Should we interrupt DOA before implanting pacemaker, ICD, Loop recorder?

Walid Amara, MD

Groupe Hospitalier Intercommunal
Le Raincy-Montfermeil

Groupement Hospitalier de Territoire
Grand Paris Nord-Est
Aulnay-sous-Bois - Le Raincy-Montfermeil - Montreuil

Disclosures

- Consulting and Speaker’s fees from Bayer, BMS, Pfizer, Boehringer Ingelheim, Biotronik, Medtronic, Boston Scientific, Saint Jude Medical, Sorin Group, MEDA, Novartis, Servier

Background

- Oral anticoagulant use is common among patients requiring pacemaker or defibrillator surgery.
- BRUISE CONTROL trial demonstrated 80% fewer device pocket hematomas when surgery was performed without interruption of warfarin.[1]

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Pacemaker or Defibrillator Surgery without Interruption of Anticoagulation

David H. Birnie, M.D., Jeff S. Healey, M.D., George A. Wells, Ph.D., Atul Verma, M.D., Anthony S. Tang, M.D., Andrew D. Krahn, M.D., Christopher S. Simpson, M.D., Felix Ayala-Paredes, M.D., Benoit Coutu, M.D., Tiago L.L. Leiria, M.D., and Vidal Essebag, M.D., Ph.D., for the BRUISE CONTROL Investigators*

Table 3. Primary and Secondary Outcomes.*

Outcome	Heparin Bridging (N=338)	Continued Warfarin (N=343)	Relative Risk (95% CI)	P Value
Primary outcome				
Clinically significant hematoma — no. (%)	54 (16.0)	12 (3.5)	0.19 (0.10–0.36)	<0.001
Components of primary outcome				
Hematoma prolonging hospitalization — no. (%)	16 (4.7)	4 (1.2)	0.24 (0.08–0.72)	0.006
Hematoma requiring interruption of anticoagulation — no. (%)	48 (14.2)	11 (3.2)	0.20 (0.10–0.39)	<0.001
Hematoma requiring evacuation — no. (%)	9 (2.7)	2 (0.6)	0.21 (0.05–1.00)	0.03

- However, since the publication of BRUISE CONTROL the use of direct oral anticoagulants (DOACs) has grown substantially and they are now used in the majority of patients with AF

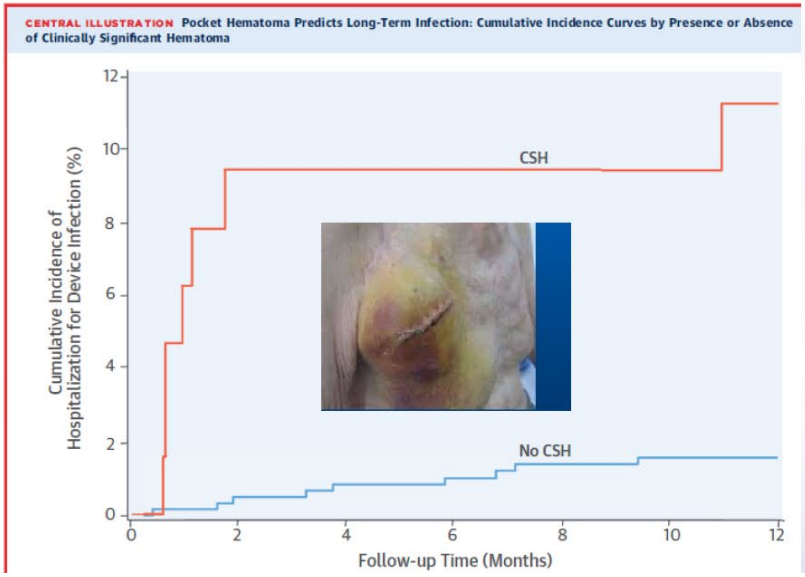
BRUISE CONTROL 2

HEART & STROKE FOUNDATION

Background – balancing risks of thrombo-embolism and perioperative bleeding

- Experience from the major DOAC clinical trials found that brief, temporary interruptions for procedures or surgery are associated with approximately 3-fold increase in stroke embolism.[2,3]

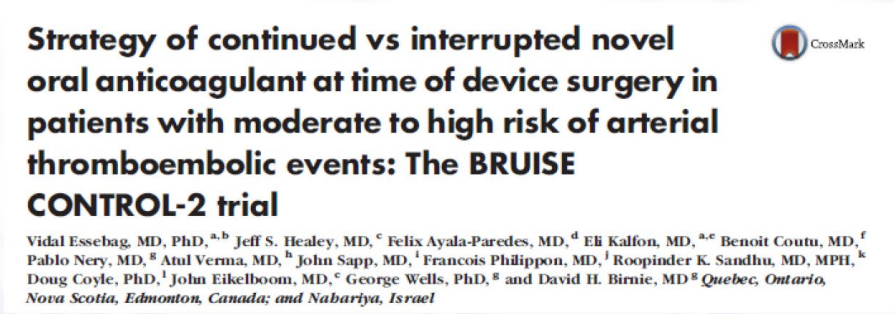
- On the other hand, device pocket hematomas may have very significant sequelae for patients.
- They can necessitate prolonged cessation of anticoagulation which increases the risk of thromboembolism
- Very importantly they are associated with a markedly increased risk of serious device system infection.[4]



2. Healey J et al Circulation 2012;126:343-8.
3. Patel MR et al J Am Coll Cardiol 2013;61:651-8.
4. Essebag V et al J Am Coll Cardiol 2016; 67:1300-8.

