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2013 ESC Guidelines on cardiac pacing and cardiac resynchronization therapy: Addenda

The Task Force on cardiac pacing and resynchronization therapy of the European Society of Cardiology (ESC). Developed in collaboration with the European Heart Rhythm Association (EHRA).

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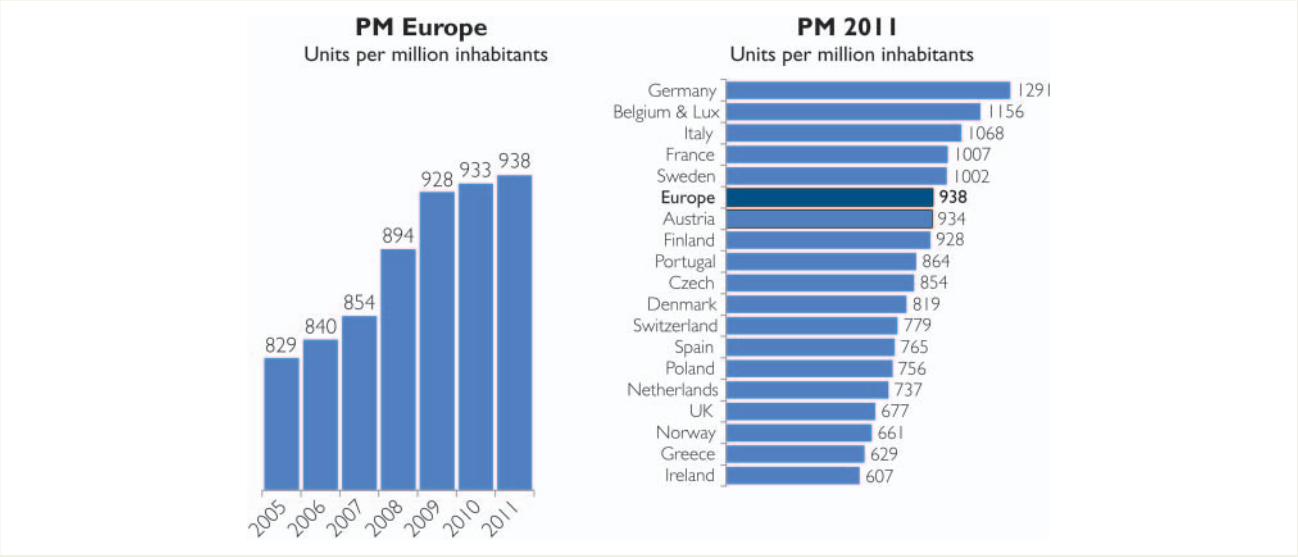
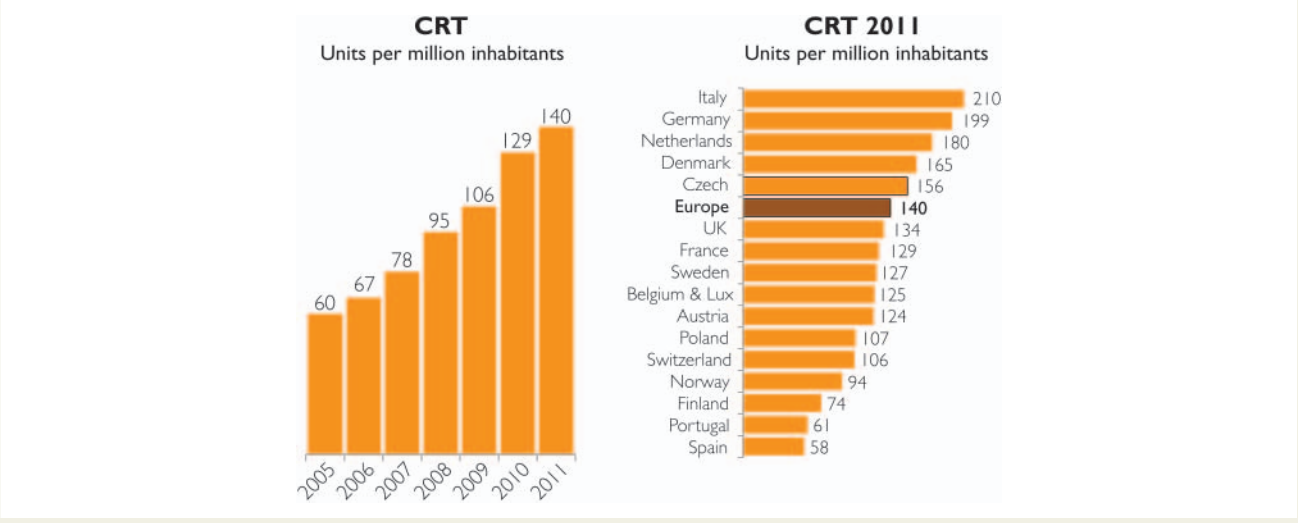
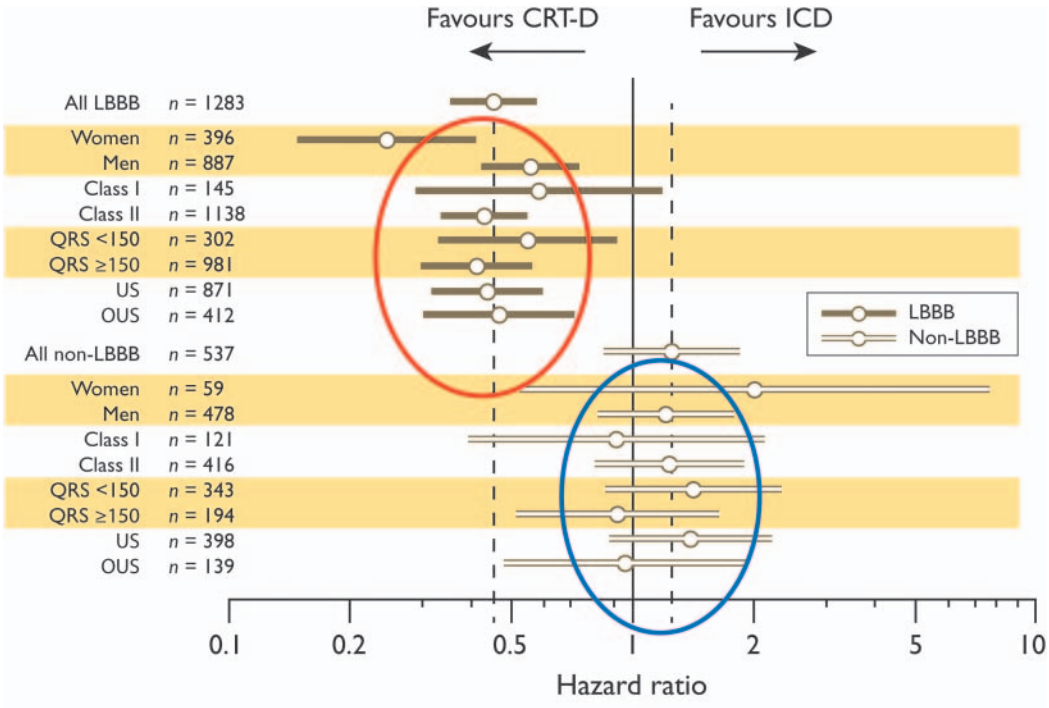


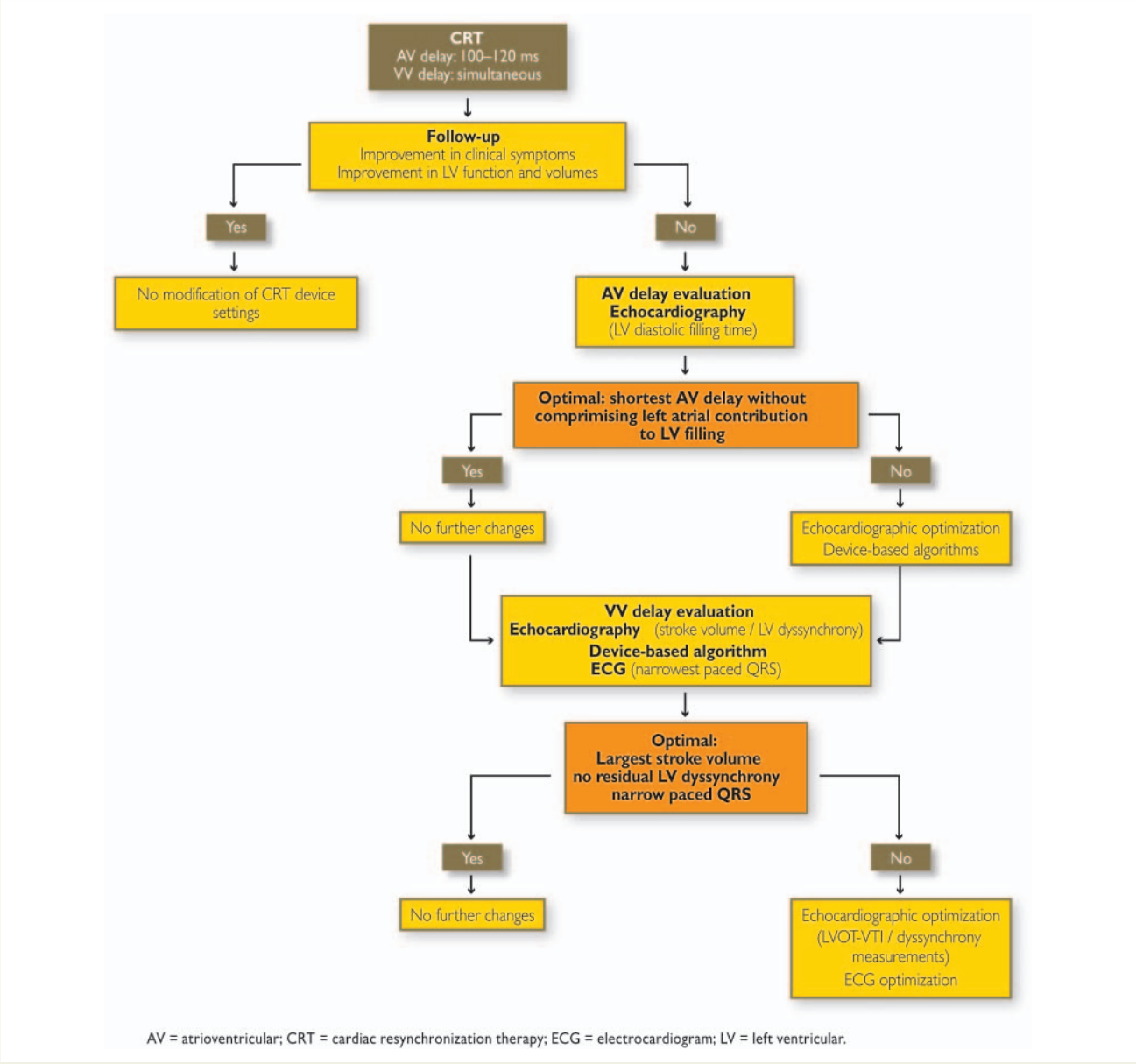
Web Figure 1 Average implantation rate of pacemaker (PM) in the 16 western European countries, Poland and Czech Republic (units per million inhabitants) based on reports from major manufacturers. The figures include first implantations and replacements
Source: Eucomed (www.eucomed.org/medical-technology/facts-figures).[w2]



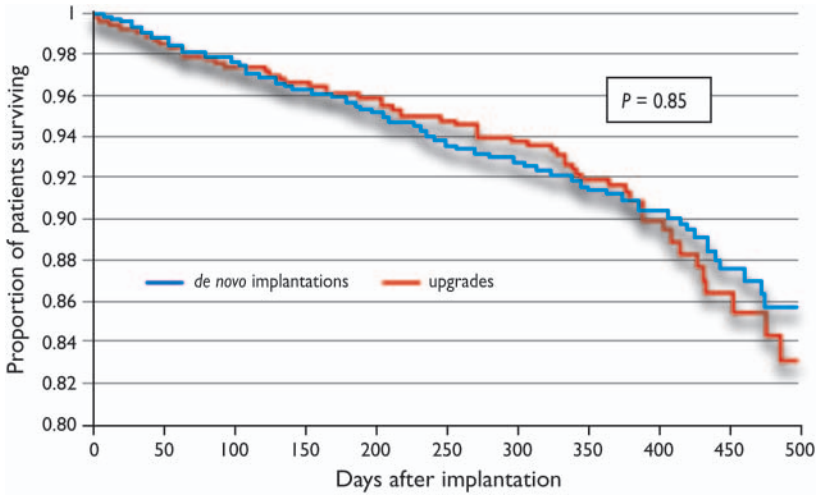
Web Figure 6 Average implantation rate of devices for cardiac resynchronization therapy (CRT) in the 16 European countries (units per million inhabitants) based on reports from major manufacturers. The figures include first implantations and replacements
Source: Eucomed (www.eucomed.org/medical-technology/facts-figures)[w2]



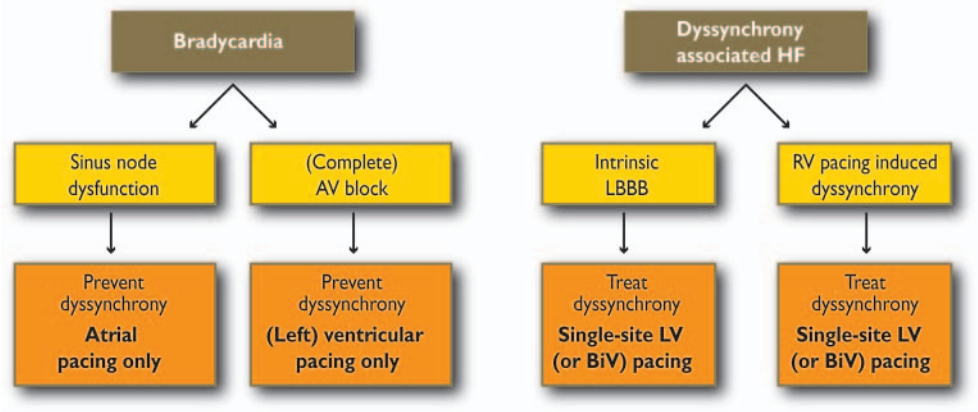
Web Figure 7 Relative risk of primary end-point (heart failure or death) by treatment (cardiac resynchronization therapy and defibrillator (CRT-D) versus implantable cardioverter defibrillator (ICD) only according to selected clinical characteristics in patients with left bundle branch block (LBBB; top) and non-LBBB patients (bottom) in the MADIT-CRT study (adapted from Zareba et al[w354]). Class I refers to New York Heart Association classification; US=United States patients; OUS=outside United States patients



Web Figure 9 Algorithm for atrioventricular and interventricular delay optimization. AV=atrioventricular; CRT=cardiac resynchronization therapy; ECG=electrocardiogram; LV=left ventricular



Web Figure 11 Kaplan-Meier estimates of time to death of any cause during the follow-up period of >1 year (9–15 months) in the European CRT Survey.[w355]



Web Figure 12 Suggested optimal pacing mode in children (modified from van Geldorp I et al[w204])

Web Table 3 **Clinical characteristics and pacing modality in patients treated by permanent pacing in the registries of the some European national pacing societies**[w3-8]

	Italy year 2007 n = 31 146	Germany year 2008 n = 67 689	France year 2009 n = 64 306	Spain year 2010 n = 11 648	Sweden year 2010 n = 6494	UK year 2010 n = 43 650
Mean age (years), gender	77.6	76m/79f	-	76.8	75m/78f	75m/77f
Indication for implant						
AVB	44.6%	37.4%	-	55.6%	37.7%	42.2%
AF + AVB	18.1%	19.6%	-	16.2%	20.7%	15.9%
SSS	26.8%	36.2%	-	20.2%	33.5%	26.3%
BBB	4.9%	6.8%	-	6.2%	6.5%	8.3%
Others (not classified)	5.5%	0.3%	-	-	1.6%	7.4%
Pacemaker type						
Dual-chamber	66.2%	70.8%	75.4%	75.0%	71.0%	63.8%
Single-chamber, ventricular	32.0%	27.6%	21.4%	24.8%	22.0%	28.2%
Single-chamber, atrial	0.2%	0.6%	-	-	1.3%	0.8%
Biventricular	1.7%	0.7%	3.2%	-	5.7%	7.2%

AVB=atrioventricular block (includes I, II and III degree); AF=atrial fibrillation; SSS=sick sinus syndrome (includes reflex syncope); BBB=bundle branch block.

Web Table 4 **Causes of bradycardia**

INTRINSIC
Idiopathic (ageing) degeneration
Ischaemic heart disease
Infiltrative diseases: sarcoidosis, amyloidosis, haemochromatosis
Collagen vascular diseases: systemic lupus erythematosus, rheumatoid arthritis, scleroderma
Congenital diseases, including sinus node and AV node disease
Infective diseases: myocarditis, endocarditis, Chagas disease, diphtheria, Gram-negative sepsis, typhoid fever, Lyme disease
Rare genetic diseases: associated with a cardiomyopathy (laminopathies, myotonic dystrophy, desminopathies, mitochondrial disorders, Danon disease, Anderson–Fabry disease, PRKAG2 mutation) or not (primary conduction defect)
Surgical trauma: valve replacement (including percutaneous aortic replacement), heart transplantation
Intended or unintended AV block due to catheter ablation procedures
EXTRINSIC
Physical training (sports)
Vagal reflex: vasovagal, situational (micturition, defaecation, swallow, gastrointestinal stimulation, cough, post-prandial, etc), carotid sinus syndrome
Idiopathic paroxysmal AV block
Drug effects
Cocaine abuse and other recreational drugs
Electrolyte imbalance: hypokalaemia, hyperkalaemia
Metabolic disorders: hypothyroidism, hypothermia, anorexia nervosa
Neurological disorders: increased intracranial pressure, central nervous system tumours
Obstructive sleep apnoea

AV=atrioventricular.

