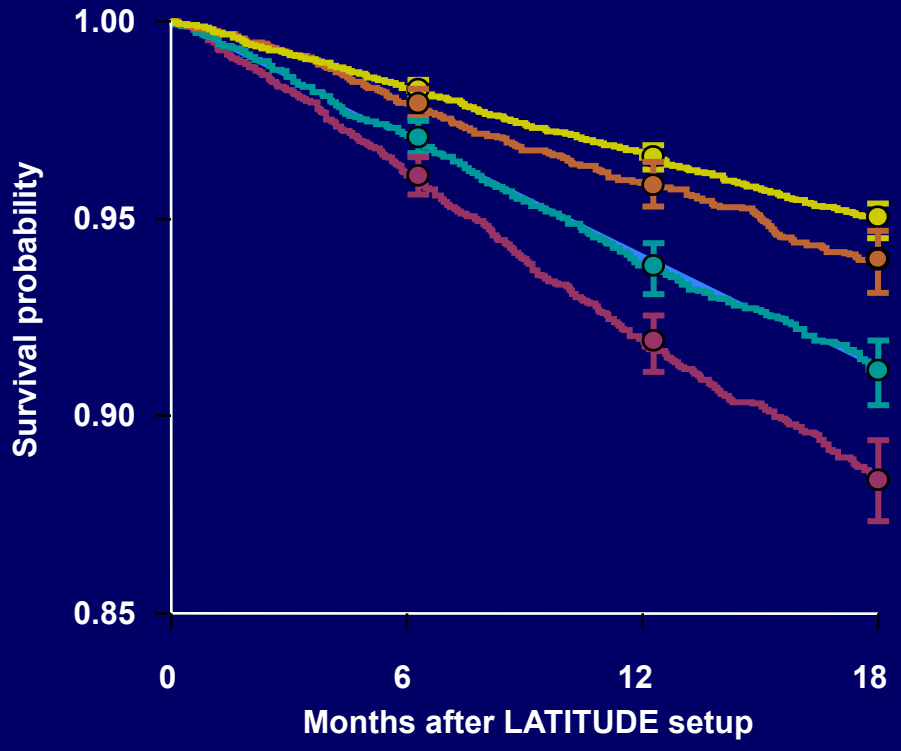
- ✓Non rate responsive AAI pacing (no V pace)
- ✓Average HR slightly higher in AAI arm
- ✓The purpose of atrial pacing uncertain
- ✓AAI programming not likely to be considered as a routine programming modality

"Whereas the DAVID trial cast the first stone against dual chamber ICD programming, its brother, the DAVID II trial, appears to have missed the shot at conquering the substantial challenges, the proverbial Goliath"

J Am Coll Cardiol 53,2009: 881–3

ALTITUDE
%RV Pacing Survival

n= 34,514



0%	14,970	12,287	8,822	3,176
1-4%	5,814	4,753	3,467	1,337
5-34%	6,940	5,634	4,003	1,403
35-100%	6,790	5,438	3,811	1,371

(0% contains 2 quintiles)