BRUISE CONTROL-2

- Multicenter single-blind randomized controlled trial
- In brief, patients treated with dabigatran or rivaroxaban or apixaban and with a CHA_2DS_2-VASc score ≥2, were randomized to continued or interrupted DOAC.[5]



Strategy of continued vs interrupted novel oral anticoagulant at time of device surgery in patients with moderate to high risk of arterial thromboembolic events: The BRUISE CONTROL-2 trial

Vidal Essebag, MD, PhD,[a,b] Jeff S. Healey, MD,[c] Felix Ayala-Paredes, MD,[d] Eli Kalfon, MD,[a,e] Benoit Coutu, MD,[f] Pablo Nery, MD,[g] Atul Verma, MD,[h] John Sapp, MD,[i] Francois Philippon, MD,[j] Roopinder K. Sandhu, MD, MPH,[k] Doug Coyle, PhD,[i] John Eikelboom, MD,[c] George Wells, PhD,[g] and David H. Birnie, MD[g] *Quebec, Ontario, Nova Scotia, Edmonton, Canada; and Nahariya, Israel*

- **Continued DOAC**
  - Patients continued their DOAC throughout the surgical period, and took their morning dose prior to surgery.
- **Interrupted DOAC**
  - Patients on rivaroxaban or apixaban discontinued drug after taking their last dose 2 days before surgery.
  - Patients on dabigatran discontinued drug at a time interval dependent on their glomerular filtration rate.
  - All 3 drugs were resumed at the next regular dose timing ≥ 24 hours after end of surgery.

Methods - Primary Outcome and Blinding

- The primary outcome was clinically significant hematoma (same definition as in BRUISE CONTROL) defined as a hematoma:
  - requiring re-operation and/or
  - resulting in prolongation of hospitalization and/or
  - requiring interruption of all anticoagulation for > 24 hours
- To permit investigator blinding, each center was required to identify two patient-care teams.
- The unblinded team had knowledge of treatment allocation and was responsible for device implantation and follow-up of only
- The blinded team had no knowledge of treatment allocation and was responsible for diagnosing, following, and making decisions about hematomas.

Results - Baseline Characteristics

Characteristic	Continued DOAC (N=328)	Interrupted DOAC (N=334)
Age – yr	74.1±8.9	73.4±8.9
Male sex – no. (%)	245 (74.7)	234 (70.1)
Body – mass index*	28.5±5.3	28.9± 5.4
Medical history – no. (%)		
Stroke	35 (10.7)	33 (9.9)
Transient ischemic attack	24 (7.3)	27 (8.1)
Peripheral embolus	8 (2.4)	8 (2.4)
Hypertension	245 (74.7)	249 (74.6)
Diabetes mellitus	103 (31.4)	119 (35.6)
Cardiomyopathy	170 (51.8)	161 (48.2)
Prior myocardial infarction	110 (33.5)	109 (32.6)
eGFR (ml/minute)	67.6±19.4	68.6±21.7
CHA_2DS_2-VASc score†	3.9±1.4	3.9±1.3
Direct oral anti-coagulant – no. (%)		
Dabigatran 110 mg twice daily**	62 (18.9)	61 (18.3)
Dabigatran 150 mg twice daily	34 (10.4)	46 (13.8)
Rivaroxaban 15mg once daily	28 (8.5)	27 (8.1)
Rivaroxaban 20 mg once daily	78 (23.8)	79 (23.7)
Apixaban 2.5mg twice daily	35 (10.7)	26 (7.8)
Apixaban 5mg twice daily	90 (27.4)	95 (28.4)

Results - Operative Details

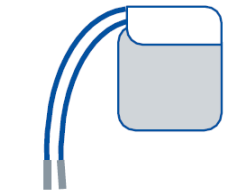
	Continued DOAC (N=319)	Interrupted DOAC (N=328)
New implant of a pacemaker – no.(%)		
Single	43 (25.2)	55 (31.1)
Dual	61 (35.7)	48 (27.1)
Cardiac resynchronization	7 (4.1)	12 (6.8)
New implant of a implantable cardioverter-defibrillator – no.(%)		
Single	30 (17.5)	27 (15.3)
Dual	17 (9.9)	20 (11.3)
Cardiac resynchronization	13 (7.6)	15 (8.5)
Device replacement or revision – no. (%)		
Pulse generator change only	113 (76.4)	116 (76.8)
Pulse generator change with additional *	29 (19.6)	32 (21.2)
Other	6 (4.1)	3 (2.0)
Details of surgery		
Duration of procedure - min		
median	39	38
Interquartile range	25-57	22 - 60
Venous-access guidance – no.(%)		
Peripheral venogram	69 (35.9)	77 (38.3)
Ultrasonography	7 (3.7)	10 (5.0)
Intrapocket administration of prohemostatic agent - no. (%)	21 (6.6)	10 (3.1)
Pressure dressing applied postoperatively – no.(%)	217 (68.0)	197 (60.1)
Sandbag applied postoperatively – no.(%)	17 (5.3)	18 (5.5)
Defibrillator threshold testing performed – no.(%)	12 (3.8)	13 (4.0)
Cardioversion performed – no.(%)	6 (1.9)	2 (0.6)
Specialty of physician performing surgery – no. (%)		
Electrophysiologist	296 (92.8)	312 (95.1)
Surgeon	17 (5.3)	12 (3.7)
Cardiologist	6 (1.9)	4 (1.2)
Fellow/Resident participation in the procedure – no.(%)	146 (45.8)	165 (50.3)

Main Results

	Continued DOAC (N =328)	Interrupted DOAC (N=334)	P Value
Primary Outcome			
Clinically significant hematoma– no. (%)	7 (2.1)	7 (2.1)	0.973
Components of the Primary Outcome			
Hematoma prolonged hospitalization – no. (%)	1 (0.3)	2 (0.6)	1.000
Hematoma requiring interruption of anti-coagulation – no. (%)	7 (2.1)	7 (2.1)	0.973
Hematoma requiring re-operation – no. (%)	2 (0.6)	1 (0.3)	0.621

	Continued DOAC (N =328)	Interrupted DOAC (N=334)	P Value
Secondary Outcomes			
Non - clinically significant hematoma no. (%)	11 (3.4)	10 (3.0)	0.792
Any hematoma no. (%)	18 (5.5)	16 (4.8)	0.684
All-cause mortality – no. (%)	2 (0.6)	1 (0.3)	0.621
Pneumothorax – no. (%)	2 (0.6)	0	0.245
Hemothorax – no. (%)	0	0	-
Cardiac tamponade – no. (%)	1 (0.3)	1 (0.3)	1.000
Stroke – no. (%)	1 (0.3)	1 (0.3)	1.000

BRUISE CONTROL-2: NOAC treatment does not need to be interrupted during device implantation