Web Table 5 **Typical symptoms of bradycardia (SB and AV block)**

Persistent bradycardia	Intermittent bradycardia
Due to cerebral hypoperfusion	
• Easy fatiguability	• Syncope, pre-syncope
• Irritability, lassitude, inability to concentrate	• Dizziness, vertigo
• Apathy, forgetfulness, cognitive impairment	• Light-headedness, blurred vision
• Dizziness, vertigo	
Due to other mechanisms	
• Shortness of breath, heart failure	• Sudden dyspnoea and chest pain unrelated to exercise
• Reduced exercise capacity (chronotropic incompetence)	• Palpitation (irregular beats)

AV=atrioventricular; SB=sinus bradycardia.

Web Table 9 **Classification of ECG observations obtained with ILR at the time of spontaneous syncope, with their probable related mechanism (adapted from ISSUE classification[w54])**

Classification	Description	Suggested mechanism
Type 1, asystole	R–R pause ≥3 s	
• Type 1A, sinus arrest	Progressive SB or initial sinus tachycardia followed by progressive SB until sinus arrest.	Probably reflex
• Type 1B, SB plus AV block	Progressive SB followed by AV block (and ventricular pause/s) with concomitant decrease in sinus rate.	Probably reflex
• Type 1C, AV block	Sudden onset AV block (and ventricular pause/s) with concomitant increase in sinus rate.	Probably intrinsic or idiopathic AV block.
Type 2, bradycardia	Progressive decrease of heart rate >30% or <40 b.p.m. for >10 s.	Probably reflex
Type 3, no or slight rhythm variations	Variations of heart rate <30% and heart rate >40 b.p.m.	Uncertain
Type 4, tachycardia	Increase of heart rate >30% of >120 b.p.m.	
• Type 4 A	Progressive sinus tachycardia.	Uncertain
• Type 4 B	Atrial fibrillation	Cardiac arrhythmia
• Type 4 C	Supraventricular tachycardia (except sinus).	Cardiac arrhythmia
• Type 4 D	Ventricular tachycardia	Cardiac arrhythmia

AV=atrioventricular; ECG=electrocardiogram; SB=sinus bradycardia.

Web Table 11 **Definition of intraventricular conduction disturbances (adapted from Surawicz et al[w111] and Zareba et al[w354])**

Disturbance	Definition
Complete LBBB	• QRS duration ≥120 ms
	• QS or rS in lead V_1
	• broad (frequently notched or slurred) R waves in leads I, aVL, V_5, or V_6
	• absent Q waves in leads V_5 and V_6
Complete RBBB	• QRS duration ≥120 ms; rSR', rSR', rSR', or qR in leads V_1 or V_2
	• occasionally, a wide and notched R wave and wide S
	• waves in leads I, V_5, and V_6.
Non-specific IVCD	QRS ≥120 ms without typical features of LBBB or RBBB
Incomplete LBBB or RBBB	QRS duration between 110 and 119 ms

LBBB=left bundle branch block; IVCD=intraventricular conduction delay; RBBB=right bundle branch block.

Web Table 12 Inclusion criteria, design, end-points and main findings of the clinical trials evaluating the effect of atrioventricular and interventricular delay optimization

Trial (ref. no.)	No.	Design	NYHA	LVEF	QRS	Primary endpoints	Secondary endpoints	Main findings
SMART-AV[w356]	980	Double-blinded, randomized AV delay optimization AV delay settings based on SmartDelay vs. Echo vs. Empiric fixed 120 ms 5.8 ± 1.6 months	III–IV	≤35%	≥120	LVESV	NYHA class, QoL, 6MWD, LVEDV, LVEF	AV delay optimization with SmartDelay or echocardiography did not provide incremental benefit over the empiric fixed AV delay at 120 ms
InSync III[w357]	397	Prospective cohort VV delay optimization Sequential BiV pacing (Echo) vs. simultaneous BiV pacing 6 months	III–IV	≤35%	≥130	NYHA class, 6MWD, QoL, LV stroke volume	NA	VV optimization with sequential BiV. pacing set with echocardiography methods improved the primary endpoint
RHYTHM II ICD[w358]	121	Single-blinded, randomized, VV delay optimization Sequential BiV pacing (Echo) vs. simultaneous BiV pacing 6 months	III–IV	≤35%	≥150	NYHA class, 6MWD, QoL	All-cause mortality and hospitalizations	VV optimization with sequential BiV pacing set with echocardiography methods did not improve the primary and secondary endpoints
DECREASE-HF[w359]	306	Double-blinded, randomized VV delay optimization (algorithms based on intracardiac ECG) Simultaneous BiV pacing vs. Sequential BiV pacing vs. LV pacing 6 months	III–IV	≤35%	≥150	Peak VO_2 and LVESD	LVEF, LV volumes and MR	Simultaneous BiV pacing was associated with trend toward improvement in LVESD
FREEDOM[w360]	1647	Double-blinded, randomized AV and VV delay optimization QuickOpt vs. standard of care method / intracardiac electrograms	III–IV	NA	NA	Composite heart failure score	Hospitalizations and all-cause mortality	AV and VV optimization did not improve further the primary endpoint
CLEAR[w361]	268	Randomized, multicenter, single-blind AV and VV delay optimization SonR® vs. standard of care	III–IV	≤35%	≥120	Composite heart failure score	Changes in NYHA functional	AV and VV optimization improved the proportion of responders at 1 year (76 vs. 62%, $P = 0.03$)
Adaptive CRT[w362]	522	Randomixed, double-blinded AV and VV delay optimization Ambulatory automatic adaptive vs. echo-optimized CRT	III–IV	≤35%	≥120	Composite heart failure score	aortic velocity time integral concordance	Automatic adaptive optimization non inferior to echocardiographic optimization
Abraham *et al.*[w363]	238	Randomized, multicenter, double-blind VV delay optimization Sequential BiV pacing (Echo) vs. simultaneous BiV pacing	III–IV	≤35%	≥130	Composite heart failure score	NYHA classification, 6MWD, quality of life, peak VO_2	Composite score improved in 75% of sequential vs. 65% of simultaneous ($P = 0.001$)

AV= atrioventricular; biv.=biventricular; DECREASE -HF=Device Evaluation of CONTAK RENEWAL 2 and EASYTRAK 2: Assessment of Safety and Effectiveness in Heart Failure; FREEDOM=Frequent Optimization Study Using the QuickOpt Method; LV=left ventricular; LVEF=left ventricular ejection fraction; LVESD=left ventricular end-systolic dimension; LVESV=left ventricular end-systolic volume; No.=number of patients; NYHA=New York Heart Association; QoL=quality-of-life score; RHYTHM ICD II=Resynchronization for the HemodYnamic Treatment for Heart Failure Management Implantable Cardioverter Defibrillator II; SMART-AV=SmartDelay Determined AV Optimization: A Comparison to Other AV Delay Methods Used in Cardiac Resynchronization Therapy; VO_2=volume of oxygen; VV=interventricular; 6MWD=6-min walk distance. CLEAR=Clinical Evaluation on Advanced Resynchronizati.

Web Table 19 **Examples of rare inherited disorders associated with clinically significant cardiac disease**

Inherited primary arrhythmias	Gene and gene symbol or proteins	Cardiac phenotype
Familial long QT syndrome	KCNQ1, KCNH2, SCN5A	Brady-dependent VA
Progressive familiar AV block, autosomal dominant sick sinus syndrome.	HCN4, SCN5A, TRPM4, GJA5 genes	Bradycardia, nodal rhythm, PAF, AV block
Neuromuscular disorders		
Myotonic dystrophy type 1 (Steinert's disease).	Myotonin kinase DMPK	AV block, fascicular block, bundle branch block, atrial flutter and fibrillation, VA, DCM.
Myotonic dystrophy type 2 (proximal myotonic myopathy: PROMM).	Zinc finger protein 9 ZNF9	PAF, AV block, VA.
X-linked Emery Dreifuss muscular dystrophy (EDMD).	Emerin EMD or STA	AV block; atrial paralysis; VA; atrial flutter and fibrillation, DCM.
Laminopathies (including autosomal EDMD, limb girdle muscular dystrophy type 1B (LGMD1B) and lamin associated protein defects.	Lamin AC (LMNA) FHL1	AV block, atrial arrhythmia, VA, DCM, ARVC, SCD.
Desminopathies	Mutated desmin (DES)	Conduction defects, arrhythmias, sudden death.
Metabolic disorders		
Anderson–Fabry disease (alpha-galactosidase A deficiency).	Alpha-galactosidase A GLA	Progressive AV block, sinus node dysfunction, HCM.
Familial amyloidosis	Transthyretin TTR	Varies with mutation: AV block, cardiomyopathy.
Mutations in AMP kinase	PRKAG2	HCM, AV block, WPW
Mitochondrial cytopathies (including Kearns–Sayre disease).	mitochondrial DNA (mtDNA) deletions	AV block, atrial and ventricular arrhythmia, ventricular preexcitation, cardiomyopathy (HCM, DCM).
Danon disease	LAMP2	
Developmental disorders		
ASD with conduction disease, tetralogy of Fallot.	NK2 homeobox 5 gene NKX2.5	ASD, VSD, tetralogy of Fallot, AV conduction.
Holt Oram syndrome	TBX5	Congenital heart defects; AV block; sinoatrial disease; WPW.

ARVC=arrhythmogenic right ventricular cardiomyopathy; ASD=atrioseptal defect; AV=atrioventricular; DCM=dilated cardiomyopathy; HCM=hypertrophic cardiomyopathy; PAF=paroxysmal atrial fibrillation; VA=ventricular arrhythmia; VSD=ventriculoseptal defect; WPW=Wolff-Parkinson-White syndrome.

Web Table 21 Most frequent/important complications of PM and CRT implantation

Related to venous access:	• Pneumothorax
	• Haemothorax
Lead-related:	• Brady/tachyarrhythmias
	• Cardiac perforation
	• Cardiac tamponade
	• Coronary sinus dissection/perforation
	• Dislodgement
	• Diaphragmatic stimulation
	• Lead malposition
	• Venous thrombosis
Pocket-related:	• Haematoma
	• Wound pain
Infections:	• Pocket infection without bloodstream infection
	• Pocket infection with bloodstream infection
	• Device-related endocarditis

CRT=cardiac resynchronisation therapy; PM=pacemaker.

Web Table 22 Suggested strategy for management of antiplatelet and anticoagulant therapy in the peri-implantation period of PM/CRT

Antiplatelet therapy	Suggested strategy	References
Primary prevention	Withhold antiplatelet therapy for 3–7 days before implant, depending on the drug.	Non-randomized large observational studies.
Dual antiplatelet therapy after stent placement and acute coronary syndromes.		Non-randomized large observational studies; expert consensus.
Non-high risk period	Continue aspirin (low increase in bleeding risk).	
High risk period[a]	Continue dual antiplatelet therapy (high increase in bleeding risk).	
Warfarin therapy		
	Withhold warfarin 3–5 days before implant or continue warfarin (lower end of the recommended INR) according to a risk evaluation[b] performed by the physician.	International expert consensus
Novel oral anticoagulant		
	Withhold anticoagulant 1–3 day before implant or continue according to a risk evaluation[b] performed by the physician and restart as soon as effective haemostasis has been achieved.	Expert consensus

[a]During the minimum recommended duration of dual platelet therap
[b]High risk typical setting: prosthetic valves, AF and history of stroke, intracardiac thrombus or other acute thromboembolic event, etc.
AF=atrial fibrillation; CRT=cardiac resynchronisation therapy; INR=international normalized ratio; PM=pacemaker.

Web Table 23 **Summary of randomized studies on pacing from alternative right ventricular sites**

Trial	Study design	Patients	Length of follow-up	Main results
Barin *et al.*[w310]	RVOT vs. RVA parallel	33	73 months	Similar electrical performances and complications.
Tse *et al.*[w326]	RVOT vs. RVA parallel	24	18 months	No difference at 6 months. RVOT: better EF at 18 months, fewer perfusion defects and wall motion abnormalities.
Lewicka-Nowak *et al.*[w319]	RVOT vs. RVA parallel	27	7 years	EF deterioration in RVA but not in RVOT group.
Leong *et al.*[w318]	RVOT vs. RVA parallel	58	11–53 months	EF deterioration in RVA but not in RVOT group. Less dyssynchrony with RVOT
Stambler *et al.*[w323]	RVOT vs. RVA RVOT + RVA vs. RVA Cross-over	103	9 months	RVA higher LVEF. QoL no difference.
Gong *et al.*[w315]	RVOT vs. RVA parallel	96	12 months	Less dyssynchrony with RVOT. No difference in cardiac remodelling and LV systolic function.
Occhetta *et al.*[w321]	Para-Hisian vs. RVA pacing cross-over	16	6 months	Para-Hisian: improvement in functional and haemodynamic parameters.
Mera *et al.*[w320]	RVS vs. RVA cross-over	12	2 months	High RVS: greater FS and resting EF, no difference in exercise capacity.
Victor *et al.*[w324]	RVOT vs. RVA cross-over	16	4 months	No difference whatever the EF.
Flevari *et al.*[w314]	RVS vs. RVA parallel	31	12 months	EF deterioration in RVA but not in RVS group.
Kypta *et al.*[w317]	RVS vs. RVA parallel	98	18 months	Similar HF rate during follow-up, no difference in EF and in exercise capacity.
Cano *et al.*[w311]	RVS vs. RVA parallel	93	12 months	Less dyssynchrony with RVS. No difference in cardiac function, exercise capacity, NYHA class and QoL.
Domenichini *et al.*[w313]	RVS vs. RVA parallel	59	1 and 4 years	RVS: no advantage on LVEF. May be deleterious when the RVS lead is inadvertently positioned anterior.
Wang *et al.*[w325]	RVOT vs. RVA parallel	60	12 months	RVA: more dyssynchrony and LV wall motion abnormalities. No difference observed between the groups with respect to LVEF.
Kristiansen[w316]	CRT with RVS vs. RVA, parallel	85	6 months	No difference in LV reverse remodelling and dyssynchrony.

EF=ejection fraction; FS=fractional shortening; HF=heart failure; LV=left ventricular; NYHA=New York Heart Association; QoL=quality of life; RVOT= right ventricle outflow tract pacing; RVA=right ventricle apical pacing; RVS=right ventricle septal pacing.

Web references

w1. Auricchio A, Kuck K-H, Hatala R, Arribas F. The EHRA White Book 2012: The Current Status of Cardiac Electrophysiology in ESC Member Countries. http://www.escardio.org/communities/EHRA/publications/Documents/white-book-2012-e-catalogue/data/catalogue.pdf.

w2. Eucomed. Medical Technology - Key Facts and Figures. http://www.eucomed.org/medical-technology/facts-figures.

w3. Coma Samartin R, Sancho-Tello de Carranza MJ, Ruiz Mateas F, Leal del Ojo Gonzalez J, Fidalgo Andres ML. [Spanish pacemaker registry. Eighth official report of the Spanish Society of Cardiology Working Group on Cardiac Pacing (2010)]. *Rev Esp Cardiol* 2011;**64**:1154–1167.

w4. Cunningham D, Charles R, Cunningham M, de Lange A. Cardiac Rhythm Management: UK National Clinical Audit 2010. http://www.ucl.ac.uk/nicor/audits/cardiacrhythmmanagement/publicreports/pdfs/Heartrhythm10.

w5. Markewitz A. [The German Pacemaker Register]. *Herzschrittmacherther Elektrophysiol* 2010;**21**:248–255.

w6. Proclemer A, Ghidina M, Gregori D, Facchin D, Rebellato L, Zakja E, Gulizia M, Esente P. Trend of the main clinical characteristics and pacing modality in patients treated by pacemaker: data from the Italian Pacemaker Registry for the quinquennium 2003-07. *Europace* 2010;**12**:202–209.

w7. Swedish ICD and Pacemaker Register. Annual Statistical Report 2010. www.pacemakerregistret.se.

w8. Tuppin P, Neumann A, Marijon E, de Peretti C, Weill A, Ricordeau P, Danchin N, Allemand H. Implantation and patient profiles for pacemakers and cardioverter-defibrillators in France (2008–2009). *Arch Cardiovasc Dis* 2011;**104**:332–342.

w9. Edhag O. Long-term cardiac pacing. Experience of fixed-rate pacing with an endocardial electrode in 260 patients. *Acta Med Scand Suppl* 1969;**502**:9–110.

w10. Edhag O, Swahn A. Prognosis of patients with complete heart block or arrhythmic syncope who were not treated with artificial pacemakers. A long-term follow-up study of 101 patients. *Acta Med Scand* 1976;**200**:457–463.

w11. Friedberg CK, Donoso E, Stein WG. Nonsurgical acquired heart block. *Ann N Y Acad Sci* 1964;**111**:835–847.

w12. Johansson BW. Complete heart block. A clinical, hemodynamic and pharmacological study in patients with and without an artificial pacemaker. *Acta Med Scand Suppl* 1966;**451**:1–127.

w13. Michaelsson M, Jonzon A, Riesenfeld T. Isolated congenital complete atrioventricular block in adult life. A prospective study. *Circulation* 1995;**92**:442–449.

w14. Barold SS. Indications for permanent cardiac pacing in first-degree AV block: class I, II, or III? *Pacing Clin Electrophysiol* 1996;**19**:747–751.

w15. Brecker SJ, Xiao HB, Sparrow J, Gibson DG. Effects of dual-chamber pacing with short atrioventricular delay in dilated cardiomyopathy. *Lancet* 1992;**340**:1308–1312.

w16. Carroz P, Delay D, Girod G. Pseudo-pacemaker syndrome in a young woman with first-degree atrio-ventricular block. *Europace* 2010;**12**:594–596.

w17. Shaw DB, Holman RR, Gowers JI. Survival in sinoatrial disorder (sick-sinus syndrome). *Br Med J* 1980;**280**:139–141.

w18. Sutton R, Kenny RA. The natural history of sick sinus syndrome. *Pacing Clin Electrophysiol* 1986;**9**:1110–1114.

w19. Sodeck GH, Domanovits H, Meron G, Rauscha F, Losert H, Thalmann M, Vlcek M, Laggner AN. Compromising bradycardia: management in the emergency department. *Resuscitation* 2007;**73**:96–102.