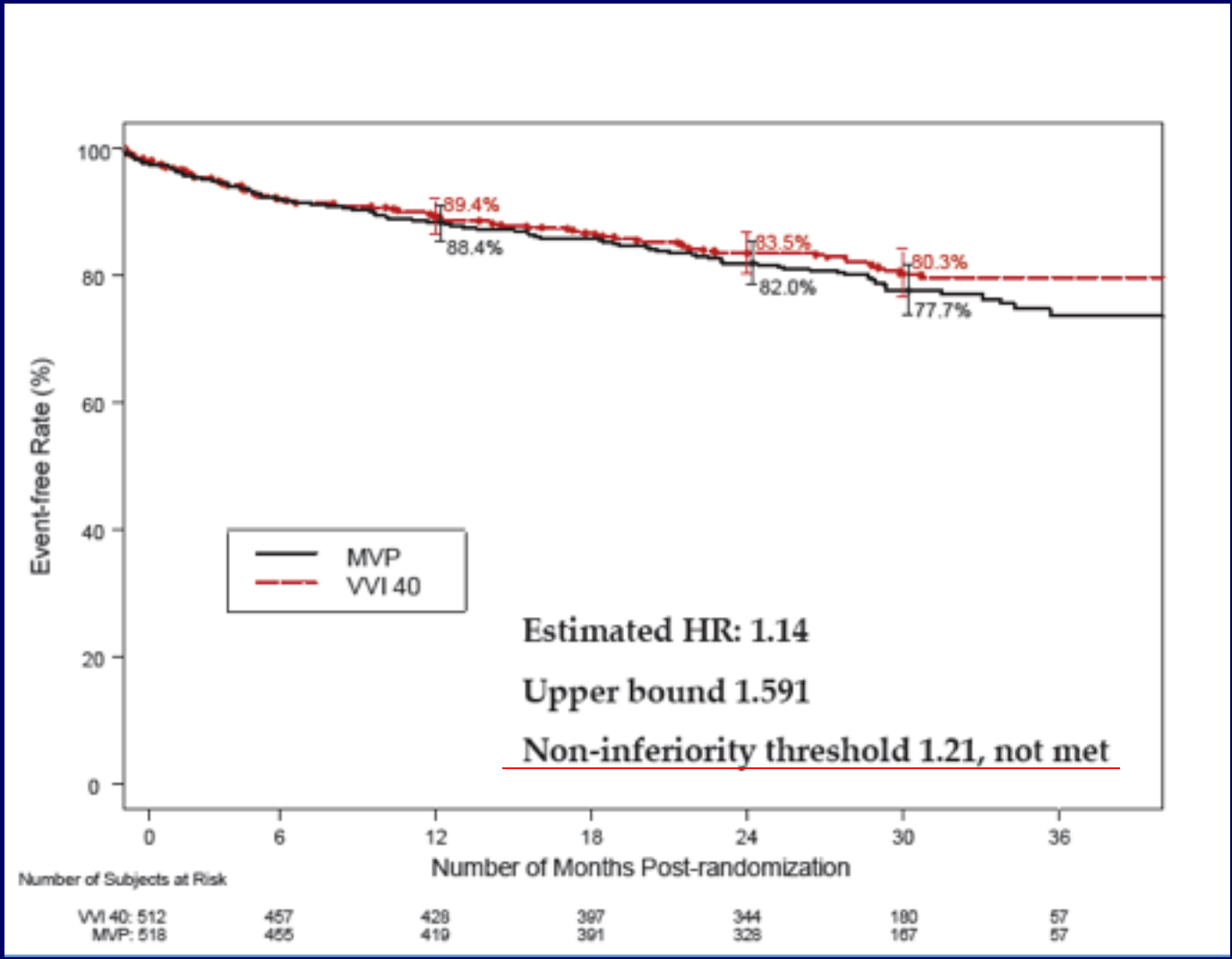
- Less than 5% RV pacing improved survival 43%
- Remote monitoring provides continuous assessment of RV pacing to guide therapy

Hayes DL, et al. Heart Rhythm 2009 Abstract

- ✓ALTITUDE analysis validates previous clinical trial results in the largest cohort of patients reported to date thereby providing a more precise estimate of risk
- ✓Less than 5% ventricular pacing was associated with 43% survival improvement
- ✓Remote monitoring provides continuous assessment of RV pacing percentage and should be used to guide clinical adjustments as necessary
- ✓Clinicians should take advantage of the various programmable parameters available to reduce unnecessary RV pacing