Patients with AF and planned pacemaker or defibrillator surgery

Uninterrupted NOAC (n=319) → 2.1%

Interrupted NOAC (n=328) → 2.1%

Similarly low rates of device pocket hematoma (primary endpoint) in both arms

- No major perioperative bleeding events were observed in the uninterrupted NOAC group
- The authors note that certain scenarios favor uninterrupted NOAC treatment:
  - If harm may be caused in the period of waiting for anticoagulation to dissipate (e.g. complete heart block)
  - High stroke risk
  - High CHA_2DS_2-VASc score

Baseline NOAC use in the uninterrupted NOAC arm: dabigatran 150 mg BID, 10.4%; dabigatran 110 mg BID, 18.9%; rivaroxaban 20 mg OD, 23.8%; rivaroxaban 15 mg OD, 8.5%; apixaban 5 mg BID, 27.4%; apixaban 2.5 mg BID, 10.7%

Birnie et al. Eur Heart J 2018;39:3973

Europace (2017) **19**, 1002–1006
doi:10.1093/europace/euw116

Wound haematoma following defibrillator implantation: incidence and predictors in the Shockless Implant Evaluation (SIMPLE) trial

Simona Masiero[1,2]*, Stuart J. Connolly[1], David Birnie[3], Jörg Neuzner[4], Stefan H. Hohnloser[5], Xavier Vinolas[6], Josef Kautzner[7], Gilles O'Hara[8], Lieselot VanErven[9], Fredrik Gadler[10], Jia Wang[1], Philippe Mabo[11], Michael Glikson[12], Valentina Kutyifa[13], David J. Wright[14], Vidal Essebag[15], and Jeff S. Healey[1], on behalf of the SIMPLE Investigators

Table 2 Clinical predictors for significant pocket haematoma using multivariable logistic regression analysis

Variables	Logistic regression	
	Odds ratio (95% CI)	*P*-value
Heparin bridging[a]	2.65 (1.48–4.73)	0.001
Upgrade from permanent pacemaker	2.52 (1.07–5.94)	0.035
Previous stroke	2.47 (1.20–5.10)	0.015
ICD implant site (sub-pectoral vs. sub-cutaneous)	2.00 (1.12–3.57)	0.020
Age (year)	1.03 (1.00–1.06)	0.049
Peri-operative OAC	1.61 (0.92–2.84)	0.096
Impaired renal function	1.21 (0.66–2.22)	0.548

[a]Unfractionated/low-molecular-weight heparin bridging.

Received: 22 October 2016 | Accepted: 19 April 2017

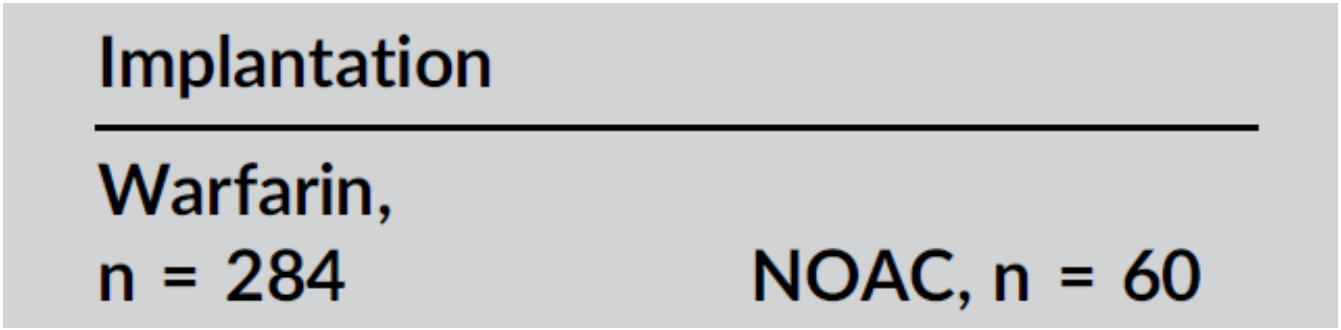
DOI: 10.1002/clc.22726

WILEY CLINICAL CARDIOLOGY

CLINICAL INVESTIGATIONS

Oral anticoagulation management in patients with atrial fibrillation undergoing cardiac implantable electronic device implantation

Eric Black-Maier[1] | Sunghee Kim[2] | Benjamin A. Steinberg[1,2] | Gregg C. Fonarow[3] | James V. Freeman[4] | Peter R. Kowey[5] | Jack Ansell[6] | Bernard J. Gersh[7] | Kenneth W. Mahaffey[8] | Gerald Naccarelli[9] | Elaine M. Hylek[10] | Alan S. Go[11] | Eric D. Peterson[1,2] | Jonathan P. Piccini[1,2] | for the Outcomes Registry for Better Informed Treatment of Atrial Fibrillation (ORBIT-AF) Investigators



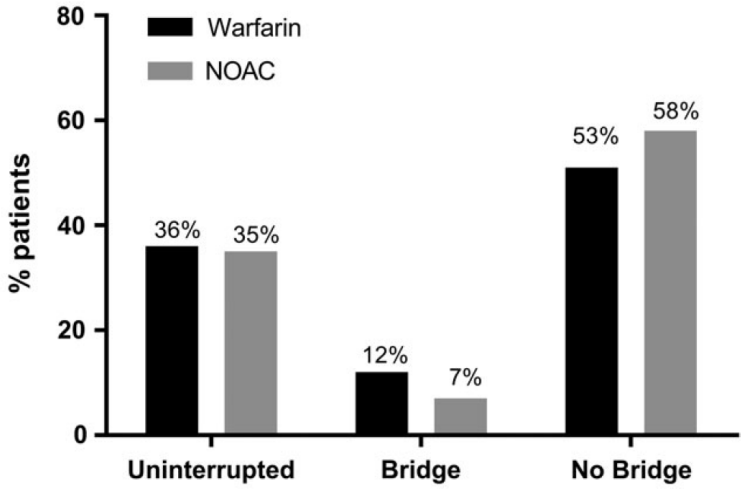


TABLE 2 Unadjusted outcomes 30 days after cardiac implantable electronic device implantation by oral anticoagulation strategy