w20. El-Sherif N, Jalife J. Paroxysmal atrioventricular block: are phase 3 and phase 4 block mechanisms or misnomers? *Heart Rhythm* 2009;**6**:1514–1521.

w21. Lee S, Wellens HJ, Josephson ME. Paroxysmal atrioventricular block. *Heart Rhythm* 2009;**6**:1229–1234.

w22. Narula OS, Samet P, Javier RP. Significance of the sinus-node recovery time. *Circulation* 1972;**45**:140–158.

w23. Alboni P, Menozzi C, Brignole M, Paparella N, Lolli G, Oddone D, Dinelli M. An abnormal neural reflex plays a role in causing syncope in sinus bradycardia. *J Am Coll Cardiol* 1993;**22**:1130–1134.

w24. Brignole M, Menozzi C, Gianfranchi L, Oddone D, Lolli G, Bertulla A. Neurally mediated syncope detected by carotid sinus massage and head-up tilt test in sick sinus syndrome. *Am J Cardiol* 1991;**68**:1032–1036.

w25. Moya A, Sutton R, Ammirati F, Blanc JJ, Brignole M, Dahm JB, Deharo JC, Gajek J, Gjesdal K, Krahn A, Massin M, Pepi M, Pezawas T, Ruiz Granell R, Sarasin F, Ungar A, van Dijk JG, Walma EP, Wieling W. Guidelines for the diagnosis and management of syncope (version 2009). *Eur Heart J* 2009;**30**:2631–2671.

w26. Edvardsson N, Frykman V, van Mechelen R, Mitro P, Mohii-Oskarsson A, Pasquie JL, Ramanna H, Schwertfeger F, Ventura R, Voulgaraki D, Garutti C, Stolt P, Linker NJ. Use of an implantable loop recorder to increase the diagnostic yield in unexplained syncope: results from the PICTURE registry. *Europace* 2011;**13**:262–269.

w27. Farwell DJ, Freemantle N, Sulke N. The clinical impact of implantable loop recorders in patients with syncope. *Eur Heart J* 2006;**27**:351–356.

w28. Furukawa T, Maggi R, Bertolone C, Fontana D, Brignole M. Additional diagnostic value of very prolonged observation by implantable loop recorder in patients with unexplained syncope. *J Cardiovasc Electrophysiol* 2012;**23**:67–71.

w29. Jose AD, Collison D. The normal range and determinants of the intrinsic heart rate in man. *Cardiovasc Res* 1970;**4**:160–167.

w30. Goldberger JJ, Johnson NP, Gidea C. Significance of asymptomatic bradycardia for subsequent pacemaker implantation and mortality in patients >60 years of age. *Am J Cardiol* 2011;**108**:857–861.

w31. Connelly DT, Steinhaus DM. Mobitz type I atrioventricular block: an indication for permanent pacing? *Pacing Clin Electrophysiol* 1996;**19**:261–264.

w32. Coumbe AG, Naksuk N, Newell MC, Somasundaram PE, Benditt DG, Adabag S. Long-term follow-up of older patients with Mobitz type I second degree atrioventricular block. *Heart* 2012.

w33. Shaw DB, Gowers JI, Kekwick CA, New KH, Whistance AW. Is Mobitz type I atrioventricular block benign in adults? *Heart* 2004;**90**:169–174.

w34. Shaw DB, Kekwick CA, Veale D, Gowers J, Whistance T. Survival in second degree atrioventricular block. *Br Heart J* 1985;**53**:587–593.

w35. Strasberg B, Amat YLF, Dhingra RC, Palileo E, Swiryn S, Bauernfeind R, Wyndham C, Rosen KM. Natural history of chronic second-degree atrioventricular nodal block. *Circulation* 1981;**63**:1043–1049.

w36. Sutton R. Mobitz type 1 second degree atrioventricular block: the value of permanent pacing in the older patient. *Heart* 2013;**99**:291–292.

w37. Donoso E, Adler LN, Friedberg CK. Unusual forms of second-degree atrioventricular block, including Mobitz type-II block, associated with the Morgagni-Adams-Stokes syndrome. *Am Heart J* 1964;**67**:150–157.

w38. Ranganathan N, Dhurandhar R, Phillips JH, Wigle ED. His bundle electrogram in bundle-branch block. *Circulation* 1972;**45**:282–294.

w39. Fored CM, Granath F, Gadler F, Blomqvist P, Rynder J, Linde C, Ekbom A, Rosenqvist M. Atrial vs. dual-chamber cardiac pacing in sinus node disease: a register-based cohort study. *Europace* 2008;**10**:825–831.

w40. Nielsen JC, Kristensen L, Andersen HR, Mortensen PT, Pedersen OL, Pedersen AK. A randomized comparison of atrial and dual-chamber pacing in 177 consecutive patients with sick sinus syndrome: echocardiographic and clinical outcome. *J Am Coll Cardiol* 2003;**42**:614–623.

w41. Cheng S, Keyes MJ, Larson MG, McCabe EL, Newton-Cheh C, Levy D, Benjamin EJ, Vasan RS, Wang TJ. Long-term outcomes in individuals with prolonged PR interval or first-degree atrioventricular block. *JAMA* 2009;**301**:2571–2577.

w42. Nielsen JC, Thomsen PE, Hojberg S, Moller M, Riahi S, Dalsgaard D, Mortensen LS, Nielsen T, Asklund M, Friis EV, Christensen PD, Simonsen EH, Eriksen UH, Jensen GV, Svendsen JH, Toff WD, Healey JS, Andersen HR. Atrial fibrillation in patients with sick sinus syndrome: the association with PQ-interval and percentage of ventricular pacing. *Europace* 2012;**14**:682–689.

w43. Padeletti L, Pieragnoli P, Di Biase L, Colella A, Landolina M, Moro E, Orazi S, Vicentini A, Maglia G, Pensabene O, Raciti G, Barold SS. Is a dual-sensor pacemaker appropriate in patients with sino-atrial disease? Results from the DUSISLOG study. *Pacing Clin Electrophysiol* 2006;**29**:34–40.

w44. Sulke N, Chambers J, Dritsas A, Sowton E. A randomized double-blind crossover comparison of four rate-responsive pacing modes. *J Am Coll Cardiol* 1991;**17**:696–706.

w45. Lamas GA, Knight JD, Sweeney MO, Mianulli M, Jorapur V, Khalighi K, Cook JR, Silverman R, Rosenthal L, Clapp-Channing N, Lee KL, Mark DB. Impact of rate-modulated pacing on quality of life and exercise capacity–evidence from the Advanced Elements of Pacing Randomized Controlled Trial (ADEPT). *Heart Rhythm* 2007;**4**:1125–1132.

w46. Lau CP, Rushby J, Leigh-Jones M, Tam CY, Poloniecki J, Ingram A, Sutton R, Camm AJ. Symptomatology and quality of life in patients with rate-responsive pacemakers: a double-blind, randomized, crossover study. *Clin Cardiol* 1989;**12**:505–512.

w47. Leung SK, Lau CP. Developments in sensor-driven pacing. *Cardiol Clin* 2000;**18**:113–155, ix.

w48. Oto MA, Muderrisoglu H, Ozin MB, Korkmaz ME, Karamehmetoglu A, Oram A, Oram E, Ugurlu S. Quality of life in patients with rate responsive pacemakers: a randomized, cross-over study. *Pacing Clin Electrophysiol* 1991;**14**:800–806.

w49. van Campen LC, De Cock CC, Visser FC, Visser CA. The effect of rate responsive pacing in patients with angina pectoris on the extent of ischemia on 201-thallium exercise scintigraphy. *Pacing Clin Electrophysiol* 2002;**25**:430–434.

w50. Sgarbossa EB, Pinski SL, Jaeger FJ, Trohman RG, Maloney JD. Incidence and predictors of syncope in paced patients with sick sinus syndrome. *Pacing Clin Electrophysiol* 1992;**15**:2055–2060.

w51. Dhingra RC. Sinus node dysfunction. *Pacing Clin Electrophysiol* 1983;**6**:1062–1069.

w52. Gann D, Tolentino A, Samet P. Electrophysiologic evaluation of elderly patients with sinus bradycardia: a long-term follow-up study. *Ann Intern Med* 1979;**90**:24–29.

w53. Menozzi C, Brignole M, Alboni P, Boni L, Paparella N, Gaggioli G, Lolli G. The natural course of untreated sick sinus syndrome and identification of the variables predictive of unfavorable outcome. *Am J Cardiol* 1998;**82**:1205–1209.

w54. Brignole M, Moya A, Menozzi C, Garcia-Civera R, Sutton R. Proposed electrocardiographic classification of spontaneous syncope documented by an implantable loop recorder. *Europace* 2005;**7**:14–18.

w55. Jardine DL, Krediet CT, Cortelli P, Wieling W. Fainting in your sleep? *Clin Auton Res* 2006;**16**:76–78.

w56. Krediet CT, Jardine DL, Cortelli P, Visman AG, Wieling W. Vasovagal syncope interrupting sleep? *Heart* 2004;**90**:e25.

w57. Krahn AD, Klein GJ, Yee R, Skanes AC. Predictive value of presyncope in patients monitored for assessment of syncope. *Am Heart J* 2001;**141**:817–821.

w58. Moya A, Brignole M, Sutton R, Menozzi C, Garcia-Civera R, Wieling W, Andresen D, Benditt DG, Garcia-Sacristan JF, Beiras X, Grovale N, Vardas P. Reproducibility of electrocardiographic findings in patients with suspected reflex neurally-mediated syncope. *Am J Cardiol* 2008;**102**:1518–1523.

w59. Northcote RJ, Canning GP, Ballantyne D. Electrocardiographic findings in male veteran endurance athletes. *Br Heart J* 1989;**61**:155–160.

w60. Wieling W, Thijs RD, van Dijk N, Wilde AA, Benditt DG, van Dijk JG. Symptoms and signs of syncope: a review of the link between physiology and clinical clues. *Brain* 2009;**132**:2630–2642.

w61. Menozzi C, Brignole M, Lolli G, Bottoni N, Oddone D, Gianfranchi L, Gaggioli G. Follow-up of asystolic episodes in patients with cardioinhibitory, neurally mediated syncope and VVI pacemaker. *Am J Cardiol* 1993;**72**:1152–1155.

w62. Brignole M, Sutton R, Wieling W, Lu SN, Erickson MK, Markowitz T, Grovale N, Ammirati F, Benditt DG. Analysis of rhythm variation during spontaneous cardioinhibitory neurally-mediated syncope. Implications for RDR pacing optimization: an ISSUE 2 substudy. *Europace* 2007;**9**:305–311.

w63. Azocar D, Ruiz-Granell R, Ferrero A, Martinez-Brotons A, Izquierdo M, Dominguez E, Palau P, Morell S, Garcia-Civera R. Syncope and bundle branch block. Diagnostic yield of a stepped use of electrophysiology study and implantable loop recorders. *Rev Esp Cardiol* 2011;**64**:213–219.

w64. Brignole M, Menozzi C, Moya A, Garcia-Civera R, Mont L, Alvarez M, Errazquin F, Beiras J, Bottoni N, Donateo P. Mechanism of syncope in patients with bundle branch block and negative electrophysiological test. *Circulation* 2001;**104**:2045–2050.

w65. Donateo P, Brignole M, Alboni P, Menozzi C, Raviele A, Del Rosso A, Dinelli M, Solano A, Bottoni N, Croci F. A standardized conventional evaluation of the mechanism of syncope in patients with bundle branch block. *Europace* 2002;**4**:357–360.

w66. Englund A, Bergfeldt L, Rehnqvist N, Astrom H, Rosenqvist M. Diagnostic value of programmed ventricular stimulation in patients with bifascicular block: a prospective study of patients with and without syncope. *J Am Coll Cardiol* 1995;**26**:1508–1515.

w67. Morady F, Higgins J, Peters RW, Schwartz AB, Shen EN, Bhandari A, Scheinman MM, Sauve MJ. Electrophysiologic testing in bundle branch block and unexplained syncope. *Am J Cardiol* 1984;**54**:587–591.

w68. Tabrizi F, Rosenqvist M, Bergfeldt L, Englund A. Long-term prognosis in patients with bifascicular block–the predictive value of noninvasive and invasive assessment. *J Intern Med* 2006;**260**:31–38.

w69. Zipes DP, Camm AJ, Borggrefe M, Buxton AE, Chaitman B, Fromer M, Gregoratos G, Klein G, Moss AJ, Myerburg RJ, Priori SG, Quinones MA, Roden DM, Silka MJ, Tracy C, Blanc JJ, Budaj A, Dean V, Deckers JW, Despres C, Dickstein K, Lekakis J, McGregor K, Metra M, Morais J, Osterspey A, Tamargo JL, Zamorano JL, Smith SC Jr, Jacobs AK, Adams CD, Antman EM, Anderson JL, Hunt SA, Halperin JL, Nishimura R, Ornato JP, Page RL, Riegel B. ACC/AHA/ESC 2006 guidelines for management of patients with ventricular arrhythmias and the prevention of sudden cardiac death–executive summary: A report of the American College of Cardiology/American Heart Association Task Force and the European Society of Cardiology Committee for Practice Guidelines (Writing Committee to Develop Guidelines for Management of Patients with Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death). Developed in collaboration with the European Heart Rhythm Association and the Heart Rhythm Society. *Eur Heart J* 2006;**27**:2099–2140.

w70. Ho RT, Stopper M, Koka AR. Alternating bundle branch block. *Pacing Clin Electrophysiol* 2012;**35**:223–226.

w71. Ogura Y, Kato J, Ogawa Y, Shiokoshi T, Kitaoka T, Suzuki T, Kawamura Y, Tanabe Y, Sato N, Hasebe N, Kikuchi K. A case of alternating bundle branch block in combination with intra-Hisian block. *Int Heart J* 2005;**46**:737–744.

w72. Rosenbaum MB, Lepeschkin E. Bilateral bundle branch block. *Am Heart J* 1955;**50**:38–61.

w73. Wu D, Denes P, Dhingra RC, Amat YLF, Wyndham CR, Chuquimia R, Rosen KM. Electrophysiological and clinical observations in patients with alternating bundle branch block. *Circulation* 1976;**53**:456–464.

w74. Krediet CT, Parry SW, Jardine DL, Benditt DG, Brignole M, Wieling W. The history of diagnosing carotid sinus hypersensitivity: why are the current criteria too sensitive? *Europace* 2011;**13**:14–22.

w75. Bartoletti A, Fabiani P, Adriani P, Baccetti F, Bagnoli L, Buffini G, Cappelletti C, Cecchini P, Gianni R, Lavacchi A, Ticali PF, Santoro GM. Hospital admission of patients referred to the Emergency Department for syncope: a single-hospital prospective study based on the application of the European Society of Cardiology Guidelines on syncope. *Eur Heart J* 2006;**27**:83–88.

w76. Brignole M, Sutton R, Menozzi C, Garcia-Civera R, Moya A, Wieling W, Andresen D, Benditt DG, Grovale N, De Santo T, Vardas P. Lack of correlation between the responses to tilt testing and adenosine triphosphate test and the mechanism of spontaneous neurally mediated syncope. *Eur Heart J* 2006;**27**:2232–2239.

w77. Deharo JC, Jego C, Lanteaume A, Djiane P. An implantable loop recorder study of highly symptomatic vasovagal patients: the heart rhythm observed during a spontaneous syncope is identical to the recurrent syncope but not correlated with the head-up tilt test or adenosine triphosphate test. *J Am Coll Cardiol* 2006;**47**:587–593.

w78. Donateo P, Brignole M, Menozzi C, Bottoni N, Alboni P, Dinelli M, Del Rosso A, Croci F, Oddone D, Solano A, Puggioni E. Mechanism of syncope in patients with positive adenosine triphosphate tests. *J Am Coll Cardiol* 2003;**41**:93–98.

w79. Proclemer A, Facchin D, Feruglio GA. [Syncope of unknown origin after electrophysiologic study: is the treatment with pacemaker useful?]. *G Ital Cardiol* 1990;**20**:195–201.

w80. Raviele A, Proclemer A, Gasparini G, Di Pede F, Delise P, Piccolo E, Feruglio GA. Long-term follow-up of patients with unexplained syncope and negative electrophysiologic study. *Eur Heart J* 1989;**10**:127–132.

w81. McMurray JJ, Adamopoulos S, Anker SD, Auricchio A, Bohm M, Dickstein K, Falk V, Filippatos G, Fonseca C, Gomez-Sanchez MA, Jaarsma T, Kober L, Lip GY, Maggioni AP, Parkhomenko A, Pieske BM, Popescu BA, Ronnevik PK, Rutten FH, Schwitter J, Seferovic P, Stepinska J, Trindade PT, Voors AA, Zannad F, Zeiher A. ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure 2012: The Task Force for the Diagnosis and Treatment of Acute and Chronic Heart Failure 2012 of the European Society of Cardiology. Developed in collaboration with the Heart Failure Association (HFA) of the ESC. *Eur Heart J* 2012;**33**:1787–1847.

w82. Khan NK, Goode KM, Cleland JG, Rigby AS, Freemantle N, Eastaugh J, Clark AL, de Silva R, Calvert MJ, Swedberg K, Komajda M, Mareev V, Follath F. Prevalence of ECG abnormalities in an international survey of patients with suspected or confirmed heart failure at death or discharge. *Eur J Heart Fail* 2007;**9**:491–501.

w83. Baldasseroni S, Opasich C, Gorini M, Lucci D, Marchionni N, Marini M, Campana C, Perini G, Deorsola A, Masotti G, Tavazzi L, Maggioni AP. Left bundle-branch block is associated with increased 1-year sudden and total mortality rate in 5517 outpatients with congestive heart failure: a report from the Italian network on congestive heart failure. *Am Heart J* 2002;**143**:398–405.

w84. Clark AL, Goode K, Cleland JG. The prevalence and incidence of left bundle branch block in ambulant patients with chronic heart failure. *Eur J Heart Fail* 2008;**10**:696–702.