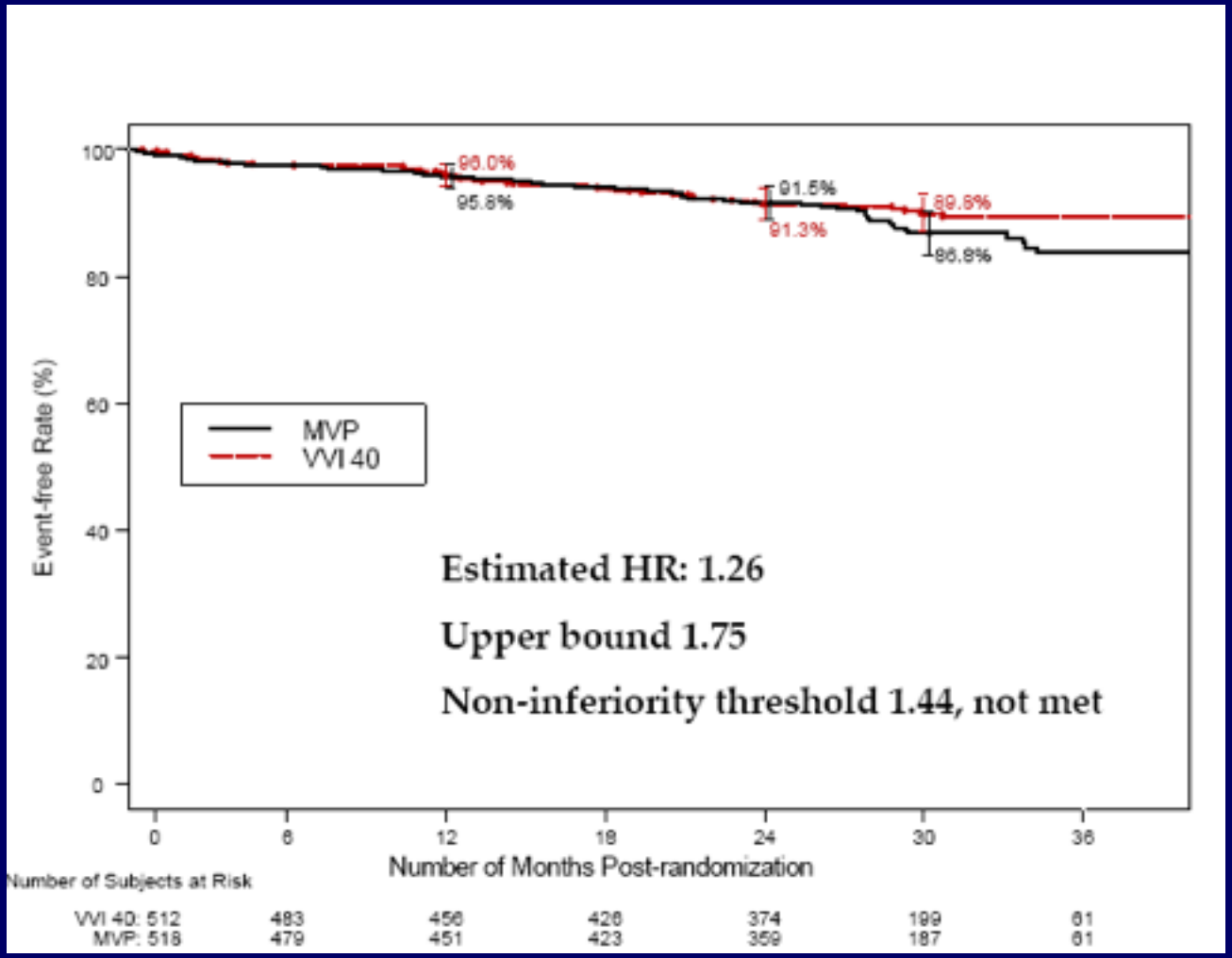
MVP TRİAL

PRİMARY ENDPOİNT: DEATH, HEART FAİLURE



Sweeney MO et al., HRS 2009 Presentation

MVP TRİAL
ALL CAUSE MORTALİTY



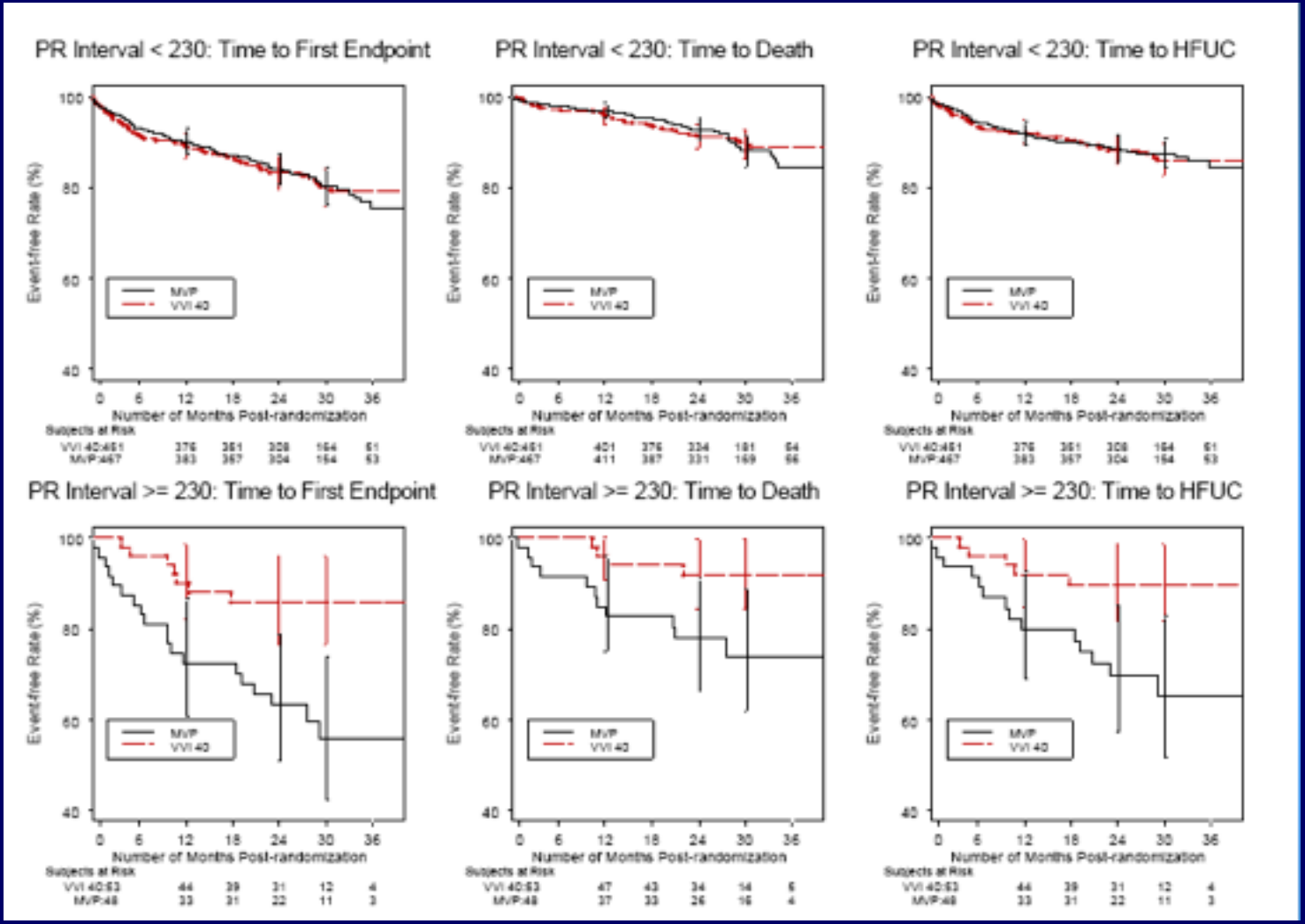
Sweeney MO et al., HRS 2009 Presentation

-MVP TRİAL-
PRİMARY ENDPOİNT SUBANALYSES
BY BASELİNE CLİNİCAL CHARACTERİSTİCS

Characteristic	Subgroups	Patients	Hazard Ratio	P-value
PR Interval	< 220 ms	859	1.03	0.908
	≥ 220 ms	160	1.79	0.202
	< 230 ms	918	1.02	0.932
	≥ 230 ms	101 (10%)	2.79	0.019
NYHA	I	262	1.17	0.726
	II	567	1.08	0.765
	III	195	1.10	0.738
LVEF	≤ 40%	616	1.07	0.781
	> 40%	244	1.37	0.545
Heart Rate	< 60 bpm	215	1.44	0.371
	≥ 60 bpm	769	1.08	0.734
Ischemic CMP	Yes	386	1.13	0.592
	No	644	1.16	0.649