	Warfarin				NOAC			
			Interrupted				Interrupted	
	Overall	Uninterrupted	Bridging	No Bridging	Overall	Uninterrupted	Bridging	No Bridging
No.	284	101	33	150	60	21	4	35
Major bleeding	1 (0.4%)	0 (0%)	1 (3.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Stroke/TIA	3 (1.1%)	1 (1.0%)	1 (3.0%)	1 (0.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
All-cause hospitalization	18 (6.3%)	4 (4.0%)	4 (12.1%)	10 (6.7%)	3 (5.0%)	1 (4.7%)	1 (25.0%)	1 (2.9%)
Cardiovascular hospitalization	12 (4.2%)	2 (2.0%)	3 (9.1%)	7 (4.7%)	1 (1.6%)	0 (0.0%)	0 (0.0%)	1 (2.9%)
Bleeding hospitalization	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (1.6%)	0 (0.0%)	0 (0.0%)	1 (2.9%)

Abbreviations: NOAC, non–vitamin K antagonist oral anticoagulants; TIA, transient ischemic attack.

Values are reported as number with percentage of total patients experiencing adverse event in parenthesis.

ESC European Society of Cardiology
Europace (2017) **19**, 1630–1636
doi:10.1093/europace/euw409

Short-term dabigatran interruption before cardiac rhythm device implantation: multi-centre experience from the RE-LY trial

Vidal Essebag[1,2]*, Riccardo Proietti[3,4], David H. Birnie[5], Jia Wang[6], James Douketis[7], Benoit Coutu[8], Ratika Parkash[9], Gregory Y. H. Lip[10], Stefan H. Hohnloser[11], Andrew Moriarty[12], Jonas Oldgren[13], Stuart J. Connolly[6], Michael Ezekowitz[14], and Jeff S. Healey[6]

Table 2 Outcomes within 30 days of CIED surgery in dabigatran vs. warfarin groups

	Dabigatran 110 mg		Dabigatran 150 mg		Dabigatran (both doses)		Warfarin		Dabigatran vs. warfarin[a]		
	N = 216		*N* = 194		*N* = 410		*N* = 201				
Event	***N***	**%**	***N***	**%**	***N***	**%**	***N***	**%**	**RD (%)**	**95% CI**	***P***
Bleeding events											
Minor bleeding	7	3.24	7	3.61	14	3.41	10	4.98	-1.56	-5.83 to 1.70	0.408
Major bleeding	2	0.93	2	1.03	4	0.98	2	1.00	-0.02	-2.77 to 1.73	>0.999
Fatal bleeding	0	0.00	0	0.00	0	0.00	0	0.00	–	–	–
Pocket hematoma	5	2.31	4	2.06	9	2.20	8	3.98	-1.78	-5.69 to 1.08	0.218
Requiring red blood cell transfusion	1	0.46	1	0.52	2	0.49	4	1.99	-1.50	-4.63 to 0.33	0.085
Thrombotic events											
Cardiovascular death[b]	1	0.46	1	0.52	2	0.49	0	0.00	0.49	-1.50 to 1.82	0.408
Stroke	0	0.00	1	0.52	1	0.24	1	0.50	-0.25	-2.63 to 1.04	0.735
Systemic embolism	0	0.00	0	0.00	0	0.00	0	0.00	–	–	–
Ischemic stroke or systemic embolism	0	0.00	1	0.52	1	0.24	1	0.50	-0.25	-2.63 to 1.04	0.735
Myocardial infarction	0	0.00	1	0.52	1	0.24	0	0.00	0.24	-1.73 to 1.43	0.599
Pulmonary embolism	0	0.00	0	0.00	0	0.00	0	0.00	–	–	–
Cardiovascular death, ischemic stroke, systemic or pulmonary embolism	1	0.46	2	1.03	3	0.73	1	0.50	0.23	-2.15 to 1.77	0.829

[a]RD comparing dabigatran (both doses) vs. warfarin. Separate analyses comparing each group of dabigatran dose (110mg and 150mg) according to treatment allocation vs. warfarin yielded all *P*-values non-significant.
[b]Cardiovascular deaths included one death due to heart failure and another death post-myocardial infarction.

ESC European Society of Cardiology
Europace (2017) **19**, 1630–1636
doi:10.1093/europace/euw409

Short-term dabigatran interruption before cardiac rhythm device implantation: multi-centre experience from the RE-LY trial

Vidal Essebag[1,2]*, Riccardo Proietti[3,4], David H. Birnie[5], Jia Wang[6], James Douketis[7], Benoit Coutu[8], Ratika Parkash[9], Gregory Y. H. Lip[10], Stefan H. Hohnloser[11], Andrew Moriarty[12], Jonas Oldgren[13], Stuart J. Connolly[6], Michael Ezekowitz[14], and Jeff S. Healey[6]

Table 4 Outcomes within 30 days of CIED surgery in dabigatran vs. warfarin groups according to use of heparin bridging

	Dabigatran (both doses)		Warfarin with bridging		Warfarin without bridging		Dabigatran vs. Warfarin with bridging			Dabigatran vs. Warfarin w/o bridging		
	N = 410		*N* = 37		*N* = 164							
Event	*N*	%	*N*	%	*N*	%	RD (%)	95% CI	*P*	RD (%)	95% CI	*P*
Bleeding events												
Minor bleeding	14	3.41	4	10.81	6	3.66	-7.40	-22.89 to 0.78	0.040	-0.24	-4.69 to 2.87	0.961
Major bleeding	4	0.98	1	2.70	1	0.61	-1.73	-14.68 to 1.40	0.417	0.37	-2.61 to 2.06	0.756
Fatal bleeding	0	0.00	0	0.00	0	0.00	–	–	–	–	–	–
Pocket hematoma	9	2.20	4	10.81	4	2.44	-8.62	-24.15 to - 0.51	0.034	-0.24	-4.20 to 2.33	0.880
Requiring RBC transfusion	2	0.49	2	5.41	2	1.22	-4.92	-18.86 to 0.08	0.034	-0.73	-4.02 to 0.90	0.385
Thrombotic events												
Cardiovascular death	2	0.49	0	0.00	0	0.00	0.49	-10.79 to 2.11	0.938	0.49	-1.96 to 1.85	0.462
Stroke	1	0.24	0	0.00	1	0.61	0.24	-11.06 to 1.80	0.983	-0.37	-3.30 to 0.96	0.562
Systemic embolism	0	0.00	0	0.00	0	0.00	–	–	–	–	–	–
Ischemic stroke or systemic embolism	1	0.24	0	0.00	1	0.61	0.24	-11.06 to 1.80	0.983	-0.37	-3.30 to 0.96	0.562
Myocardial infarction	1	0.24	0	0.00	0	0.00	0.24	-11.06 to 1.80	0.983	0.24	-2.19 to 1.43	0.719
Pulmonary embolism	0	0.00	0	0.00	0	0.00	–	–	–	–	–	–
Cardiovascular death, ischemic stroke, systemic or pulmonary embolism	3	0.73	0	0.00	1	0.61	0.73	-10.53 to 2.56	0.854	0.12	-2.84 to 1.73	0.961