w85. Dickstein K, Vardas PE, Auricchio A, Daubert JC, Linde C, McMurray J, Ponikowski P, Priori SG, Sutton R, van Veldhuisen DJ. 2010 focused update of ESC Guidelines on device therapy in heart failure: an update of the 2008 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure and the 2007 ESC Guidelines for cardiac and resynchronization therapy. Developed with the special contribution of the Heart Failure Association and the European Heart Rhythm Association. *Eur J Heart Fail* 2010;**12**:1143–1153.

w86. Nieminen MS, Brutsaert D, Dickstein K, Drexler H, Follath F, Harjola VP, Hochadel M, Komajda M, Lassus J, Lopez-Sendon JL, Ponikowski P, Tavazzi L. EuroHeart Failure Survey II (EHFS II): a survey on hospitalized acute heart failure patients: description of population. *Eur Heart J* 2006;**27**:2725–2736.

w87. Cleland JG, McDonagh T, Rigby AS, Yassin A, Whittaker T, Dargie HJ. The national heart failure audit for England and Wales 2008–2009. *Heart* 2011;**97**:876–886.

w88. Merkely B, Roka A, Kutyifa V, Boersma L, Leenhardt A, Lubinski A, Oto A, Proclemer A, Brugada J, Vardas PE, Wolpert C. Tracing the European course of cardiac resynchronization therapy from 2006 to 2008. *Europace* 2010;**12**:692–701.

w89. Harjola VP, Follath F, Nieminen MS, Brutsaert D, Dickstein K, Drexler H, Hochadel M, Komajda M, Lopez-Sendon JL, Ponikowski P, Tavazzi L. Characteristics, outcomes, and predictors of mortality at 3 months and 1 year in patients hospitalized for acute heart failure. *Eur J Heart Fail* 2010;**12**:239–248.

w90. Swedberg K, Komajda M, Bohm M, Borer JS, Ford I, Dubost-Brama A, Lerebours G, Tavazzi L. Ivabradine and outcomes in chronic heart failure (SHIFT): a randomised placebo-controlled study. *Lancet* 2010;**376**:875–885.

w91. Zannad F, McMurray JJ, Krum H, van Veldhuisen DJ, Swedberg K, Shi H, Vincent J, Pocock SJ, Pitt B. Eplerenone in patients with systolic heart failure and mild symptoms. *N Engl J Med* 2011;**364**:11–21.

w92. Cohn JN, Archibald DG, Ziesche S, Franciosa JA, Harston WE, Tristani FE, Dunkman WB, Jacobs W, Francis GS, Flohr KH *et al.* Effect of vasodilator therapy on mortality in chronic congestive heart failure. Results of a Veterans Administration Cooperative Study. *N Engl J Med* 1986;**314**:1547–1552.

w93. Cleland JG, Daubert JC, Erdmann E, Freemantle N, Gras D, Kappenberger L, Tavazzi L. Longer-term effects of cardiac resynchronization therapy on mortality in heart failure [the CArdiac REsynchronization-Heart Failure (CARE-HF) trial extension phase]. *Eur Heart J* 2006;**27**:1928–1932.

w94. Baldasseroni S, Gentile A, Gorini M, Marchionni N, Marini M, Masotti G, Porcu M, Maggioni AP. Intraventricular conduction defects in patients with congestive heart failure: left but not right bundle branch block is an independent predictor of prognosis. A report from the Italian Network on Congestive Heart Failure (IN-CHF database). *Ital Heart J* 2003;**4**:607–613.

w95. Pitt B, Zannad F, Remme WJ, Cody R, Castaigne A, Perez A, Palensky J, Wittes J. The effect of spironolactone on morbidity and mortality in patients with severe heart failure. Randomized Aldactone Evaluation Study Investigators. *N Engl J Med* 1999;**341**:709–717.

w96. Shamim W, Francis DP, Yousufuddin M, Varney S, Pieopli MF, Anker SD, Coats AJ. Intraventricular conduction delay: a prognostic marker in chronic heart failure. *Int J Cardiol* 1999;**70**:171–178.

w97. Xiao HB, Roy C, Fujimoto S, Gibson DG. Natural history of abnormal conduction and its relation to prognosis in patients with dilated cardiomyopathy. *Int J Cardiol* 1996;**53**:163–170.

w98. Cleland JG, Swedberg K, Follath F, Komajda M, Cohen-Solal A, Aguilar JC, Dietz R, Gavazzi A, Hobbs R, Korewicki J, Madeira HC, Moiseyev VS, Preda I, van Gilst WH, Widimsky J, Freemantle N, Eastaugh J, Mason J. The EuroHeart Failure survey programme– a survey on the quality of care among patients with heart failure in Europe. Part 1: patient characteristics and diagnosis. *Eur Heart J* 2003;**24**:442–463.

w99. Khand AU, Rankin AC, Kaye GC, Cleland JG. Systematic review of the management of atrial fibrillation in patients with heart failure. *Eur Heart J* 2000;**21**: 614–632.

w100. Crijns HJ, Tjeerdsma G, de Kam PJ, Boomsma F, van Gelder IC, van den Berg MP, van Veldhuisen DJ. Prognostic value of the presence and development of atrial fibrillation in patients with advanced chronic heart failure. *Eur Heart J* 2000;**21**: 1238–1245.

w101. Dries DL, Exner DV, Gersh BJ, Domanski MJ, Waclawiw MA, Stevenson LW. Atrial fibrillation is associated with an increased risk for mortality and heart failure progression in patients with asymptomatic and symptomatic left ventricular systolic dysfunction: a retrospective analysis of the SOLVD trials. Studies of Left Ventricular Dysfunction. *J Am Coll Cardiol* 1998;**32**:695–703.

w102. Mathew J, Hunsberger S, Fleg J, Mc Sherry F, Williford W, Yusuf S. Incidence, predictive factors, and prognostic significance of supraventricular tachyarrhythmias in congestive heart failure. *Chest* 2000;**118**:914–922.

w103. Olsson LG, Swedberg K, Ducharme A, Granger CB, Michelson EL, McMurray JJ, Puu M, Yusuf S, Pfeffer MA. Atrial fibrillation and risk of clinical events in chronic heart failure with and without left ventricular systolic dysfunction: results from the Candesartan in Heart failure-Assessment of Reduction in Mortality and morbidity (CHARM) program. *J Am Coll Cardiol* 2006;**47**:1997–2004.

w104. Swedberg K, Olsson LG, Charlesworth A, Cleland J, Hanrath P, Komajda M, Metra M, Torp-Pedersen C, Poole-Wilson P. Prognostic relevance of atrial fibrillation in patients with chronic heart failure on long-term treatment with beta-blockers: results from COMET. *Eur Heart J* 2005;**26**:1303–1308.

w105. Talajic M, Khairy P, Levesque S, Connolly SJ, Dorian P, Dubuc M, Guerra PG, Hohnloser SH, Lee KL, Macle L, Nattel S, Pedersen OD, Stevenson LW, Thibault B, Waldo AL, Wyse DG, Roy D. Maintenance of sinus rhythm and survival in patients with heart failure and atrial fibrillation. *J Am Coll Cardiol* 2010;**55**: 1796–1802.

w106. Barold SS, Ilercil A, Herweg B. Echocardiographic optimization of the atrioventricular and interventricular intervals during cardiac resynchronization. *Europace* 2008;**10**(Suppl. 3):iii88–95.

w107. Vernooy K, Verbeek XA, Peschar M, Crijns HJ, Arts T, Cornelussen RN, Prinzen FW. Left bundle branch block induces ventricular remodelling and functional septal hypoperfusion. *Eur Heart J* 2005;**26**:91–98.

w108. Cleland JG, Tageldien A, Buga L, Wong K, Gorcsan J 3rd. Should we be trying to define responders to cardiac resynchronization therapy? *JACC Cardiovasc Imaging* 2010;**3**:541–549.

w109. Cleland JG, Tavazzi L, Daubert JC, Tageldien A, Freemantle N. Cardiac resynchronization therapy: are modern myths preventing appropriate use? *J Am Coll Cardiol* 2009;**53**:608–611.

w110. Lindenfeld J, Feldman AM, Saxon L, Boehmer J, Carson P, Ghali JK, Anand I, Singh S, Steinberg JS, Jaski B, DeMarco T, Mann D, Yong P, Galle E, Ecklund F, Bristow M. Effects of cardiac resynchronization therapy with or without a defibrillator on survival and hospitalizations in patients with New York Heart Association class IV heart failure. *Circulation* 2007;**115**:204–212.

w111. Surawicz B, Childers R, Deal BJ, Gettes LS, Bailey JJ, Gorgels A, Hancock EW, Josephson M, Kligfield P, Kors JA, Macfarlane P, Mason JW, Mirvis DM, Okin P, Pahlm O, Rautaharju PM, van Herpen G, Wagner GS, Wellens H. AHA/ACCF/HRS recommendations for the standardization and interpretation of the electrocardiogram: part III: intraventricular conduction disturbances: a scientific statement from the American Heart Association Electrocardiography and Arrhythmias Committee, Council on Clinical Cardiology; the American College of Cardiology Foundation; and the Heart Rhythm Society: endorsed by the International Society for Computerized Electrocardiology. *Circulation* 2009; **119**:e235–240.

w112. Arshad A, Moss AJ, Foster E, Padeletti L, Barsheshet A, Goldenberg I, Greenberg H, Hall WJ, McNitt S, Zareba W, Solomon S, Steinberg JS, MADIT-CRT Executive Committee. Cardiac resynchronization therapy is more effective in women than in men: the MADIT-CRT (Multicenter Automatic Defibrillator Implantation Trial with Cardiac Resynchronization Therapy) trial. *J Am Coll Cardiol* 2011;**57**:813–820.

w113. Barsheshet A, Goldenberg I, Moss AJ, Eldar M, Huang DT, McNitt S, Klein HU, Hall WJ, Brown MW, Goldberger JJ, Goldstein RE, Schuger C, Zareba W, Daubert JP. Response to preventive cardiac resynchronization therapy in patients with ischaemic and nonischaemic cardiomyopathy in MADIT-CRT. *Eur Heart J* 2011;**32**:1622–1630.

w114. Bax JJ, Gorcsan J 3rd. Echocardiography and noninvasive imaging in cardiac resynchronization therapy: results of the PROSPECT (Predictors of Response to Cardiac Resynchronization Therapy) study in perspective. *J Am Coll Cardiol* 2009;**53**:1933–1943.

w115. Delgado V, Bax JJ. Assessment of systolic dyssynchrony for cardiac resynchronization therapy is clinically useful. *Circulation* 2011;**123**:640–655.

w116. Richardson M, Freemantle N, Calvert MJ, Cleland JG, Tavazzi L. Predictors and treatment response with cardiac resynchronization therapy in patients with heart failure characterized by dyssynchrony: a pre-defined analysis from the CARE-HF trial. *Eur Heart J* 2007;**28**:1827–1834.

w117. Chung ES, Leon AR, Tavazzi L, Sun JP, Nihoyannopoulos P, Merlino J, Abraham WT, Ghio S, Leclercq C, Bax JJ, Yu CM, Gorcsan J 3rd, St John Sutton M, De Sutter J, Murillo J. Results of the Predictors of Response to CRT (PROSPECT) trial. *Circulation* 2008;**117**:2608–2616.

w118. van Bommel RJ, Bax JJ, Abraham WT, Chung ES, Pires LA, Tavazzi L, Zimetbaum PJ, Gerritse B, Kristiansen N, Ghio S. Characteristics of heart failure patients associated with good and poor response to cardiac resynchronization therapy: a PROSPECT (Predictors of Response to CRT) sub-analysis. *Eur Heart J* 2009;**30**:2470–2477.

w119. Bilchick KC, Dimaano V, Wu KC, Helm RH, Weiss RG, Lima JA, Berger RD, Tomaselli GF, Bluemke DA, Halperin HR, Abraham T, Kass DA, Lardo AC. Cardiac magnetic resonance assessment of dyssynchrony and myocardial scar predicts function class improvement following cardiac resynchronization therapy. *JACC Cardiovasc Imaging* 2008;**1**:561–568.

w120. Boogers MM, Van Kriekinge SD, Henneman MM, Ypenburg C, Van Bommel RJ, Boersma E, Dibbets-Schneider P, Stokkel MP, Schalij MJ, Berman DS, Germano G, Bax JJ. Quantitative gated SPECT-derived phase analysis on gated myocardial perfusion SPECT detects left ventricular dyssynchrony and predicts response to cardiac resynchronization therapy. *J Nucl Med* 2009;**50**:718–725.

w121. Delgado V, van Bommel RJ, Bertini M, Borleffs CJ, Marsan NA, Arnold CT, Nucifora G, van de Veire NR, Ypenburg C, Boersma E, Holman ER, Schalij MJ, Bax JJ. Relative merits of left ventricular dyssynchrony, left ventricular lead position, and myocardial scar to predict long-term survival of ischemic heart failure patients undergoing cardiac resynchronization therapy. *Circulation* 2011; **123**:70–78.

w122. Gorcsan J 3rd, Oyenuga O, Habib PJ, Tanaka H, Adelstein EC, Hara H, McNamara DM, Saba S. Relationship of echocardiographic dyssynchrony to long-term survival after cardiac resynchronization therapy. *Circulation* 2010;**122**: 1910–1918.

w123. Hara H, Oyenuga OA, Tanaka H, Adelstein EC, Onishi T, McNamara DM, Schwartzman D, Saba S, Gorcsan J 3rd. The relationship of QRS morphology and mechanical dyssynchrony to long-term outcome following cardiac resynchronization therapy. *Eur Heart J* 2012;**33**:2680–2691.

w124. Daubert JC, Saxon L, Adamson PB, Auricchio A, Berger RD, Beshai JF, Breithard O, Brignole M, Cleland J, DeLurgio DB, Dickstein K, Exner DV, Gold M, Grimm RA, Hayes DL, Israel C, Leclercq C, Linde C, Lindenfeld J, Merkely B, Mont L, Murgatroyd F, Prinzen F, Saba SF, Shinbane JS, Singh J, Tang AS, Vardas PE, Wilkoff BL, Zamorano JL, Anand I, Blomstrom-Lundqvist C, Boehmer JP, Calkins H, Cazeau S, Delgado V, Estes NA, Haines D, Kusumoto F, Leyva P, Ruschitzka F, Stevenson LW, Torp-Pedersen CT. 2012 EHRA/HRS expert consensus statement on cardiac resynchronization therapy in heart failure: implant and follow-up recommendations and management. *Europace* 2012;**14**:1236–1286.

w125. Buck S, Maass AH, Nieuwland W, Anthonio RL, Van Veldhuisen DJ, Van Gelder IC. Impact of interventricular lead distance and the decrease in septal-to-lateral delay on response to cardiac resynchronization therapy. *Europace* 2008;**10**:1313–1319.

w126. Heist EK, Fan D, Mela T, Arzola-Castaner D, Reddy VY, Mansour M, Picard MH, Ruskin JN, Singh JP. Radiographic left ventricular-right ventricular interlead distance predicts the acute hemodynamic response to cardiac resynchronization therapy. *Am J Cardiol* 2005;**96**:685–690.

w127. Merchant FM, Heist EK, Nandigam KV, Mulligan LJ, Blendea D, Riedl L, McCarty D, Orencole M, Picard MH, Ruskin JN, Singh JP. Interlead distance and left ventricular lead electrical delay predict reverse remodeling during cardiac resynchronization therapy. *Pacing Clin Electrophysiol* 2010;**33**:575–582.

w128. Auricchio A, Fantoni C, Regoli F, Carbucicchio C, Goette A, Geller C, Kloss M, Klein H. Characterization of left ventricular activation in patients with heart failure and left bundle-branch block. *Circulation* 2004;**109**:1133–1139.

w129. Pappone C, Rosanio S, Oreto G, Tocchi M, Gulletta S, Salvati A, Dicandia C, Santinelli V, Mazzone P, Veglia F, Ding J, Sallusti L, Spinelli J, Vicedomini G. Cardiac pacing in heart failure patients with left bundle branch block: impact of pacing site for optimizing left ventricular resynchronization. *Ital Heart J* 2000;**1**: 464–469.

w130. Leclercq C, Gadler F, Kranig W, Ellery S, Gras D, Lazarus A, Clementy J, Boulogne E, Daubert JC. A randomized comparison of triple-site versus dual-site ventricular stimulation in patients with congestive heart failure. *J Am Coll Cardiol* 2008;**51**:1455–1462.

w131. Lenarczyk R, Kowalski O, Kukulski T, Pruszkowska-Skrzep P, Sokal A, Szulik M, Zielinska T, Kowalczyk J, Pluta S, Sredniawa B, Musialik-Lydka A, Kalarus Z. Mid-term outcomes of triple-site vs. conventional cardiac resynchronization therapy: a preliminary study. *Int J Cardiol* 2009;**133**:87–94.

w132. Garrigue S, Jais P, Espil G, Labeque JN, Hocini M, Shah DC, Haissaguerre M, Clementy J. Comparison of chronic biventricular pacing between epicardial and endocardial left ventricular stimulation using Doppler tissue imaging in patients with heart failure. *Am J Cardiol* 2001;**88**:858–862.

w133. Mullens W, Grimm RA, Verga T, Dresing T, Starling RC, Wilkoff BL, Tang WH. Insights from a cardiac resynchronization optimization clinic as part of a heart failure disease management program. *J Am Coll Cardiol* 2009;**53**:765–773.

w134. Adlbrecht C, Hulsmann M, Gwechenberger M, Graf S, Wiesbauer F, Strunk G, Khazen C, Brodnjak I, Neuhold S, Binder T, Maurer G, Pacher R. Electrical optimization of cardiac resynchronization in chronic heart failure is associated with improved clinical long-term outcome. *Eur J Clin Invest* 2010;**40**:678–684.

w135. Auricchio A, Stellbrink C, Sack S, Block M, Vogt J, Bakker P, Huth C, Schondube F, Wolfhard U, Bocker D, Krahnefeld O, Kirkels H. Long-term clinical effect of hemodynamically optimized cardiac resynchronization therapy in patients with heart failure and ventricular conduction delay. *J Am Coll Cardiol* 2002;**39**: 2026–2033.