Sweeney MO et al., HRS 2009 Presentation

-MVP TRİAL-
PRİMARY ENDPOİNT BY PR INTERVAL >230 MS



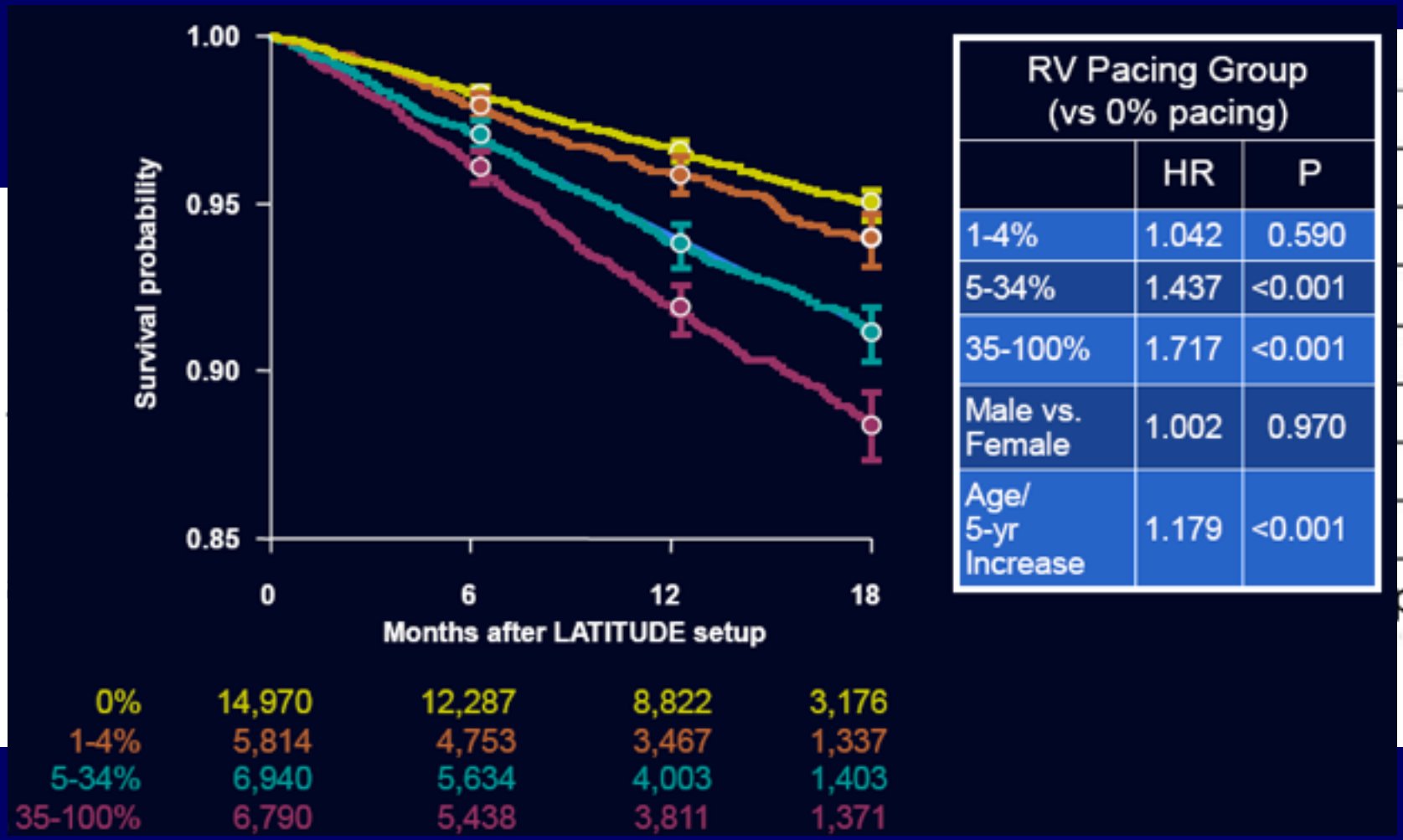
HFUC: Heart failure related urgent care: Requiring intravenous heart failure therapy (diuretics, vasodilators, inotropic agents)

Sweeney MO et al., HRS 2009 Presentation

Lessons from DAVID I/II, Intrinsic RV, Altitude and MVP

- Atrial pacing in ICD patients is safe (no improved survival with atrial pacing)
- Dual chamber ICDs are safe provided RV pacing is avoided
- Lingering questions:
  - Where is cutt-off point of percentage for RV pacing (How much RV pacing is safe)
  - Is there a limit as to how far we can extend the AV delay in heart failure patients to avoid RV pacing…

HOW MUCH RV PACİNG İS SAFE?



RV Pacing Group (vs 0% pacing)		
	HR	P
1-4%	1.042	0.590
5-34%	1.437	<0.001
35-100%	1.717	<0.001
Male vs. Female	1.002	0.970
Age/ 5-yr Increase	1.179	<0.001

1- Sweeney MO, et al. *Circulation. 2003;107:2932-2937*
2- Olshansky B. Heart Rhythm 2007;4:886–891
3- Hayes DL, et al. Heart Rhythm 2009 Abstract

HOW FAR WE CAN EXTEND THE AV DELAY?

"No definitive conclusion can be drawn regarding the best option for a patient with sinus bradycardia, a long PR, a narrow QRS and LV dysfunction"

"It would be reasonable to perform a study to evaluate the best approach for these patients"

Brian Olshansky; LV Dysfunction, Bradycardia and Marked 1st Degree AV Block: ICD with AV Delay of 350-400 msec or CRTD? HRS 2009

COST

Cost Advantage of Dual-Chamber Versus Single-Chamber Cardioverter-Defibrillator Implantation

Zachary Goldberger, MD,* Brian Elbel, MPH,† Craig A. McPherson, MD, FACC,*
A. David Paltiel, PHD,† Rachel Lampert, MD, FACC*

New Haven, Connecticut

OBJECTIVES The purpose of this study was to determine the least expensive strategy for device selection in patients receiving implantable cardioverter-defibrillators (ICDs).