George C. Leef, MD; Anne S. Hellkamp, MS; Manesh R. Patel, MD; Richard C. Becker, MD; Scott D. Berkowitz, MD; Günter Breithardt, MD; Jonathan L. Halperin, MD; Graeme J. Hankey, MD; Werner Hacke, MD, PhD; Christopher C. Nessel, MD; Daniel E. Singer, MD; Keith A.A. Fox, MB, ChB; Kenneth W. Mahaffey, MD; Jonathan P. Piccini, MD, MHS

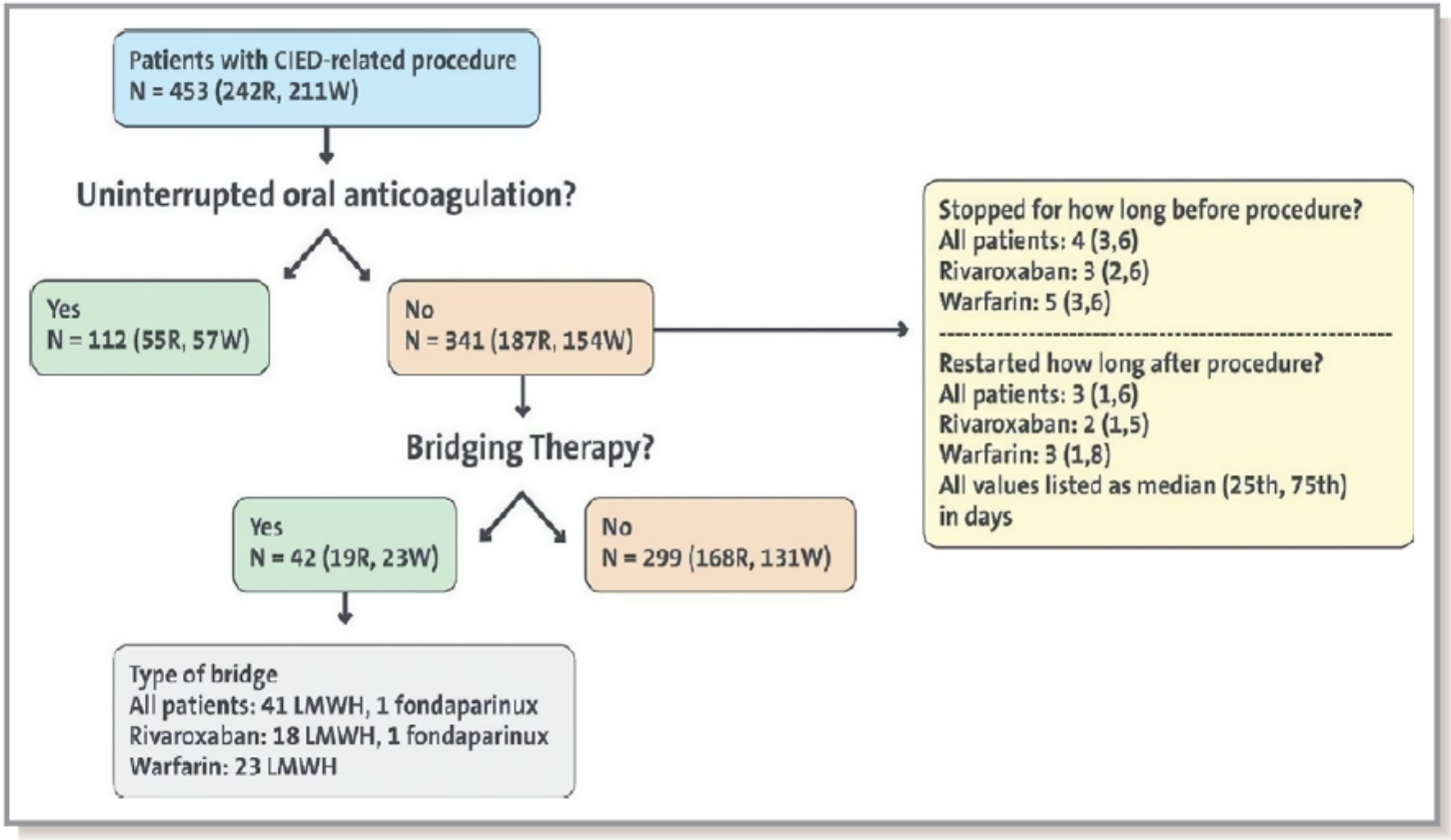


Figure 2. Study drug interruption and bridging therapy at the time of CIED-related procedure. CIED indicates cardiac implantable electronic devices; LMWH, low-molecular-weight heparin; R, rivaroxaban; W, warfarin.