w136. Bertini M, Ziacchi M, Biffi M, Martignani C, Saporito D, Valzania C, Diemberger I, Cervi E, Frisoni J, Sangiorgi D, Branzi A, Boriani G. Interventricular delay interval optimization in cardiac resynchronization therapy guided by echocardiography versus guided by electrocardiographic QRS interval width. *Am J Cardiol* 2008; **102**:1373–1377.

w137. Hardt SE, Yazdi SH, Bauer A, Filusch A, Korosoglou G, Hansen A, Bekeredjian R, Ehlermann P, Remppis A, Katus HA, Kuecherer HF. Immediate and chronic effects of AV-delay optimization in patients with cardiac resynchronization therapy. *Int J Cardiol* 2007;**115**:318–325.

w138. Hsing JM, Selzman KA, Leclercq C, Pires LA, McLaughlin MG, McRae SE, Peterson BJ, Zimetbaum PJ. Paced left ventricular QRS width and ECG parameters predict outcomes after cardiac resynchronization therapy: PROSPECT-ECG substudy. *Circ Arrhythm Electrophysiol* 2011;**4**:851–857.

w139. Kedia N, Ng K, Apperson-Hansen C, Wang C, Tchou P, Wilkoff BL, Grimm RA. Usefulness of atrioventricular delay optimization using Doppler assessment of mitral inflow in patients undergoing cardiac resynchronization therapy. *Am J Cardiol* 2006;**98**:780–785.

w140. Morales MA, Startari U, Panchetti L, Rossi A, Piacenti M. Atrioventricular delay optimization by doppler-derived left ventricular dP/dt improves 6-month outcome of resynchronized patients. *Pacing Clin Electrophysiol* 2006;**29**:564–568.

w141. Steendijk P, Tulner SA, Bax JJ, Oemrawsingh PV, Bleeker GB, van Erven L, Putter H, Verwey HF, van der Wall EE, Schalij MJ. Hemodynamic effects of long-term cardiac resynchronization therapy: analysis by pressure-volume loops. *Circulation* 2006;**113**:1295–1304.

w142. Tournoux FB, Alabiad C, Fan D, Chen AA, Chaput M, Heist EK, Mela T, Mansour M, Reddy V, Ruskin JN, Picard MH, Singh JP. Echocardiographic measures of acute haemodynamic response after cardiac resynchronization therapy predict long-term clinical outcome. *Eur Heart J* 2007;**28**:1143–1148.

w143. Vidal B, Sitges M, Marigliano A, Delgado V, Diaz-Infante E, Azqueta M, Tamborero D, Tolosana JM, Berruezo A, Perez-Villa F, Pare C, Mont L, Brugada J. Optimizing the programation of cardiac resynchronization therapy devices in patients with heart failure and left bundle branch block. *Am J Cardiol* 2007;**100**:1002–1006.

w144. Marsan NA, Bleeker GB, Van Bommel RJ, Borleffs C, Bertini M, Holman ER, van der Wall EE, Schalij MJ, Bax JJ. Cardiac resynchronization therapy in patients with ischemic versus non-ischemic heart failure: Differential effect of optimizing interventricular pacing interval. *Am Heart J* 2009;**158**:769–776.

w145. Camm AJ, Kirchhof P, Lip GY, Schotten U, Savelieva I, Ernst S, Van Gelder IC, Al-Attar N, Hindricks G, Prendergast B, Heidbuchel H, Alfieri O, Angelini A, Atar D, Colonna P, De Caterina R, De Sutter J, Goette A, Gorenek B, Heldal M, Hohloser SH, Kolh P, Le Heuzey JY, Ponikowski P, Rutten FH. Guidelines for the management of atrial fibrillation: the Task Force for the Management of Atrial Fibrillation of the European Society of Cardiology (ESC). *Eur Heart J* 2010;**31**:2369–2429.

w146. Dickstein K, Bogale N, Priori S, Auricchio A, Cleland JG, Gitt A, Limbourg T, Linde C, van Veldhuisen DJ, Brugada J. The European cardiac resynchronization therapy survey. *Eur Heart J* 2009;**30**:2450–2460.

w147. Fein AS, Wang Y, Curtis JP, Masoudi FA, Varosy PD, Reynolds MR. Prevalence and predictors of off-label use of cardiac resynchronization therapy in patients enrolled in the National Cardiovascular Data Registry Implantable Cardiac-Defibrillator Registry. *J Am Coll Cardiol* 2010;**56**:766–773.

w148. Chatterjee NA, Upadhyay GA, Ellenbogen KA, McAlister FA, Choudhry NK, Singh JP. Atrioventricular nodal ablation in atrial fibrillation: a meta-analysis and systematic review. *Circ Arrhythm Electrophysiol* 2012;**5**:68–76.

w149. Kay GN, Ellenbogen KA, Giudici M, Redfield MM, Jenkins LS, Mianulli M, Wilkoff B. The Ablate and Pace Trial: a prospective study of catheter ablation of the AV conduction system and permanent pacemaker implantation for treatment of atrial fibrillation. APT Investigators. *J Interv Card Electrophysiol* 1998;**2**:121–135.

w150. Wood MA, Brown-Mahoney C, Kay GN, Ellenbogen KA. Clinical outcomes after ablation and pacing therapy for atrial fibrillation : a meta-analysis. *Circulation* 2000; **101**:1138–1144.

w151. Buck S, Rienstra M, Maass AH, Nieuwland W, Van Veldhuisen DJ, Van Gelder IC. Cardiac resynchronization therapy in patients with heart failure and atrial fibrillation: importance of new-onset atrial fibrillation and total atrial conduction time. *Europace* 2008;**10**:558–565.

w152. Smit MD, Maass AH, Hillege HL, Wiesfeld AC, Van Veldhuisen DJ, Van Gelder IC. Prognostic importance of natriuretic peptides and atrial fibrillation in patients receiving cardiac resynchronization therapy. *Eur J Heart Fail* 2011;**13**:543–550.

w153. Brignole M, Gianfranchi L, Menozzi C, Alboni P, Musso G, Bongiorni MG, Gasparini M, Raviele A, Lolli G, Paparella N, Acquarone S. Assessment of atrioventricular junction ablation and DDDR mode-switching pacemaker versus pharmacological treatment in patients with severely symptomatic paroxysmal atrial fibrillation: a randomized controlled study. *Circulation* 1997;**96**:2617–2624.

w154. Brignole M, Menozzi C, Gianfranchi L, Musso G, Mureddu R, Bottoni N, Lolli G. Assessment of atrioventricular junction ablation and VVIR pacemaker versus pharmacological treatment in patients with heart failure and chronic atrial fibrillation: a randomized, controlled study. *Circulation* 1998;**98**:953–960.

w155. Chen L, Hodge D, Jahangir A, Ozcan C, Trusty J, Friedman P, Rea R, Bradley D, Brady P, Hammill S, Hayes D, Shen WK. Preserved left ventricular ejection fraction following atrioventricular junction ablation and pacing for atrial fibrillation. *J Cardiovasc Electrophysiol* 2008;**19**:19–27.

w156. Tops LF, Schalij MJ, Holman ER, van Erven L, van der Wall EE, Bax JJ. Right ventricular pacing can induce ventricular dyssynchrony in patients with atrial fibrillation after atrioventricular node ablation. *J Am Coll Cardiol* 2006;**48**:1642–1648.

w157. Hsu LF, Jais P, Sanders P, Garrigue S, Hocini M, Sacher F, Takahashi Y, Rotter M, Pasquie JL, Scavee C, Bordachar P, Clementy J, Haissaguerre M. Catheter ablation for atrial fibrillation in congestive heart failure. *N Engl J Med* 2004;**351**: 2373–2383.

w158. Khan MN, Jais P, Cummings J, Di Biase L, Sanders P, Martin DO, Kautzner J, Hao S, Themistoclakis S, Fanelli R, Potenza D, Massaro R, Wazni O, Schweikert R, Saliba W, Wang P, Al-Ahmad A, Beheiry S, Santarelli P, Starling RC, Dello Russo A, Pelargonio G, Brachmann J, Schibgilla V, Bonso A, Casella M, Raviele A, Haissaguerre M, Natale A. Pulmonary-vein isolation for atrial fibrillation in patients with heart failure. *N Engl J Med* 2008;**359**:1778–1785.

w159. Auricchio A, Prinzen FW. Update on the pathophysiological basics of cardiac resynchronization therapy. *Europace* 2008;**10**:797–800.

w160. Kerr CR, Connolly SJ, Abdollah H, Roberts RS, Gent M, Yusuf S, Gillis AM, Tang AS, Talajic M, Klein GJ, Newman DM. Canadian Trial of Physiological Pacing: Effects of physiological pacing during long-term follow-up. *Circulation* 2004;**109**:357–362.

w161. Steinberg JS, Fischer A, Wang P, Schuger C, Daubert J, McNitt S, Andrews M, Brown M, Hall WJ, Zareba W, Moss AJ. The clinical implications of cumulative right ventricular pacing in the multicenter automatic defibrillator trial II. *J Cardiovasc Electrophysiol* 2005;**16**:359–365.

w162. Sweeney MO, Hellkamp AS, Ellenbogen KA, Greenspon AJ, Freedman RA, Lee KL, Lamas GA. Adverse effect of ventricular pacing on heart failure and

atrial fibrillation among patients with normal baseline QRS duration in a clinical trial of pacemaker therapy for sinus node dysfunction. *Circulation* 2003;**107**: 2932–2937.

w163. Poole JE, Gleva MJ, Mela T, Chung MK, Uslan DZ, Borge R, Gottipaty V, Shinn T, Dan D, Feldman LA, Seide H, Winston SA, Gallagher JJ, Langberg JJ, Mitchell K, Holcomb R. Complication rates associated with pacemaker or implantable cardioverter-defibrillator generator replacements and upgrade procedures: results from the REPLACE registry. *Circulation* 2010;**122**:1553–1561.

w164. Funck RC, Blanc JJ, Mueller HH, Schade-Brittinger C, Bailleul C, Maisch B. Biventricular stimulation to prevent cardiac desynchronization: rationale, design, and endpoints of the 'Biventricular Pacing for Atrioventricular Block to Prevent Cardiac Desynchronization (BioPace)' study. *Europace* 2006;**8**:629–635.

w165. Bardy GH, Lee KL, Mark DB, Poole JE, Packer DL, Boineau R, Domanski M, Troutman C, Anderson J, Johnson G, McNulty SE, Clapp-Channing N, Davidson-Ray LD, Fraulo ES, Fishbein DP, Luceri RM, Ip JH. Amiodarone or an implantable cardioverter-defibrillator for congestive heart failure. *N Engl J Med* 2005;**352**:225–237.

w166. Kleemann T, Becker T, Doenges K, Vater M, Senges J, Schneider S, Saggau W, Weisse U, Seidl K. Annual rate of transvenous defibrillation lead defects in implantable cardioverter-defibrillators over a period of >10 years. *Circulation* 2007;**115**: 2474–2480.

w167. Poole JE, Johnson GW, Hellkamp AS, Anderson J, Callans DJ, Raitt MH, Reddy RK, Marchlinski FE, Yee R, Guarnieri T, Talajic M, Wilber DJ, Fishbein DP, Packer DL, Mark DB, Lee KL, Bardy GH. Prognostic importance of defibrillator shocks in patients with heart failure. *N Engl J Med* 2008;**359**:1009–1017.

w168. Goldenberg I, Vyas AK, Hall WJ, Moss AJ, Wang H, He H, Zareba W, McNitt S, Andrews ML. Risk stratification for primary implantation of a cardioverter-defibrillator in patients with ischemic left ventricular dysfunction. *J Am Coll Cardiol* 2008;**51**:288–296.

w169. Barsheshet A, Moss AJ, Huang DT, McNitt S, Zareba W, Goldenberg I. Applicability of a risk score for prediction of the long-term (8-year) benefit of the implantable cardioverter-defibrillator. *J Am Coll Cardiol* 2012;**59**:2075–2079.

w170. Boriani G, Mantovani LG, Biffi M, Schalij MJ, Martignani C, Leclercq C, Bax JJ, Auricchio A. Cardiac resynchronization therapy: a cost or an investment? *Europace* 2011;**13**(Suppl. 2):ii32–38.

w171. Calvert MJ, Freemantle N, Yao G, Cleland JG, Billingham L, Daubert JC, Bryan S. Cost-effectiveness of cardiac resynchronization therapy: results from the CARE-HF trial. *Eur Heart J* 2005;**26**:2681–2688.

w172. Feldman AM, de Lissovoy G, Bristow MR, Saxon LA, De Marco T, Kass DA, Boehmer J, Singh S, Whellan DJ, Carson P, Boscoe A, Baker TM, Gunderman MR. Cost effectiveness of cardiac resynchronization therapy in the Comparison of Medical Therapy, Pacing, and Defibrillation in Heart Failure (COMPANION) trial. *J Am Coll Cardiol* 2005;**46**:2311–2321.

w173. Linde C, Mealing S, Hawkins N, Eaton J, Brown B, Daubert JC. Cost-effectiveness of cardiac resynchronization therapy in patients with asymptomatic to mild heart failure: insights from the European cohort of the REVERSE (Resynchronization Reverses remodeling in Systolic Left Ventricular Dysfunction). *Eur Heart J* 2011; **32**:1631–1639.

w174. Berger PB, Ruocco NA Jr., Ryan TJ, Frederick MM, Jacobs AK, Faxon DP. Incidence and prognostic implications of heart block complicating inferior myocardial infarction treated with thrombolytic therapy: results from TIMI II. *J Am Coll Cardiol* 1992;**20**:533–540.

w175. Clemmensen P, Bates ER, Califf RM, Hlatky MA, Aronson L, George BS, Lee KL, Kereiakes DJ, Gacioch G, Berrios E *et al.* Complete atrioventricular block complicating inferior wall acute myocardial infarction treated with reperfusion therapy. TAMI Study Group. *Am J Cardiol* 1991;**67**:225–230.

w176. Harpaz D, Behar S, Gottlieb S, Boyko V, Kishon Y, Eldar M. Complete atrioventricular block complicating acute myocardial infarction in the thrombolytic era. SPRINT Study Group and the Israeli Thrombolytic Survey Group. Secondary Prevention Reinfarction Israeli Nifedipine Trial. *J Am Coll Cardiol* 1999;**34**: 1721–1728.

w177. Meine TJ, Al-Khatib SM, Alexander JH, Granger CB, White HD, Kilaru R, Williams K, Ohman EM, Topol E, Califf RM. Incidence, predictors, and outcomes of high-degree atrioventricular block complicating acute myocardial infarction treated with thrombolytic therapy. *Am Heart J* 2005;**149**:670–674.

w178. Newby KH, Pisano E, Krucoff MW, Green C, Natale A. Incidence and clinical relevance of the occurrence of bundle-branch block in patients treated with thrombolytic therapy. *Circulation* 1996;**94**:2424–2428.

w179. Wong CK, Stewart RA, Gao W, French JK, Raffel C, White HD. Prognostic differences between different types of bundle branch block during the early phase of acute myocardial infarction: insights from the Hirulog and Early Reperfusion or Occlusion (HERO)-2 trial. *Eur Heart J* 2006;**27**:21–28.

w180. Feigl D, Ashkenazy J, Kishon Y. Early and late atrioventricular block in acute inferior myocardial infarction. *J Am Coll Cardiol* 1984;**4**:35–38.

w181. Zimetbaum PJ, Josephson ME. Use of the electrocardiogram in acute myocardial infarction. *N Engl J Med* 2003;**348**:933–940.

w182. Hindman MC, Wagner GS, JaRo M, Atkins JM, Scheinman MM, DeSanctis RW, Hutter AH Jr, Yeatman L, Rubenfire M, Pujura C, Rubin M, Morris JJ. The clinical significance of bundle branch block complicating acute myocardial infarction. 1. Clinical characteristics, hospital mortality, and one-year follow-up. *Circulation* 1978;**58**:679–688.

w183. Ritter WS, Atkins JM, Blomqvist CG, Mullins CB. Permanent pacing in patients with transient trifascicular block during acute myocardial infarction. *Am J Cardiol* 1976;**38**:205–208.

w184. Brodell GK, Cosgrove D, Schiavone W, Underwood DA, Loop FD. Cardiac rhythm and conduction disturbances in patients undergoing mitral valve surgery. *Cleve Clin J Med* 1991;**58**:397–399.

w185. Chung MK. Cardiac surgery: postoperative arrhythmias. *Crit Care Med* 2000;**28**: N136–144.

w186. Jaeger FJ, Trohman RG, Brener S, Loop F. Permanent pacing following repeat cardiac valve surgery. *Am J Cardiol* 1994;**74**:505–507.

w187. Reade MC. Temporary epicardial pacing after cardiac surgery: a practical review: part 1: general considerations in the management of epicardial pacing. *Anaesthesia* 2007;**62**:264–271.

w188. Reade MC. Temporary epicardial pacing after cardiac surgery: a practical review. Part 2: Selection of epicardial pacing modes and troubleshooting. *Anaesthesia* 2007;**62**:364–373.

w189. Merin O, Ilan M, Oren A, Fink D, Deeb M, Bitran D, Silberman S. Permanent pacemaker implantation following cardiac surgery: indications and long-term follow-up. *Pacing Clin Electrophysiol* 2009;**32**:7–12.

w190. Glikson M, Dearani JA, Hyberger LK, Schaff HV, Hammill SC, Hayes DL. Indications, effectiveness, and long-term dependency in permanent pacing after cardiac surgery. *Am J Cardiol* 1997;**80**:1309–1313.

w191. Kim MH, Deeb GM, Eagle KA, Bruckman D, Pelosi F, Oral H, Sticherling C, Baker RL, Chough SP, Wasmer K, Michaud GF, Knight BP, Strickberger SA, Morady F. Complete atrioventricular block after valvular heart surgery and the timing of pacemaker implantation. *Am J Cardiol* 2001;**87**:649–651, A610.