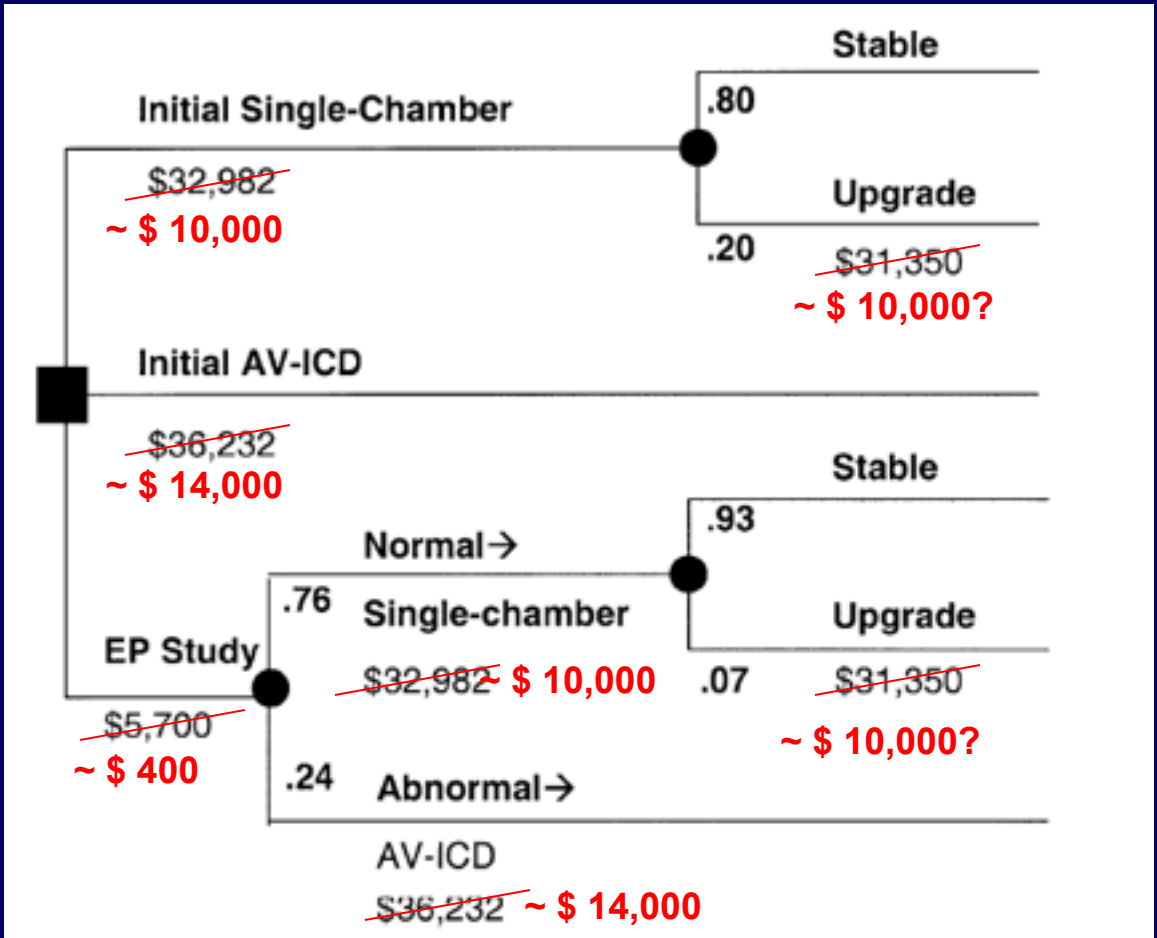
BACKGROUND Device cost for a single-chamber ICD is less than an atrioventricular (dual-chamber) ICD (AV-ICD); however, some patients without clinical need for AV-ICD at implantation might require a later upgrade, potentially offsetting the initial cost advantage of the single-chamber device.