Safety and Efficacy of Rivaroxaban in Patients With Cardiac Implantable Electronic Devices: Observations From the ROCKET AF Trial

George C. Leef, MD; Anne S. Hellkamp, MS; Manesh R. Patel, MD; Richard C. Becker, MD; Scott D. Berkowitz, MD; Günter Breithardt, MD; Jonathan L. Halperin, MD; Graeme J. Hankey, MD; Werner Hacke, MD, PhD; Christopher C. Nessel, MD; Daniel E. Singer, MD; Keith A.A. Fox, MB, ChB; Kenneth W. Mahaffey, MD; Jonathan P. Piccini, MD, MHS

	All Patients	Rivaroxaban	Warfarin
Efficacy end points			
N	450*	239	211
Stroke/systemic embolism	4 (0.89%)	3 (1.26%)	1 (0.48%)
Stroke/systemic embolism/vascular death/MI	7 (1.56%)	3 (1.26%)	4 (1.90%)
All-cause death	2 (0.44%)	1 (0.42%)	1 (0.47%)
Vascular death	1 (0.22%)	0 (0)	1 (0.47%)
Safety end points			
N	453	242	211
Major or NMCR bleeding	26 (5.75%)	11 (4.55%)	15 (7.13%)
Major bleeding	5 (1.11%)	3 (1.24%)	2 (0.95%)
NMCR bleeding	21 (4.64%)	8 (3.31%)	13 (6.18%)
Transfusion	2 (0.44%)	1 (0.41%)	1 (0.47%)
Hematoma at surgical site†	7 (1.56%)	1 (0.41%)	6 (2.86%)
Infection at surgical site	4 (0.90%)	3 (1.26%)	1 (0.49%)

Thirty-day Kaplan–Meier rates are shown, with total number of events. CIED indicates cardiac implantable electronic device; MI, myocardial infarction; NMCR, nonmajor clinically relevant.

*Efficacy events were excluded for patients from a single good clinical practice-violating site, so the N for efficacy end points is slightly smaller than the N for safety end points.

†Six of the 7 hematomas (the 1 in rivaroxaban patients and 5 of the 6 in warfarin patients) were adjudicated as NMCR.

	On Study Drug	Off Study Drug	Bridging Therapy	No Bridging Therapy
Efficacy end points				
N	112	338	42	296
Stroke/systemic embolism	2 (1.79%)	2 (0.59%)	0 (0)	2 (0.68%)
Stroke/systemic embolism/vascular death/MI	3 (2.68%)	4 (1.18%)	0 (0)	4 (1.35%)
All-cause death	1 (0.89%)	1 (0.30%)	1 (2.38%)	0 (0)
Vascular death	1 (0.89%)	0 (0)	0 (0)	0 (0)
Safety end points				
N	112	341	42	299
Major or NMCR bleeding	7 (6.28%)	19 (5.57%)	2 (4.82%)	17 (5.69%)
Major bleeding	1 (0.90%)	4 (1.17%)	0 (0)	4 (1.34%)
NMCR bleeding	6 (5.38%)	15 (4.40%)	2 (4.82%)	13 (4.35%)
Transfusion	1 (0.90%)	1 (0.29%)	0 (0)	1 (0.33%)
Hematoma at surgical site	3 (2.74%)	4 (1.18%)	0 (0)	4 (1.34%)
Infection at surgical site	1 (0.92%)	3 (0.89%)	0 (0)	3 (1.02%)

Thirty-day Kaplan–Meier rates are shown, with total number of events. CIED indicates cardiac implantable electronic device; MI, myocardial infarction; NMCR, nonmajor clinically relevant.

Real-world evidence of pacemaker and ICD implantation in patients taking Apixaban: The French AMPER-AF implantation study

W. AMARA[1] ; R. GARCIA[2]; J. MANSOURATI [3]; J.TAIEB[4] ; E. GANDJBACKH[5] ; A.DOMPNIER[6] ; H.GORKA[7]; N. ZANNAD[8] ; A. DA COSTA[9] ; F. SACHER[10] ; F. JOURDA[11] ; S. FROMENTIN[12]; S. CHEGGOUR[13]; D. MLAYEH[1] ; A. MILHEM[14]. On behalf of the AMPER ABLATION study investigators, France

Purpose: To evaluate bleeding complications in patients taking Apixaban and undergoing a pacemaker or ICD implantation in everyday clinical practice.

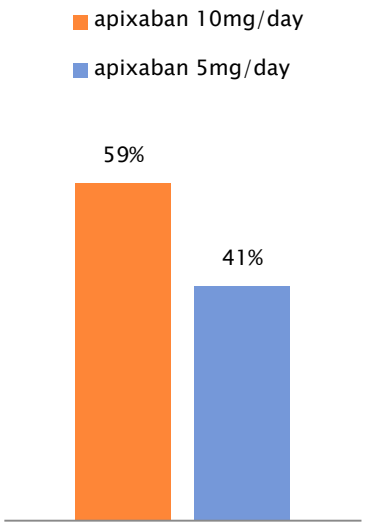
Methods: It is a multicentre, observational, prospective study of patients with non-valvular atrial fibrillation (AF) undergoing a pacemaker or implantable cardioverter defibrillator [ICD]. Eligible patients had been taking Apixaban (2.5 or 5 mg twice daily) for ≥3 weeks before the procedure, and were followed for 30 days afterwards.

Results: A total of 115 patients were enrolled at 25 academic/non-academic centres in France. The implantation was a planned procedure in 102 (89%) of cases. The mean duration of procedure was 51 min. The management of Apixaban in the periprocedural period was let to the investigators preference. Median withdrawal time was 25 h. Bleeding events were detected in 4 (3.5%) cases. One of them was a pocket hematoma with infection treated by the extraction of the device. Three patients presented minor bleedings according to ISTH classification without prolongation of hospitalization.

Baseline characteristics

Age	80 [72, 85] years
Sex	63% male
mean CHA2DS2-VASc score	3
mean HAS BLED score	3
HTA	55%
Diabetes	15%
Vascular disease	10%
History of stroke	6%
Mean creatinine value	93±25 µmol/L
mean creatinine clearance (Cockroft–Gault)	82± 34 mL/min
median weight	83±18 kg

Apixaban's dose



Conclusion: These observational data of patients on Apixaban undergoing pacemaker/ICD implantation in everyday practice show a management of Apixaban according to guidelines with a low rate of bleeding events.