w192. Bates MG, Matthews IG, Fazal IA, Turley AJ. Postoperative permanent pacemaker implantation in patients undergoing trans-catheter aortic valve implantation: what is the incidence and are there any predicting factors? *Interact Cardiovasc Thorac Surg* 2011;**12**:243–253.

w193. Khawaja MZ, Rajani R, Cook A, Khavandi A, Moynagh A, Chowdhary S, Spence MS, Brown S, Khan SQ, Walker N, Trivedi U, Hutchinson N, De Belder AJ, Moat N, Blackman DJ, Levy RD, Manoharan G, Roberts D, Khogali SS, Crean P, Brecker SJ, Baumbach A, Mullen M, Laborde JC, Hildick-Smith D. Permanent pacemaker insertion after CoreValve transcatheter aortic valve implantation: incidence and contributing factors (the UK CoreValve Collaborative). *Circulation* 2011;**123**:951–960.

w194. DiBiase A, Tse TM, Schnittger I, Wexler L, Stinson EB, Valantine HA. Frequency and mechanism of bradycardia in cardiac transplant recipients and need for pacemakers. *Am J Cardiol* 1991;**67**:1385–1389.

w195. Melton IC, Gilligan DM, Wood MA, Ellenbogen KA. Optimal cardiac pacing after heart transplantation. *Pacing Clin Electrophysiol* 1999;**22**:1510–1527.

w196. Jacquet L, Ziady G, Stein K, Griffith B, Armitage J, Hardesty R, Kormos R. Cardiac rhythm disturbances early after orthotopic heart transplantation: prevalence and clinical importance of the observed abnormalities. *J Am Coll Cardiol* 1990;**16**: 832–837.

w197. Holt ND, McComb JM. Cardiac transplantation and pacemakers: when and what to implant. *Card Electrophysiol Rev* 2002;**6**:140–151.

w198. Berul CI, Cecchin F. Indications and techniques of pediatric cardiac pacing. *Expert Rev Cardiovasc Ther* 2003;**1**:165–176.

w199. Cohen MI, Bush DM, Vetter VL, Tanel RE, Wieand TS, Gaynor JW, Rhodes LA. Permanent epicardial pacing in pediatric patients: seventeen years of experience and 1200 outpatient visits. *Circulation* 2001;**103**:2585–2590.

w200. Khairy P, Landzberg MJ, Gatzoulis MA, Mercier LA, Fernandes SM, Cote JM, Lavoie JP, Fournier A, Guerra PG, Frogoudaki A, Walsh EP, Dore A. Transvenous pacing leads and systemic thromboemboli in patients with intracardiac shunts: a multicenter study. *Circulation* 2006;**113**:2391–2397.

w201. Bar-Cohen Y, Berul CI, Alexander ME, Fortescue EB, Walsh EP, Triedman JK, Cecchin F. Age, size, and lead factors alone do not predict venous obstruction in children and young adults with transvenous lead systems. *J Cardiovasc Electrophysiol* 2006;**17**:754–759.

w202. Figa FH, McCrindle BW, Bigras JL, Hamilton RM, Gow RM. Risk factors for venous obstruction in children with transvenous pacing leads. *Pacing Clin Electrophysiol* 1997;**20**:1902–1909.

w203. Klug D, Vaksmann G, Jarwe M, Wallet F, Francart C, Kacet S, Rey C. Pacemaker lead infection in young patients. *Pacing Clin Electrophysiol* 2003;**26**:1489–1493.

w204. van Geldorp IE, Vanagt WY, Prinzen FW, Delhaas T. Chronic ventricular pacing in children: toward prevention of pacing-induced heart disease. *Heart Fail Rev* 2011; **16**:305–314.

w205. Jaeggi ET, Hamilton RM, Silverman ED, Zamora SA, Hornberger LK. Outcome of children with fetal, neonatal or childhood diagnosis of isolated congenital atrioventricular block. A single institution's experience of 30 years. *J Am Coll Cardiol* 2002;**39**:130–137.

w206. Michaelsson M, Engle MA. Congenital complete heart block: an international study of the natural history. *Cardiovasc Clin* 1972;**4**:85–101.

w207. Villain E, Coastedoat-Chalumeau N, Marijon E, Boudjemline Y, Piette JC, Bonnet D. Presentation and prognosis of complete atrioventricular block in childhood, according to maternal antibody status. *J Am Coll Cardiol* 2006;**48**: 1682–1687.

w208. Breur JM, Udink Ten Cate FE, Kapusta L, Cohen MI, Crosson JE, Boramanand N, Lubbers LJ, Friedman AH, Brenner JI, Vetter VL, Sreeram N, Meijboom EJ. Pacemaker therapy in isolated congenital complete atrioventricular block. *Pacing Clin Electrophysiol* 2002;**25**:1685–1691.

w209. Karpawich PP, Gillette PC, Garson A Jr, Hesslein PS, Porter CB, McNamara DG. Congenital complete atrioventricular block: clinical and electrophysiologic predictors of need for pacemaker insertion. *Am J Cardiol* 1981;**48**:1098–1102.

w210. Beaufort-Krol GC, Schasfoort-van Leeuwen MJ, Stienstra Y, Bink-Boelkens MT. Longitudinal echocardiographic follow-up in children with congenital complete atrioventricular block. *Pacing Clin Electrophysiol* 2007;**30**:1339–1343.

w211. Dewey RC, Capeless MA, Levy AM. Use of ambulatory electrocardiographic monitoring to identify high-risk patients with congenital complete heart block. *N Engl J Med* 1987;**316**:835–839.

w212. Sagar S, Shen WK, Asirvatham SJ, Cha YM, Espinosa RE, Friedman PA, Hodge DO, Munger TM, Porter CB, Rea RF, Hayes DL, Jahangir A. Effect of long-term right ventricular pacing in young adults with structurally normal heart. *Circulation* 2010;**121**:1698–1705.

w213. Tantengco MV, Thomas RL, Karpawich PP. Left ventricular dysfunction after long-term right ventricular apical pacing in the young. *J Am Coll Cardiol* 2001;**37**: 2093–2100.

w214. Thambo JB, Bordachar P, Garrigue S, Lafitte S, Sanders P, Reuter S, Girardot R, Crepin D, Reant P, Roudaut R, Jais P, Haissaguerre M, Clementy J, Jimenez M. Detrimental ventricular remodeling in patients with congenital complete heart block and chronic right ventricular apical pacing. *Circulation* 2004;**110**:3766–3772.

w215. Udink ten Cate FE, Breur JM, Cohen MI, Boramanand N, Kapusta L, Crosson JE, Brenner JI, Lubbers LJ, Friedman AH, Vetter VL, Meijboom EJ. Dilated cardiomyopathy in isolated congenital complete atrioventricular block: early and long-term risk in children. *J Am Coll Cardiol* 2001;**37**:1129–1134.

w216. Bonatti V, Agnetti A, Squarcia U. Early and late postoperative complete heart block in pediatric patients submitted to open-heart surgery for congenital heart disease. *Pediatr Med Chir* 1998;**20**:181–186.

w217. Villain E. Indications for pacing in patients with congenital heart disease. *Pacing Clin Electrophysiol* 2008;**31**(Suppl. 1):S17–20.

w218. Flinn CJ, Wolff GS, Dick M 2nd, Campbell RM, Borkat G, Casta A, Hordof A, Hougen TJ, Kavey RE, Kugler J *et al.* Cardiac rhythm after the Mustard operation for complete transposition of the great arteries. *N Engl J Med* 1984;**310**: 1635–1638.

w219. Rein AJ, Simcha A, Ludomirsky A, Appelbaum A, Uretzky G, Tamir I. Symptomatic sinus bradycardia in infants with structurally normal hearts. *J Pediatr* 1985;**107**: 724–727.

w220. Gillette PC, Shannon C, Garson A Jr., Porter CJ, Ott D, Cooley DA, McNamara DG. Pacemaker treatment of sick sinus syndrome in children. *J Am Coll Cardiol* 1983;**1**:1325–1329.

w221. Kay R, Estioko M, Wiener I. Primary sick sinus syndrome as an indication for chronic pacemaker therapy in young adults: incidence, clinical features, and long-term evaluation. *Am Heart J* 1982;**103**:338–342.

w222. Anand N, McCrindle BW, Chiu CC, Hamilton RM, Kirsh JA, Stephenson EA, Gross GJ. Chronotropic incompetence in young patients with late postoperative atrial flutter: a case-control study. *Eur Heart J* 2006;**27**:2069–2073.

w223. Silka MJ, Manwill JR, Kron J, McAnulty JH. Bradycardia-mediated tachyarrhythmias in congenital heart disease and responses to chronic pacing at physiologic rates. *Am J Cardiol* 1990;**65**:488–493.

w224. Stephenson EA, Casavant D, Tuzi J, Alexander ME, Law I, Serwer G, Strieper M, Walsh EP, Berul CI. Efficacy of atrial antitachycardia pacing using the Medtronic AT500 pacemaker in patients with congenital heart disease. *Am J Cardiol* 2003; **92**:871–876.

w225. Cecchin F, Frangini PA, Brown DW, Fynn-Thompson F, Alexander ME, Triedman JK, Gauvreau K, Walsh EP, Berul CI. Cardiac resynchronization therapy (and multisite pacing) in pediatrics and congenital heart disease: five years experience in a single institution. *J Cardiovasc Electrophysiol* 2009;**20**:58–65.

w226. Dubin AM, Janousek J, Rhee E, Strieper MJ, Cecchin F, Law IH, Shannon KM, Temple J, Rosenthal E, Zimmerman FJ, Davis A, Karpawich PP, Al Ahmad A, Vetter VL, Kertesz NJ, Shah M, Snyder C, Stephenson E, Emmel M, Sanatani S, Kanter R, Batra A, Collins KK. Resynchronization therapy in pediatric and congenital heart disease patients: an international multicenter study. *J Am Coll Cardiol* 2005;**46**:2277–2283.

w227. Janousek J, Gebauer RA, Abdul-Khaliq H, Turner M, Kornyei L, Grollmuss O, Rosenthal E, Villain E, Fruh A, Paul T, Blom NA, Happonen JM, Bauersfeld U, Jacobsen JR, van den Heuvel F, Delhaas T, Papagiannis J, Trigo C. Cardiac resynchronisation therapy in paediatric and congenital heart disease: differential effects in various anatomical and functional substrates. *Heart* 2009;**95**: 1165–1171.

w228. Thambo JB, Dos Santos P, De Guillebon M, Roubertie F, Labrousse L, Sacher F, Iriart X, Lafitte S, Ploux S, Jais P, Roques X, Haissaguerre M, Ritter P, Clementy J, Narayan SM, Bordachar P. Biventricular stimulation improves right and left ventricular function after tetralogy of Fallot repair: acute animal and clinical studies. *Heart Rhythm* 2010;**7**:344–350.

w229. Janousek J, van Geldorp IE, Krupickova S, Rosenthal E, Nugent K, Tomaske M, Fruh A, Elders J, Hiippala A, Kerst G, Gebauer RA, Kubus P, Frias P, Gabbarini F, Clur SA, Nagel B, Ganame J, Papagiannis J, Marek J, Tisma-Dupanovic S, Tsao S, Nurnberg JH, Wren C, Friedberg M, de Guillebon M, Volaufova J, Prinzen FW, Delhaas T, Working Group for Cardiac Dysrhythmias and Electrophysiology of the Association for European Pediatric Cardiology. Permanent cardiac pacing in children: choosing the optimal pacing site: a multicenter study. *Circulation* 2013;**127**:613–623.

w230. Efthimiadis GK, Giannakoulas G, Parcharidou DG, Pagourelias ED, Kouidi EJ, Spanos G, Kamperidis V, Gavrielides S, Karvounis H, Styliadis I, Parcharidis GE. Chronotropic incompetence and its relation to exercise intolerance in hypertrophic cardiomyopathy. *Int J Cardiol* 2011;**153**:179–184.

w231. Sharma S, Elliott P, Whyte G, Jones S, Mahon N, Whipp B, McKenna WJ. Utility of cardiopulmonary exercise in the assessment of clinical determinants of functional capacity in hypertrophic cardiomyopathy. *Am J Cardiol* 2000;**86**:162–168.

w232. Agarwal S, Tuzcu EM, Desai MY, Smedira N, Lever HM, Lytle BW, Kapadia SR. Updated meta-analysis of septal alcohol ablation versus myectomy for hypertrophic cardiomyopathy. *J Am Coll Cardiol* 2010;**55**:823–834.

w233. Alam M, Dokainish H, Lakkis NM. Hypertrophic obstructive cardiomyopathy-alcohol septal ablation vs. myectomy: a meta-analysis. *Eur Heart J* 2009;**30**:1080–1087.

w234. Leonardi RA, Kransdorf EP, Simel DL, Wang A. Meta-analyses of septal reduction therapies for obstructive hypertrophic cardiomyopathy: comparative rates of overall mortality and sudden cardiac death after treatment. *Circ Cardiovasc Interv* 2010;**3**:97–104.

w235. Jeanrenaud X, Goy JJ, Kappenberger L. Effects of dual-chamber pacing in hypertrophic obstructive cardiomyopathy. *Lancet* 1992;**339**:1318–1323.

w236. Nishimura RA, Hayes DL, Ilstrup DM, Holmes DR Jr, Tajik AJ. Effect of dual-chamber pacing on systolic and diastolic function in patients with hypertrophic cardiomyopathy. Acute Doppler echocardiographic and catheterization hemodynamic study. *J Am Coll Cardiol* 1996;**27**:421–430.

w237. Jeanrenaud X, Schlapfer J, Fromer M, Aebischer N, Kappenberger L. Dual chamber pacing in hypertrophic obstructive cardiomyopathy: beneficial effect of atrioventricular junction ablation for optimal left ventricular capture and filling. *Pacing Clin Electrophysiol* 1997;**20**:293–300.

w238. D'Andrea A, Caso P, Severino S, Cuomo S, Capozzi G, Calabro P, Cice G, Ascione L, Scherillo M, Calabro R. Prognostic value of intra-left ventricular electromechanical asynchrony in patients with hypertrophic cardiomyopathy. *Eur Heart J* 2006;**27**:1311–1318.

w239. Ashrafian H, Mason MJ, Mitchell AG. Regression of dilated-hypokinetic hypertrophic cardiomyopathy by biventricular cardiac pacing. *Europace* 2007;**9**:50–54.

w240. Pezzulich B, Montagna L, Lucchina PG. Successful treatment of end-stage hypertrophic cardiomyopathy with biventricular cardiac pacing. *Europace* 2005;**7**: 388–391.

w241. Rinaldi CA, Bucknall CA, Gill JS. Beneficial effects of biventricular pacing in a patient with hypertrophic cardiomyopathy and intraventricular conduction delay. *Heart* 2002;**87**:e6.

w242. Rogers DP, Marazia S, Chow AW, Lambiase PD, Lowe MD, Frenneaux M, McKenna WJ, Elliott PM. Effect of biventricular pacing on symptoms and cardiac remodelling in patients with end-stage hypertrophic cardiomyopathy. *Eur J Heart Fail* 2008;**10**:507–513.

w243. Lenarczyk R, Wozniak A, Kowalski O, Sokal A, Pruszkowska-Skrzep P, Sredniawa B, Szulik M, Zielinska T, Kukulski T, Stabryla J, Mazurek M, Bialkowski J, Kalarus Z. Effect of cardiac resynchronization on gradient reduction in patients with obstructive hypertrophic cardiomyopathy: preliminary study. *Pacing Clin Electrophysiol* 2011;**34**:1544–1552.

w244. Rinaldi CA, Kirubakaran S, Bucknall CA, Bostock J, Gill JS. Initial experience of a cohort of patients with hypertrophic cardiomyopathy undergoing biventricular pacing. *Indian Pacing Electrophysiol J* 2011;**11**:5–14.

w245. Priori SG, Napolitano C, Schwartz PJ, Grillo M, Bloise R, Ronchetti E, Moncalvo C, Tulipani C, Veia A, Bottelli G, Nastoli J. Association of long QT syndrome loci and cardiac events among patients treated with beta-blockers. *JAMA* 2004;**292**: 1341–1344.

w246. Priori SG, Schwartz PJ, Napolitano C, Bloise R, Ronchetti E, Grillo M, Vicentini A, Spazzolini C, Nastoli J, Bottelli G, Folli R, Cappelletti D. Risk stratification in the long-QT syndrome. *N Engl J Med* 2003;**348**:1866–1874.

w247. Schwartz PJ, Spazzolini C, Crotti L. All LQT3 patients need an ICD: true or false? *Heart Rhythm* 2009;**6**:113–120.

w248. Eldar M, Griffin JC, Abbott JA, Benditt D, Bhandari A, Herre JM, Benson DW, Scheinman MM. Permanent cardiac pacing in patients with the long QT syndrome. *J Am Coll Cardiol* 1987;**10**:600–607.

w249. Moss AJ, Liu JE, Gottlieb S, Locati EH, Schwartz PJ, Robinson JL. Efficacy of permanent pacing in the management of high-risk patients with long QT syndrome. *Circulation* 1991;**84**:1524–1529.

w250. Viskin S, Fish R, Zeltser D, Belhassen B, Heller K, Brosh D, Laniado S, Barron HV. Arrhythmias in the congenital long QT syndrome: how often is torsade de pointes pause dependent? *Heart* 2000;**83**:661–666.

w251. Diegoli M, Grasso M, Favalli V, Serio A, Gambarin FI, Klersy C, Pasotti M, Agozzino E, Scelsi L, Ferlini A, Febo O, Piccolo G, Tavazzi L, Narula J, Arbustini E. Diagnostic work-up and risk stratification in X-linked dilated cardiomyopathies caused by dystrophin defects. *J Am Coll Cardiol* 2011;**58**:925–934.

w252. Online Mendelian Inheritance in Man (OMIM). McKusick-Nathans Institute of Genetic Medicine, Johns Hopkins University (Baltimore, MD) and National Center for Biotechnology Information, National Library of Medicine (Bethesda, MD). http://www.ncbi.nlm.nih.gov/omim.