METHODS Decision analysis was used to estimate expected resource utilization costs of three alternative implantation strategies: 1) single-chamber device in all, with later upgrade to AV-ICD if needed; 2) initial implantation of an AV-ICD in all; and 3) targeted device selection on the basis of results of electrophysiologic testing (presence or absence of induced bradyarrhythmias or atrial arrhythmias). Clinical base estimates were obtained from retrospective review of all patients receiving ICDs between June 1997 and July 2001 at a single university hospital. Economic inputs were collected from national and single-center sources.

RESULTS In patients without other indications for electrophysiologic study (EPS), the expected per-person cost was least with the strategy of universal initial AV-ICD implantation ($36,232) compared with initial single-chamber ICD/upgrade as needed ($39,230) or EPS-guided selection ($41,130). Sensitivity analyses demonstrated that universal AV-ICD implantation remained least expensive with upgrade rates as low as 10%. At a 5% upgrade rate, AV-ICD remained cheapest if the device cost-differential narrowed to $1,568. For patients undergoing EPS for risk assessment, EP-guided selection was least expensive.

CONCLUSIONS The strategy of universal AV-ICD implantation, which provides the benefits of dual-chamber capability while obviating any potential need for future upgrade, is the least costly strategy for most patient populations receiving ICDs. (J Am Coll Cardiol 2005;46:850–7) © 2005 by the American College of Cardiology Foundation

COST



Decision tree. The costs listed are the non-cumulative costs associated with that particular point in the decision analytic model. AV-ICD atrioventricular ICD; EP electrophysiologic. Red numbers are approximate costs in Turkey.

DETECT SVT STUDY

Dual-Chamber Versus Single-Chamber Detection Enhancements for Implantable Defibrillator Rhythm Diagnosis

The Detect Supraventricular Tachycardia Study

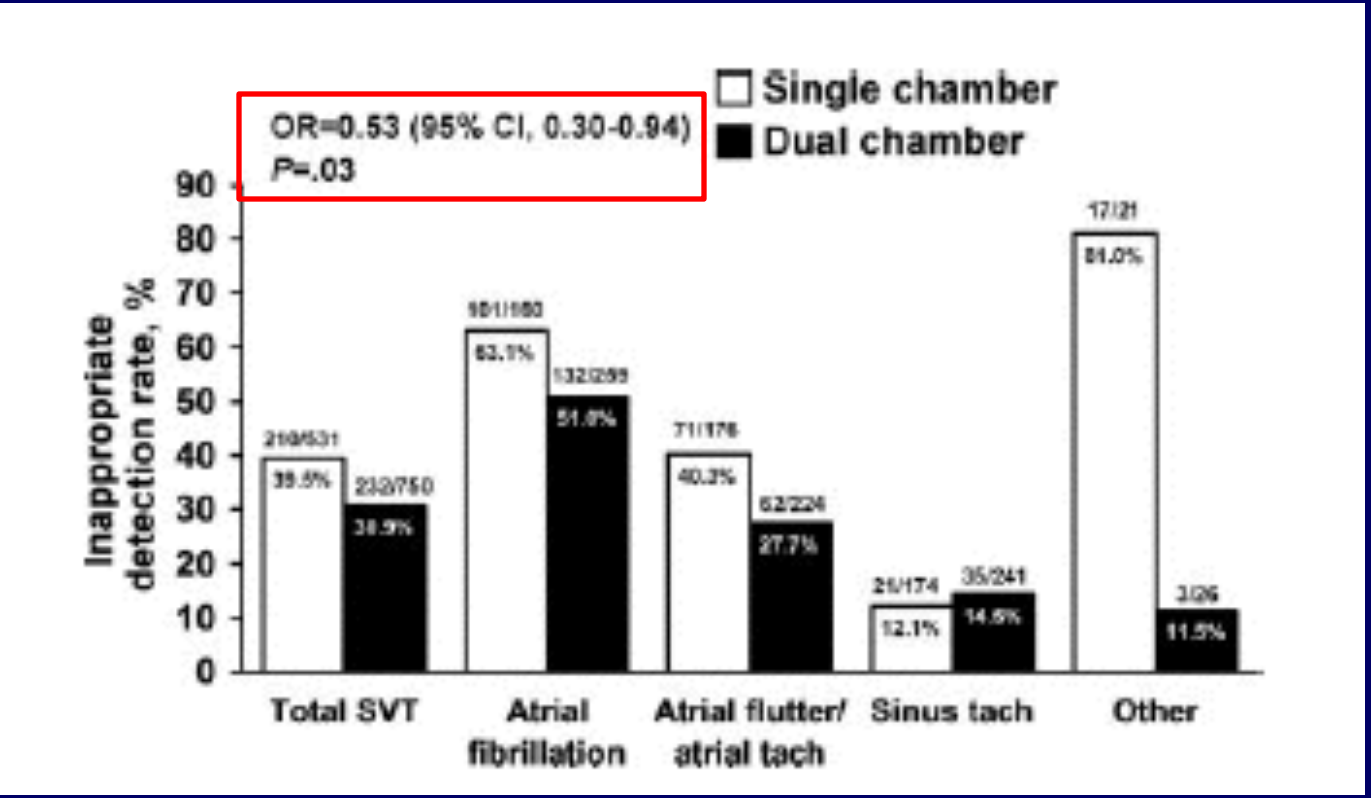
Paul A. Friedman, MD; Robyn L. McClelland, PhD; William R. Bamlet, MS; Helbert Acosta, MD; David Kessler, MD; Thomas M. Munger, MD; Neal G. Kavesh, MD; Mark Wood, MD; Emile Daoud, MD; Ali Massumi, MD; Claudio Schuger, MD; Stephen Shorofsky, MD; Bruce Wilkoff, MD; Michael Glikson, MD