(1) GHI Le Raincy-Montfermeil, France; (2) CHU Poitiers, France; (3) CHU Brest, France; (4) CH Aix en Provence, France ; (5) CHU Pitie-Salpetriere, Paris, France; (6) CH Annecy, France; (7) CH Louis Pasteur, Chartres, France; (8) CHR Metz-Thionville, France; (9) CHU Saint-Etienne, France; (10) CHU Haut Leveque, Pessac, France; (11) CH Auxerre, France; (12) CH Belfort-Montbeliard, France; (13) CH Avignon, France; (14) CH La Rochelle, France.

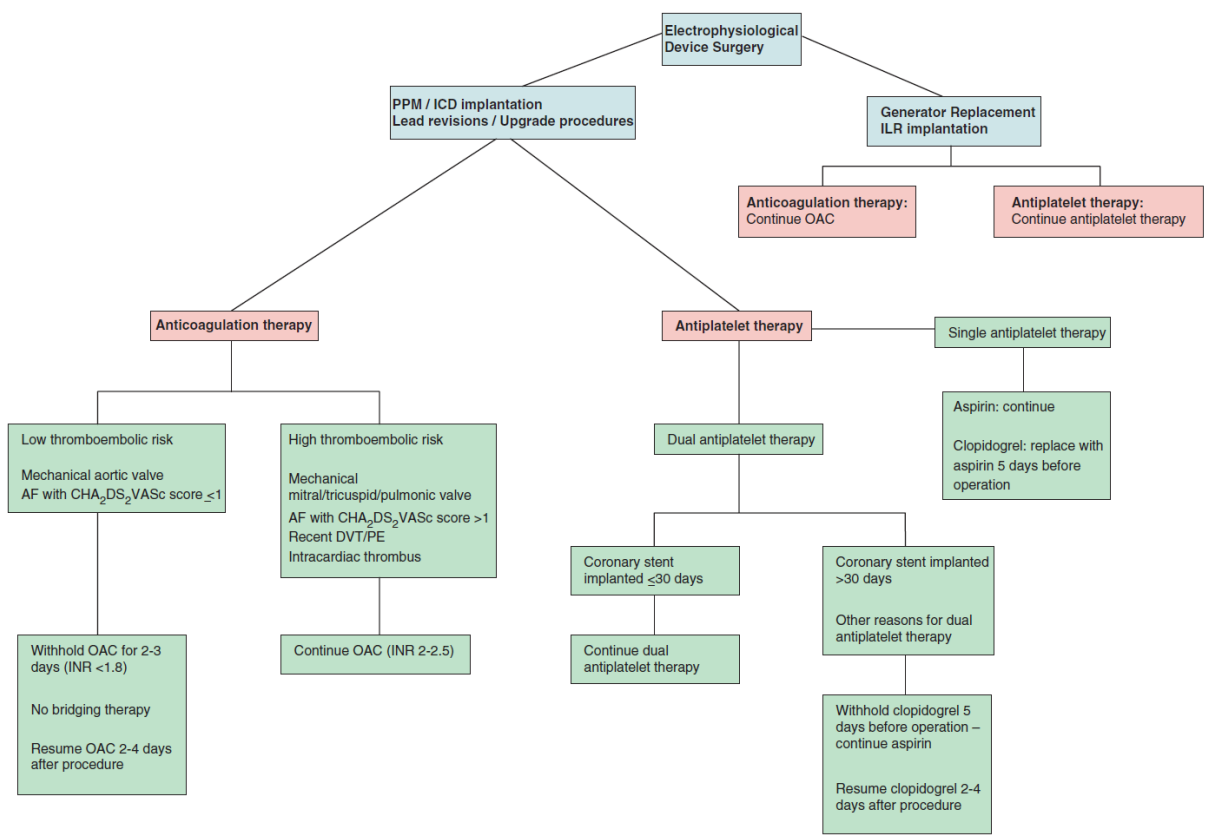


Figure 1 Simplified algorithm for the management of antithrombotic therapy in implantation of electrophysiological devices. This algorithm is based on the published data and on our own experience. DVT, deep venous thrombosis; ICD, implantable cardioverter–defibrillator; ILR, implantable loop recorder; INR, international normalized ratio; PE, pulmonary embolism; PPM, permanent pacemaker; OAC, oral anticoagulation.

ESC European Society of Cardiology

European Heart Journal (2018) **00**, 1–64
doi:10.1093/eurheartj/ehy136

SPECIAL ARTICLE

The 2018 European Heart Rhythm Association Practical Guide on the use of non-vitamin K antagonist oral anticoagulants in patients with atrial fibrillation

Jan Steffel[1]*, Peter Verhamme[2], Tatjana S. Potpara[3], Pierre Albaladejo[4], Matthias Antz[5], Lien Desteghe[6], Karl Georg Haeusler[7], Jonas Oldgren[8], Holger Reinecke[9], Vanessa Roldan-Schilling[10], Nigel Rowell[11], Peter Sinnaeve[2], Ronan Collins[12], A. John Camm[13], and Hein Heidbüchel[6,14]

Classification of elective surgical interventions according to bleeding risk

Interventions with minor bleeding risk
Dental interventions
Extraction of 1–3 teeth
Paradontal surgery
Incision of abscess
Implant positioning
Cataract or glaucoma intervention
Endoscopy without biopsy or resection
Superficial surgery (e.g. abscess incision; small dermatologic excisions; . . .)
Interventions with low bleeding risk (i.e. infrequent or with low clinical impact)
Endoscopy with biopsy
Prostate or bladder biopsy
Electrophysiological study or catheter ablation (except complex procedures, see below)
Non-coronary angiography (for coronary angiography and ACS: see Patients undergoing a planned invasive procedure, surgery or ablation section)
Pacemaker or ICD implantation (unless complex anatomical setting, e.g. congenital heart disease)

Interventions with high bleeding risk (i.e. frequent and/or with high impact)
Complex endoscopy (e.g. polypectomy, ERCP with sphincterotomy etc.)
Spinal or epidural anaesthesia; lumbar diagnostic puncture
Thoracic surgery
Abdominal surgery
Major orthopaedic surgery
Liver biopsy
Transurethral prostate resection
Kidney biopsy
Extracorporeal shockwave lithotripsy (ESWL)
Interventions with high bleeding risk AND increased thromboembolic risk
Complex left-sided ablation (pulmonary vein isolation; some VT ablations)

For each patient, individual factors relating to bleeding and thromboembolic risk need to be taken into account, and be discussed with the operating physician.