w253. Taylor MR, Fain PR, Sinagra G, Robinson ML, Robertson AD, Carniel E, Di Lenarda A, Bohlmeyer TJ, Ferguson DA, Brodsky GL, Boucek MM, Lascor J, Moss AC, Li WL, Stetler GL, Muntoni F, Bristow MR, Mestroni L. Natural history of dilated cardiomyopathy due to lamin A/C gene mutations. *J Am Coll Cardiol* 2003;**41**:771–780.

w254. Taylor MR, Slavov D, Ku L, Di Lenarda A, Sinagra G, Carniel E, Haubold K, Boucek MM, Ferguson D, Graw SL, Zhu X, Cavanaugh J, Sucharov CC, Long CS, Bristow MR, Lavori P, Mestroni L. Prevalence of desmin mutations in dilated cardiomyopathy. *Circulation* 2007;**115**:1244–1251.

w255. Becane HM, Bonne G, Varnous S, Muchir A, Ortega V, Hammouda EH, Urtizberea JA, Lavergne T, Fardeau M, Eymard B, Weber S, Schwartz K, Duboc D. High incidence of sudden death with conduction system and myocardial disease due to lamins A and C gene mutation. *Pacing Clin Electrophysiol* 2000; **23**:1661–1666.

w256. Meune C, Van Berlo JH, Anselme F, Bonne G, Pinto YM, Duboc D. Primary prevention of sudden death in patients with lamin A/C gene mutations. *N Engl J Med* 2006;**354**:209–210.

w257. Parks SB, Kushner JD, Nauman D, Burgess D, Ludwigsen S, Peterson A, Li D, Jakobs P, Litt M, Porter CB, Rahko PS, Hershberger RE. Lamin A/C mutation analysis in a cohort of 324 unrelated patients with idiopathic or familial dilated cardiomyopathy. *Am Heart J* 2008;**156**:161–169.

w258. Pasotti M, Klersy C, Pilotto A, Marziliano N, Rapezzi C, Serio A, Mannarino S, Gambarin F, Favalli V, Grasso M, Agozzino M, Campana C, Gavazzi A, Febo O, Marini M, Landolina M, Mortara A, Piccolo G, Vigano M, Tavazzi L, Arbustini E. Long-term outcome and risk stratification in dilated cardiolaminopathies. *J Am Coll Cardiol* 2008;**52**:1250–1260.

w259. van Berlo JH, de Voogt WG, van der Kooi AJ, van Tintelen JP, Bonne G, Yaou RB, Duboc D, Rossenbacker T, Heidbuchel H, de Visser M, Crijns HJ, Pinto YM. Meta-analysis of clinical characteristics of 299 carriers of LMNA gene mutations: do lamin A/C mutations portend a high risk of sudden death? *J Mol Med (Berl)* 2005;**83**:79–83.

w260. van Rijsingen IA, Arbustini E, Elliott PM, Mogensen J, Hermans-van Ast JF, van der Kooi AJ, van Tintelen JP, van den Berg MP, Pilotto A, Pasotti M, Jenkins S, Rowland C, Aslam U, Wilde AA, Perrot A, Pankuweit S, Zwinderman AH, Charron P, Pinto YM. Risk factors for malignant ventricular arrhythmias in lamin a/c mutation carriers a European cohort study. *J Am Coll Cardiol* 2012;**59**: 493–500.

w261. Hermans MC, Pinto YM, Merkies IS, de Die-Smulders CE, Crijns HJ, Faber CG. Hereditary muscular dystrophies and the heart. *Neuromuscul Disord* 2010;**20**: 479–492.

w262. Boriani G, Gallina M, Merlini L, Bonne G, Toniolo D, Amati S, Biffi M, Martignani C, Frabetti L, Bonvicini M, Rapezzi C, Branzi A. Clinical relevance of atrial fibrillation/flutter, stroke, pacemaker implant, and heart failure in Emery-Dreifuss muscular dystrophy: a long-term longitudinal study. *Stroke* 2003;**34**:901–908.

w263. Lazarus A, Varin J, Babuty D, Anselme F, Coste J, Duboc D. Long-term follow-up of arrhythmias in patients with myotonic dystrophy treated by pacing: a multicenter diagnostic pacemaker study. *J Am Coll Cardiol* 2002;**40**:1645–1652.

w264. Petri H, Vissing J, Witting N, Bundgaard H, Kober L. Cardiac manifestations of myotonic dystrophy type 1. *Int J Cardiol* 2012;**160**:82–88.

w265. Grigg LE, Chan W, Mond HG, Vohra JK, Downey WF. Ventricular tachycardia and sudden death in myotonic dystrophy: clinical, electrophysiologic and pathologic features. *J Am Coll Cardiol* 1985;**6**:254–256.

w266. Groh WJ, Groh MR, Saha C, Kincaid JC, Simmons Z, Ciafaloni E, Pourmand R, Otten RF, Bhakta D, Nair GV, Marashdeh MM, Zipes DP, Pascuzzi RM. Electrocardiographic abnormalities and sudden death in myotonic dystrophy type 1. *N Engl J Med* 2008;**358**:2688–2697.

w267. Lallemand B, Clementy N, Bernard-Brunet A, Pierre B, Corcia P, Fauchier L, Raynaud M, Pellieux S, Babuty D. The evolution of infrahissian conduction time in myotonic dystrophy patients: clinical implications. *Heart* 2012;**98**:291–296.

w268. Laurent V, Pellieux S, Corcia P, Magro P, Pierre B, Fauchier L, Raynaud M, Babuty D. Mortality in myotonic dystrophy patients in the area of prophylactic pacing devices. *Int J Cardiol* 2011;**150**:54–58.

w269. van Spaendonck-Zwarts K, van Hessem L, Jongbloed J, de Walle H, Capetanaki Y, van der Kooi A, van Langen I, van den Berg M, van Tintelen J. Desmin-related myopathy. *Clin Genet* 2011;**80**:354–366.

w270. Wahbi K, Behin A, Charron P, Dunand M, Richard P, Meune C, Vicart P, Laforet P, Stojkovic T, Becane HM, Kuntzer T, Duboc D. High cardiovascular morbidity and mortality in myofibrillar myopathies due to DES gene mutations: a 10-year longitudinal study. *Neuromuscul Disord* 2012;**22**:211–218.

w271. Wahbi K, Meune C, Porcher R, Becane HM, Lazarus A, Laforet P, Stojkovic T, Behin A, Radvanyi-Hoffmann H, Eymard B, Duboc D. Electrophysiological study with prophylactic pacing and survival in adults with myotonic dystrophy and conduction system disease. *JAMA* 2012;**307**:1292–1301.

w272. Anan R, Nakagawa M, Miyata M, Higuchi I, Nakao S, Suehara M, Osame M, Tanaka H. Cardiac involvement in mitochondrial diseases. A study on 17 patients with documented mitochondrial DNA defects. *Circulation* 1995;**91**:955–961.

w273. Guenthard J, Wyler F, Fowler B, Baumgartner R. Cardiomyopathy in respiratory chain disorders. *Arch Dis Child* 1995;**72**:223–226.

w274. Limongelli G, Tome-Esteban M, Dejthevaporn C, Rahman S, Hanna MG, Elliott PM. Prevalence and natural history of heart disease in adults with primary mitochondrial respiratory chain disease. *Eur J Heart Fail* 2010;**12**: 114–121.

w275. Elliott P, Baker R, Pasquale F, Quarta G, Ebrahim H, Mehta AB, Hughes DA. Prevalence of Anderson-Fabry disease in patients with hypertrophic cardiomyopathy: the European Anderson-Fabry Disease survey. *Heart* 2011;**97**:1957–1960.

w276. O'Mahony C, Coats C, Cardona M, Garcia A, Calcagnino M, Murphy E, Lachmann R, Mehta A, Hughes D, Elliott PM. Incidence and predictors of antibradycardia pacing in patients with Anderson-Fabry disease. *Europace* 2011;**13**: 1781–1788.

w277. Regitz-Zagrosek V, Blomstrom Lundqvist C, Borghi C, Cifkova R, Ferreira R, Foidart JM, Gibbs JS, Gohlke-Baerwolf C, Gorenek B, Iung B, Kirby M, Maas AH, Morais J, Nihoyannopoulos P, Pieper PG, Presbitero P, Roos-Hesselink JW, Schaufelberger M, Seeland U, Torracca L, Bax J, Auricchio A, Baumgartner H, Ceconi C, Dean V, Deaton C, Fagard R, Funck-Brentano C, Hasdai D, Hoes A, Knuuti J, Kolh P, McDonagh T, Moulin C, Poldermans D, Popescu BA, Reiner Z, Sechtem U, Sirnes PA, Torbicki A, Vahanian A, Windecker S, Aguiar C, Al-Attar N, Garcia AA, Antoniou A, Coman I, Elkayam U, Gomez-Sanchez MA, Gotcheva N, Hilfiker-Kleiner D, Kiss RG, Kitsiou A, Konings KT, Lip GY, Manolis A, Mebaaza A, Mintale I, Morice MC, Mulder BJ, Pasquet A, Price S, Priori SG, Salvador MJ, Shotan A, Silversides CK, Skouby SO, Stein JI, Tornos P, Vejlstrup N, Walker F, Warnes C. ESC Guidelines on the management of cardiovascular diseases during pregnancy: the Task Force on the Management of Cardiovascular Diseases during Pregnancy of the European Society of Cardiology (ESC). *Eur Heart J* 2011; **32**:3147–3197.

w278. Avasthi K, Gupta S, Avasthi G. An unusual case of complete heart block with triplet pregnancy. *Indian Heart J* 2003;**55**:641–642.

w279. Kenmure AC, Cameron AJ. Congenital complete heart block in pregnancy. *Br Heart J* 1967;**29**:910–912.

w280. Suri V, Keepanasseril A, Aggarwal N, Vijayvergiya R, Chopra S, Rohilla M. Maternal complete heart block in pregnancy: analysis of four cases and review of management. *J Obstet Gynaecol Res* 2009;**35**:434–437.

w281. Merino JL, Peinado R, Silvestre J. Dual-chamber implantable cardioverter defibrillator implantation guided by non-fluoroscopic electro-anatomical navigation. *Europace* 2008;**10**:1124–1125.

w282. Ruiz-Granell R, Morell-Cabedo S, Ferrero-De-Loma A, Garcia-Civera R. Atrioventricular node ablation and permanent ventricular pacemaker implantation without fluoroscopy: use of an electroanatomic navigation system. *J Cardiovasc Electrophysiol* 2005;**16**:793–795.

w283. Barold SS, Herweg B. Conventional and biventricular pacing in patients with first-degree atrioventricular block. *Europace* 2012;**14**:1414–1419.

w284. Olshansky B, Day JD, Sullivan RM, Yong P, Galle E, Steinberg JS. Does cardiac resynchronization therapy provide unrecognized benefit in patients with

prolonged PR intervals? The impact of restoring atrioventricular synchrony: an analysis from the COMPANION Trial. *Heart Rhythm* 2012;**9**:34–39.
w285. Friedman PA, Dijkman B, Warman EN, Xia HA, Mehra R, Stanton MS, Hammill SC. Atrial therapies reduce atrial arrhythmia burden in defibrillator patients. *Circulation* 2001;**104**:1023–1028.
w286. Gold MR, Sulke N, Schwartzman DS, Mehra R, Euler DE. Clinical experience with a dual-chamber implantable cardioverter defibrillator to treat atrial tachyarrhythmias. *J Cardiovasc Electrophysiol* 2001;**12**:1247–1253.
w287. Gillis AM, Koehler J, Morck M, Mehra R, Hettrick DA. High atrial antitachycardia pacing therapy efficacy is associated with a reduction in atrial tachyarrhythmia burden in a subset of patients with sinus node dysfunction and paroxysmal atrial fibrillation. *Heart Rhythm* 2005;**2**:791–796.
w288. Hemels ME, Ruiter JH, Molhoek GP, Veeger NJ, Wiesfeld AC, Ranchor AV, van Trigt M, Pilmeyer A, Van Gelder IC. Right atrial preventive and antitachycardia pacing for prevention of paroxysmal atrial fibrillation in patients without bradycardia: a randomized study. *Europace* 2008;**10**:306–313.
w289. Padeletti L, Purerfellner H, Adler SW, Waller TJ, Harvey M, Horvitz L, Holbrook R, Kempen K, Mugglin A, Hettrick DA. Combined efficacy of atrial septal lead placement and atrial pacing algorithms for prevention of paroxysmal atrial tachyarrhythmia. *J Cardiovasc Electrophysiol* 2003;**14**:1189–1195.
w290. Saksena S, Prakash A, Ziegler P, Hummel JD, Friedman P, Plumb VJ, Wyse DG, Johnson E, Fitts S, Mehra R. Improved suppression of recurrent atrial fibrillation with dual-site right atrial pacing and antiarrhythmic drug therapy. *J Am Coll Cardiol* 2002;**40**:1140–1150; discussion 1151-1142.
w291. Levy T, Walker S, Rochelle J, Paul V. Evaluation of biatrial pacing, right atrial pacing, and no pacing in patients with drug refractory atrial fibrillation. *Am J Cardiol* 1999; **84**:426–429.
w292. Parsonnet V, Bernstein AD, Lindsay B. Pacemaker-implantation complication rates: an analysis of some contributing factors. *J Am Coll Cardiol* 1989;**13**:917–921.
w293. Kirkfeldt RE, Johansen JB, Nohr EA, Moller M, Arnsbo P, Nielsen JC. Risk factors for lead complications in cardiac pacing: a population-based cohort study of 28,860 Danish patients. *Heart Rhythm* 2011;**8**:1622–1628.
w294. Kirkfeldt RE, Johansen JB, Nohr EA, Moller M, Arnsbo P, Nielsen JC. Pneumothorax in cardiac pacing: a population-based cohort study of 28,860 Danish patients. *Europace* 2012;**14**:1132–1138.
w295. Udo EO, Zuithoff NP, van Hemel NM, de Cock CC, Hendriks T, Doevendans PA, Moons KG. Incidence and predictors of short- and long-term complications in pacemaker therapy: the FOLLOWPACE study. *Heart Rhythm* 2012;**9**:728–735.
w296. Ellenbogen KA, Hellkamp AS, Wilkoff BL, Camunas JL, Love JC, Hadjis TA, Lee KL, Lamas GA. Complications arising after implantation of DDD pacemakers: the MOST experience. *Am J Cardiol* 2003;**92**:740–741.
w297. Reynolds MR, Cohen DJ, Kugelmass AD, Brown PP, Becker ER, Culler SD, Simon AW. The frequency and incremental cost of major complications among medicare beneficiaries receiving implantable cardioverter-defibrillators. *J Am Coll Cardiol* 2006;**47**:2493–2497.
w298. Tompkins C, Cheng A, Dalal D, Brinker JA, Leng CT, Marine JE, Nazarian S, Spragg DD, Sinha S, Halperin H, Tomaselli GF, Berger RD, Calkins H, Henrikson CA. Dual antiplatelet therapy and heparin "bridging" significantly increase the risk of bleeding complications after pacemaker or implantable cardioverter-defibrillator device implantation. *J Am Coll Cardiol* 2010;**55**: 2376–2382.
w299. Kutinsky IB, Jarandilla R, Jewett M, Haines DE. Risk of hematoma complications after device implant in the clopidogrel era. *Circ Arrhythm Electrophysiol* 2010;**3**: 312–318.
w300. Tompkins C, Henrikson CA. Optimal strategies for the management of antiplatelet and anticoagulation medications prior to cardiac device implantation. *Cardiol J* 2011;**18**:103–109.
w301. Wiegand UK, LeJeune D, Boguschewski F, Bonnemeier H, Eberhardt F, Schunkert H, Bode F. Pocket hematoma after pacemaker or implantable cardioverter defibrillator surgery: influence of patient morbidity, operation strategy, and perioperative antiplatelet/anticoagulation therapy. *Chest* 2004;**126**: 1177–1186.
w302. Jamula E, Douketis JD, Schulman S. Perioperative anticoagulation in patients having implantation of a cardiac pacemaker or defibrillator: a systematic review and practical management guide. *J Thromb Haemost* 2008;**6**:1615–1621.
w303. Ghanbari H, Feldman D, Schmidt M, Ottino J, Machado C, Akoum N, Wall TS, Daccarett M. Cardiac resynchronization therapy device implantation in patients with therapeutic international normalized ratios. *Pacing Clin Electrophysiol* 2010; **33**:400–406.
w304. Giudici MC, Paul DL, Bontu P, Barold SS. Pacemaker and implantable cardioverter defibrillator implantation without reversal of warfarin therapy. *Pacing Clin Electrophysiol* 2004;**27**:358–360.
w305. Sie P, Samama CM, Godier A, Rosencher N, Steib A, Llau JV, Van der Linden P, Pernod G, Lecompte T, Gouin-Thibault I, Albaladejo P. Surgery and invasive procedures in patients on long-term treatment with direct oral anticoagulants: thrombin or factor-Xa inhibitors. Recommendations of the Working Group on Perioperative Haemostasis and the French Study Group on Thrombosis and Haemostasis. *Arch Cardiovasc Dis* 2011;**104**:669–676.
w306. Johansen JB, Jorgensen OD, Moller M, Arnsbo P, Mortensen PT, Nielsen JC. Infection after pacemaker implantation: infection rates and risk factors associated with infection in a population-based cohort study of 46299 consecutive patients. *Eur Heart J* 2011;**32**:991–998.
w307. Uslan DZ, Sohail MR, St Sauver JL, Friedman PA, Hayes DL, Stoner SM, Wilson WR, Steckelberg JM, Baddour LM. Permanent pacemaker and implantable cardioverter defibrillator infection: a population-based study. *Arch Intern Med* 2007;**167**:669–675.
w308. Da Costa A, Kirkorian G, Cucherat M, Delahaye F, Chevalier P, Cerisier A, Isaaz K, Touboul P. Antibiotic prophylaxis for permanent pacemaker implantation: a meta-analysis. *Circulation* 1998;**97**:1796–1801.
w309. de Oliveira JC, Martinelli M, Nishioka SA, Varejao T, Uipe D, Pedrosa AA, Costa R, D'Avila A, Danik SB. Efficacy of antibiotic prophylaxis before the implantation of pacemakers and cardioverter-defibrillators: results of a large, prospective, randomized, double-blinded, placebo-controlled trial. *Circ Arrhythm Electrophysiol* 2009; **2**:29–34.
w310. Barin ES, Jones SM, Ward DE, Camm AJ, Nathan AW. The right ventricular outflow tract as an alternative permanent pacing site: long-term follow-up. *Pacing Clin Electrophysiol* 1991;**14**:3–6.
w311. Cano O, Osca J, Sancho-Tello MJ, Sanchez JM, Ortiz V, Castro JE, Salvador A, Olague J. Comparison of effectiveness of right ventricular septal pacing versus right ventricular apical pacing. *Am J Cardiol* 2010;**105**:1426–1432.
w312. de Cock CC, Giudici MC, Twisk JW. Comparison of the haemodynamic effects of right ventricular outflow-tract pacing with right ventricular apex pacing: a quantitative review. *Europace* 2003;**5**:275–278.
w313. Domenichini G, Sunthorn H, Fleury E, Foulkes H, Stettler C, Burri H. Pacing of the interventricular septum versus the right ventricular apex: a prospective, randomized study. *Eur J Intern Med* 2012;**23**:621–627.
w314. Flevari P, Leftheriotis D, Fountoulaki K, Panou F, Rigopoulos AG, Paraskevaidis I, Kremastinos DT. Long-term nonoutflow septal versus apical right ventricular pacing: relation to left ventricular dyssynchrony. *Pacing Clin Electrophysiol* 2009; **32**:354–362.
w315. Gong X, Su Y, Pan W, Cui J, Liu S, Shu X. Is right ventricular outflow tract pacing superior to right ventricular apex pacing in patients with normal cardiac function? *Clin Cardiol* 2009;**32**:695–699.
w316. Kristiansen HM, Vollan G, Hovstad T, Keilegavlen H, Faerestrand S. A randomized study of haemodynamic effects and left ventricular dyssynchrony in right ventricular apical vs. high posterior septal pacing in cardiac resynchronization therapy. *Eur J Heart Fail* 2012;**14**:506–516.
w317. Kypta A, Steinwender C, Kammler J, Leisch F, Hofmann R. Long-term outcomes in patients with atrioventricular block undergoing septal ventricular lead implantation compared with standard apical pacing. *Europace* 2008;**10**:574–579.
w318. Leong DP, Mitchell AM, Salna I, Brooks AG, Sharma G, Lim HS, Alasady M, Barlow M, Leitch J, Sanders P, Young GD. Long-term mechanical consequences of permanent right ventricular pacing: effect of pacing site. *J Cardiovasc Electrophysiol* 2010;**21**:1120–1126.
w319. Lewicka-Nowak E, Dabrowska-Kugacka A, Tybura S, Krzyminska-Stasiuk E, Wilczek R, Staniewicz J, Swiatecka G, Raczek G. Right ventricular apex versus right ventricular outflow tract pacing: prospective, randomised, long-term clinical and echocardiographic evaluation. *Kardiol Pol* 2006;**64**:1082–1091; discussion 1092-1083.
w320. Mera F, DeLurgio DB, Patterson RE, Merlino JD, Wade ME, Leon AR. A comparison of ventricular function during high right ventricular septal and apical pacing after his-bundle ablation for refractory atrial fibrillation. *Pacing Clin Electrophysiol* 1999;**22**:1234–1239.
w321. Occhetta E, Bortnik M, Magnani A, Francalacci G, Piccinino C, Plebani L, Marino P. Prevention of ventricular desynchronization by permanent para-Hisian pacing after atrioventricular node ablation in chronic atrial fibrillation: a crossover, blinded, randomized study versus apical right ventricular pacing. *J Am Coll Cardiol* 2006;**47**:1938–1945.
w322. Shimony A, Eisenberg MJ, Filion KB, Amit G. Beneficial effects of right ventricular non-apical vs. apical pacing: a systematic review and meta-analysis of randomized-controlled trials. *Europace* 2012;**14**:81–91.
w323. Stambler BS, Ellenbogen K, Zhang X, Porter TR, Xie F, Malik R, Small R, Burke M, Kaplan A, Nair L, Belz M, Fuenzalida C, Gold M, Love C, Sharma A, Silverman R, Sogade F, Van Natta B, Wilkoff BL. Right ventricular outflow versus apical pacing in pacemaker patients with congestive heart failure and atrial fibrillation. *J Cardiovasc Electrophysiol* 2003;**14**:1180–1186.
w324. Victor F, Mabo P, Mansour H, Pavin D, Kabalu G, de Place C, Leclercq C, Daubert JC. A randomized comparison of permanent septal versus apical right ventricular pacing: short-term results. *J Cardiovasc Electrophysiol* 2006;**17**: 238–242.