Background—Delivery of inappropriate shocks caused by misdetection of supraventricular tachycardia (SVT) remains a substantial complication of implanted cardioverter/defibrillator (ICD) therapy. Whether use of optimally programmed dual-chamber ICDs lowers this risk compared with that in single-chamber ICDs is not clear.

Methods and Results—Subjects with a clinical indication for ICD (n=400) at 27 participating centers received dual-chamber ICDs and were randomly assigned to strictly defined optimal single- or dual-chamber detection in a single-blind manner. Programming minimized ventricular pacing. The primary end point was the proportion of SVT episodes inappropriately detected from the time of programming until crossover or end of study. On a per-episode basis, 42% of the episodes in the single-chamber arm and 69% of the episodes in the dual-chamber arm were due to SVT. Mortality (3.5% in both groups) and early study withdrawal (14% single-chamber, 11% dual-chamber) were similar in both groups. The rate of inappropriate detection of SVT was 39.5% in the single-chamber detection arm compared with 30.9% in the dual-chamber arm. The odds of inappropriate detection were decreased by almost half with the use of the dual-chamber detection enhancements (odds ratio, 0.53; 95% confidence interval, 0.30 to 0.94; P=0.03).

Conclusions—Dual-chamber ICDs, programmed to optimize detection enhancements and to minimize ventricular pacing, significantly decrease inappropriate detection. (***Circulation*. 2006;113:2871-2879.**)

Rate of inappropriate detection of SVT for subjects with single- or dual-chamber ICD



"Other" arrhythmias include atrial tachycardia, junctional tachycardia, AVNRT, and AVRT.

Detect SVT; Friedman et al, Circulation 2006;113:2871-2879.)

Atrial Extra Leads Complications

- ✓DATAS –Atrial lead dislodgement 4/223 (1.8%)
- ✓INTRINSIC RV –atrial lead issues 26/1530 (1.6%)
- ✓CMS database 1.3% lead dislodgement
- ✓Pacemaker leads similar (experienced implanters)

NATIONAL ICD REGISTRY ANNUAL REPORT 2008

Year	2006	2007	2008
Total implants (N)	92,375	119,550	127,151
Single chamber ICD (%)	23.4	21.8	20.5
Dual chamber ICD (%)	39.1	39.1	39.7
Biventricular ICD (%)	37.4	39.0	39.7

Heart Rhythm,2009;(6),1397-1401

CONCLUSİON

- ✓No evidence that atrial pacing improves outcomes in ICD patients
- ✓A Class I indication for bradycardia pacing emerged in 5.5% of patients
  - – Dual chamber mode required in 8.8% of VVI40
  - – Rate response required in 4.1% of MVP
- ✓Despite 4 RCTs enrolling 3,125 patients, the optimal *a priori strategy for bradycardia* pacing support that is required or desired in typical ICD patients is still unknown.
- ✓SVT detection is better in dual chamber pacing in comparison with single chamber.
- ✓Cost should be calculated for every country for its own conditions.
- ✓Extra lead adds a small percentage of complication rate.

MY OPİNİON İS:

DECİSİON MUST BE MADE FOR EVERY İNDİVİDUAL PATİENT

THANK YOU…