Steffel et al., EHRA Practical Guide, European Heart Journal 2018

NEW

Perioperative management of NOACs

Table 11 Timing of last non-vitamin K antagonist oral anticoagulant intake before start of an elective intervention

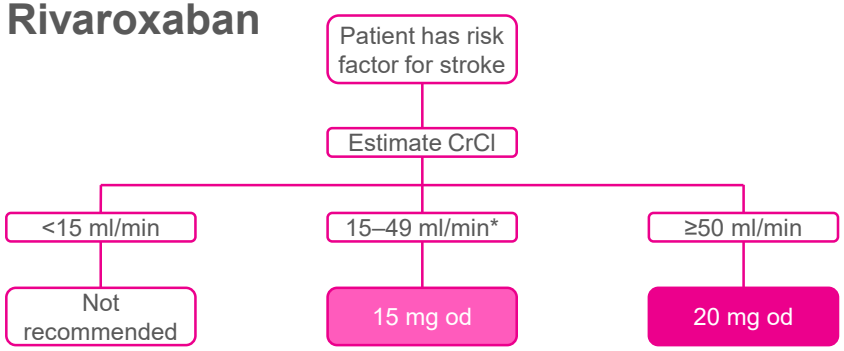
	Dabigatran		Apixaban – Edoxaban – Rivaroxaban	
	No important bleeding risk and/or adequate local haemostasis possible: perform at trough level (i.e. 12 h or 24 h after last intake)			
	Low risk	High risk	Low risk	High risk
CrCl ≥80 mL/min	≥24 h	≥48 h	≥24 h	≥48 h
CrCl 50–79 mL/min	≥36 h	≥72 h	≥24 h	≥48 h
CrCl 30–49 mL/min	≥48 h	≥96 h	≥24 h	≥48 h
CrCl 15–29 mL/min	Not indicated	Not indicated	≥36 h	≥48 h
CrCl <15 mL/min	No official indication for use			
No bridging with LMWH/UFH				
Resume full dose of NOAC ≥24 h post-low bleeding risk interventions and 48 (–72) h post-high-bleeding risk interventions (see also *Figure 8*)				
Patients undergoing a planned intervention should receive a written note indicating the anticipated date and time of their intervention, and the date and time of the last intake of their NOAC (and any other medication)				

Low risk: with a low frequency of bleeding and/or minor impact of a bleeding; high risk: with a high frequency of bleeding and/or important clinical impact. See also *Table 12*.
CrCl, creatinine clearance; LMWH, low molecular weight heparin; UFH, unfractionated heparin.

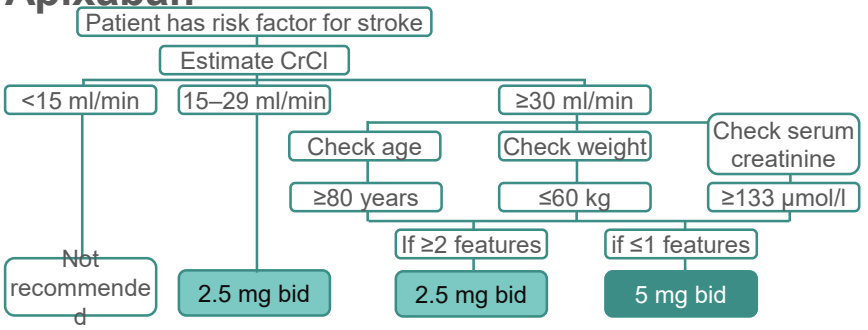
Steffel et al., EHRA Practical Guide, European Heart Journal 2018

Dose Adjustments in Non-valvular AF

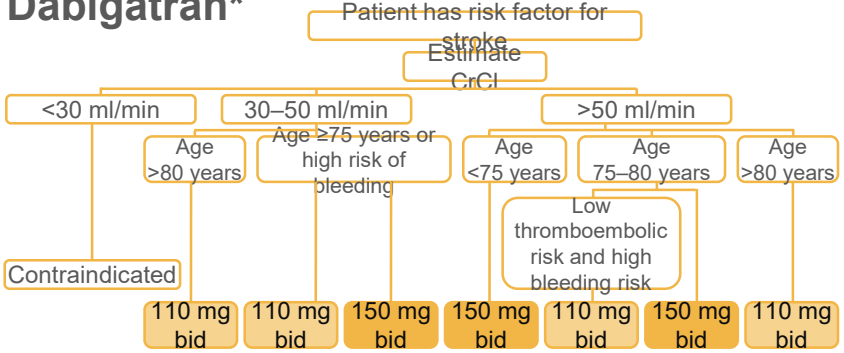
Rivaroxaban



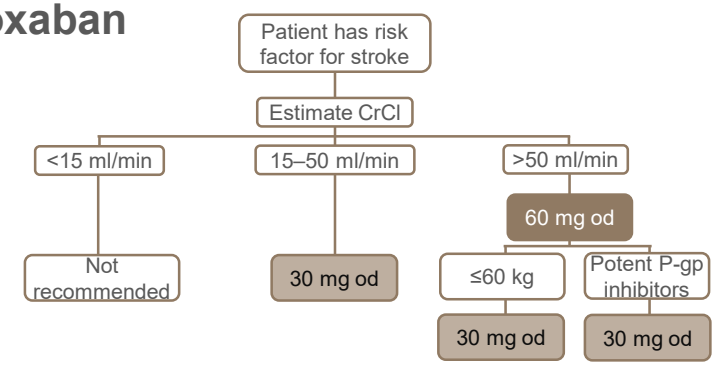
Apixaban



Dabigatran*



Edoxaban



*Patients receiving concomitant dabigatran and verapamil should reduce their dabigatran dose to 110 mg bid

*1. Rivaroxaban SmPC; 2. Apixaban SmPC; 3. Dabigatran SmPC; 4. Edoxaban SmPC

Conclusion

- The main message is to AVOID BRIDGING
- NOACs can safely withhold 24h before procedure of pacemaker / ICD implantation or replacement
- ILR implantation can be performed safely without any interruption of the anticoagulant
- Write your management protocols