w325. Wang F, Shi H, Sun Y, Wang J, Yan Q, Jin W, Zhang J, Meng W, Zhang F, Chen G, Sun B. Right ventricular outflow pacing induces less regional wall motion abnormalities in the left ventricle compared with apical pacing. *Europace* 2012;**14**: 351–357.

w326. Tse HF, Yu C, Wong KK, Tsang V, Leung YL, Ho WY, Lau CP. Functional abnormalities in patients with permanent right ventricular pacing: the effect of sites of electrical stimulation. *J Am Coll Cardiol* 2002;**40**:1451–1458.

w327. Habib G, Hoen B, Tornos P, Thuny F, Prendergast B, Vilacosta I, Moreillon P, de Jesus Antunes M, Thilen U, Lekakis J, Lengyel M, Muller L, Naber CK, Nihoyannopoulos P, Moritz A, Zamorano JL. Guidelines on the prevention, diagnosis, and treatment of infective endocarditis (new version 2009): the Task Force on the Prevention, Diagnosis, and Treatment of Infective Endocarditis of the European Society of Cardiology (ESC). Endorsed by the European Society of Clinical Microbiology and Infectious Diseases (ESCMID) and the International Society of Chemotherapy (ISC) for Infection and Cancer. *Eur Heart J* 2009;**30**: 2369–2413.

w328. Baddour LM, Epstein AE, Erickson CC, Knight BP, Levison ME, Lockhart PB, Masoudi FA, Okum EJ, Wilson WR, Beerman LB, Bolger AF, Estes NA 3rd, Gewitz M, Newburger JW, Schron EB, Taubert KA. Update on cardiovascular implantable electronic device infections and their management: a scientific statement from the American Heart Association. *Circulation* 2010;**121**:458–477.

w329. Wilkoff BL, Love CJ, Byrd CL, Bongiorni MG, Carrillo RG, Crossley GH 3rd, Epstein LM, Friedman RA, Kennergren CE, Mitkowski P, Schaerf RH, Wazni OM. Transvenous lead extraction: Heart Rhythm Society expert consensus on facilities, training, indications, and patient management: this document was endorsed by the American Heart Association (AHA). *Heart Rhythm* 2009;**6**: 1085–1104.

w330. Marijon E, De Guillebon M, Bordachar P, Jacob S, Vahdat O, Sidobre L, Deplagne A, Combes N, Albenque JP, Clementy J, Haissaguerre M, Ritter P, Boveda S. Safety of deferring the reimplantation of pacing systems after their removal for infectious complications in selected patients: a 1-year follow-up study. *J Cardiovasc Electrophysiol* 2010;**21**:540–544.

w331. Sohail MR, Uslan DZ, Khan AH, Friedman PA, Hayes DL, Wilson WR, Steckelberg JM, Stoner S, Baddour LM. Management and outcome of permanent pacemaker and implantable cardioverter-defibrillator infections. *J Am Coll Cardiol* 2007;**49**:1851–1859.

w332. Tarakji KG, Chan EJ, Cantillon DJ, Doonan AL, Hu T, Schmitt S, Fraser TG, Kim A, Gordon SM, Wilkoff BL. Cardiac implantable electronic device infections: presentation, management, and patient outcomes. *Heart Rhythm* 2010;**7**:1043–1047.

w333. Pichlmaier M, Knigina L, Kutschka I, Bara C, Oswald H, Klein G, Bisdas T, Haverich A. Complete removal as a routine treatment for any cardiovascular implantable electronic device-associated infection. *J Thorac Cardiovasc Surg* 2011;**142**:1482–1490.

w334. Kalin R, Stanton MS. Current clinical issues for MRI scanning of pacemaker and defibrillator patients. *Pacing Clin Electrophysiol* 2005;**28**:326–328.

w335. Levine GN, Gomes AS, Arai AE, Bluemke DA, Flamm SD, Kanal E, Manning WJ, Martin ET, Smith JM, Wilke N, Shellock FS. Safety of magnetic resonance imaging in patients with cardiovascular devices: an American Heart Association scientific statement from the Committee on Diagnostic and Interventional Cardiac Catheterization, Council on Clinical Cardiology, and the Council on Cardiovascular Radiology and Intervention: endorsed by the American College of Cardiology Foundation, the North American Society for Cardiac Imaging, and the Society for Cardiovascular Magnetic Resonance. *Circulation* 2007;**116**:2878–2891.

w336. Irnich W. Risks to pacemaker patients undergoing magnetic resonance imaging examinations. *Europace* 2010;**12**:918–920.

w337. Sommer T, Vahlhaus C, Lauck G, von Smekal A, Reinke M, Hofer U, Block W, Traber F, Schneider C, Gieseke J, Jung W, Schild H. MR imaging and cardiac pacemakers: in-vitro evaluation and in-vivo studies in 51 patients at 0.5 T. *Radiology* 2000;**215**:869–879.

w338. Vahlhaus C, Sommer T, Lewalter T, Schimpf R, Schumacher B, Jung W, Luderitz B. Interference with cardiac pacemakers by magnetic resonance imaging: are there irreversible changes at 0.5 Tesla? *Pacing Clin Electrophysiol* 2001;**24**:489–495.

w339. Faris OP, Shein M. Food and Drug Administration perspective: Magnetic resonance imaging of pacemaker and implantable cardioverter-defibrillator patients. *Circulation* 2006;**114**:1232–1233.

w340. Faris OP, Shein MJ. Government viewpoint: U.S. Food & Drug Administration: Pacemakers, ICDs and MRI. *Pacing Clin Electrophysiol* 2005;**28**:268–269.

w341. Levine PA. Industry viewpoint: St. Jude Medical: Pacemakers, ICDs and MRI. *Pacing Clin Electrophysiol* 2005;**28**:266–267.

w342. Smith JM. Industry viewpoint: Guidant: Pacemakers, ICDs, and MRI. *Pacing Clin Electrophysiol* 2005;**28**:264.

w343. Stanton MS. Industry viewpoint: Medtronic: Pacemakers, ICDs, and MRI. *Pacing Clin Electrophysiol* 2005;**28**:265.

w344. Austin JL, Preis LK, Crampton RS, Beller GA, Martin RP. Analysis of pacemaker malfunction and complications of temporary pacing in the coronary care unit. *Am J Cardiol* 1982;**49**:301–306.

w345. Hildick-Smith DJ, Petch MC. Temporary pacing before permanent pacing should be avoided unless essential. *BMJ* 1998;**317**:79–80.

w346. Hill PE. Complications of permanent transvenous cardiac pacing: a 14-year review of all transvenous pacemakers inserted at one community hospital. *Pacing Clin Electrophysiol* 1987;**10**:564–570.

w347. McLeod AA, Jokhi PP. Pacemaker induced ventricular fibrillation in coronary care units. *BMJ* 2004;**328**:1249–1250.

w348. Murphy JJ. Current practice and complications of temporary transvenous cardiac pacing. *BMJ* 1996;**312**:1134.

w349. Nolewajka AJ, Goddard MD, Brown TC. Temporary transvenous pacing and femoral vein thrombosis. *Circulation* 1980;**62**:646–650.

w350. Reddy SC, Saxena A, Iyer KS. Inadvertent but asymptomatic right atrial perforation with epicardial pacing in a neonate: a rare complication of temporary transvenous cardiac pacing. *Pacing Clin Electrophysiol* 1997;**20**:368–369.

w351. Rubenfire M, Melean J, Conrad E. Pseudoarrhythmia caused by temporary transvenous pacemaker. *JAMA* 1976;**235**:842–844.

w352. Camm AJ, Lip GY, De Caterina R, Savelieva I, Atar D, Hohnloser SH, Hindricks G, Kirchhof P, Bax JJ, Baumgartner H, Ceconi C, Dean V, Deaton C, Fagard R, Funck-Brentano C, Hasdai D, Hoes A, Knuuti J, Kolh P, McDonagh T, Moulin C, Popescu BA, Reiner Z, Sechtem U, Sirnes PA, Tendera M, Torbicki A, Vahanian A, Windecker S, Vardas P, Al-Attar N, Alfieri O, Angelini A, Blomstrom-Lundqvist C, Colonna P, De Sutter J, Ernst S, Goette A, Gorenek B, Hatala R, Heidbuchel H, Heldal M, Kristensen SD, Le Heuzey JY, Mavrakis H, Mont L, Filardi PP, Ponikowski P, Prendergast B, Rutten FH, Schotten U, Van Gelder IC, Verheugt FW. 2012 focused update of the ESC Guidelines for the management of atrial fibrillation: an update of the 2010 ESC Guidelines for the management of atrial fibrillation. Developed with the special contribution of the European Heart Rhythm Association. *Eur Heart J* 2012;**33**: 2719–2747.

w353. Kirchhof P, Lip GY, Van Gelder IC, Bax J, Hylek E, Kaab S, Schotten U, Wegscheider K, Boriani G, Ezekowitz M, Diener H, Heidbuchel H, Lane D, Mont L, Willems S, Dorian P, Vardas P, Breithardt G, Camm AJ. Comprehensive risk reduction in patients with atrial fibrillation: Emerging diagnostic and therapeutic options. Executive summary of the report from the 3rd AFNET/EHRA consensus conference. *Thromb Haemost* 2011;**106**:1012–1019.

w354. Zareba W, Klein H, Cygankiewicz I, Hall WJ, McNitt S, Brown M, Cannom D, Daubert JP, Eldar M, Gold MR, Goldberger JJ, Goldenberg I, Lichstein E, Pitschner H, Rashtian M, Solomon S, Viskin S, Wang P, Moss AJ. Effectiveness of Cardiac Resynchronization Therapy by QRS Morphology in the Multicenter Automatic Defibrillator Implantation Trial-Cardiac Resynchronization Therapy (MADIT-CRT). *Circulation* 2011;**123**:1061–1072.

w355. Bogale N, Witte K, Priori S, Cleland J, Auricchio A, Gadler F, Gitt A, Limbourg T, Linde C, Dickstein K. The European Cardiac Resynchronization Therapy Survey: comparison of outcomes between de novo cardiac resynchronization therapy implantations and upgrades. *Eur J Heart Fail* 2011;**13**:974–983.

w356. Ellenbogen KA, Gold MR, Meyer TE, Fernndez Lozano I, Mittal S, Waggoner AD, Lemke B, Singh JP, Spinale FG, Van Eyk JE, Whitehill J, Weiner S, Bedi M, Rapkin J, Stein KM. Primary results from the SmartDelay determined AV optimization: a comparison to other AV delay methods used in cardiac resynchronization therapy (SMART-AV) trial: a randomized trial comparing empirical, echocardiography-guided, and algorithmic atrioventricular delay programming in cardiac resynchronization therapy. *Circulation* 2010;**122**:2660–2668.

w357. Leon AR, Abraham WT, Brozena S, Daubert JP, Fisher WG, Gurley JC, Liang CS, Wong G. Cardiac resynchronization with sequential biventricular pacing for the treatment of moderate-to-severe heart failure. *J Am Coll Cardiol* 2005;**46**: 2298–2304.

w358. Boriani G, Muller CP, Seidl KH, Grove R, Vogt J, Danschel W, Schuchert A, Djiane P, Biffi M, Becker T, Bailleul C, Trappe HJ. Randomized comparison of simultaneous biventricular stimulation versus optimized interventricular delay in cardiac resynchronization therapy. The Resynchronization for the HemodYnamic Treatment for Heart Failure Management II implantable cardioverter defibrillator (RHYTHM II ICD) study. *Am Heart J* 2006;**151**:1050–1058.

w359. Rao RK, Kumar UN, Schafer J, Viloria E, De Lurgio D, Foster E. Reduced ventricular volumes and improved systolic function with cardiac resynchronization therapy: a randomized trial comparing simultaneous biventricular pacing, sequential biventricular pacing, and left ventricular pacing. *Circulation* 2007;**115**: 2136–2144.

w360. Abraham WT, Calò L, Islam N, Klein N, Alawwa A, Exner D, Goodman J, Messano L, Clyne C, Pelargonio G, Hasan A, Seidl K, Sheppard R, Yu CM, Herre J, Lee LY, Boulogne E, Petrutiu S, Birgersdotter-Green U, Gras D. Randomized controlled trial of frequent optimization of cardiac resynchronization

therapy: results of the Frequent Optimization Study Using the QuickOpt™ Method (FREEDOM) Trial. *(in press)*.

w361. Ritter P, Delnoy PP, Padeletti L, Lunati M, Naegele H, Borri-Brunetto A, Silvestre J. A randomized pilot study of optimization of cardiac resynchronization therapy in sinus rhythm patients using a peak endocardial acceleration sensor vs. standard methods. *Europace* 2012;**14**:1324–1333.

w362. Martin DO, Lemke B, Birnie D, Krum H, Lee KL, Aonuma K, Gasparini M, Starling RC, Milasinovic G, Rogers T, Sambelashvili A, Gorcsan J 3rd, Houmsse M. Investigation of a novel algorithm for synchronized left-ventricular pacing and ambulatory optimization of cardiac resynchronization therapy: results of the adaptive CRT trial. *Heart Rhythm* 2012;**9**: 1807–1814.

w363. Abraham WT, Leon AR, St John Sutton MG, Keteyian SJ, Fieberg AM, Chinchoy E, Haas G. Randomized controlled trial comparing simultaneous versus optimized sequential interventricular stimulation during cardiac resynchronization therapy. *Am Heart J* 2012;**164**:735–741.