How to Manage High Atrial Rate Events Detected in ICD

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Atrial tachyarrhythmia in ICD recipient

- Atrial fibrillation is a very common arrhythmia in patients who need an ICD.
  - About 20% at the time of implantation
  - 50% of patients may develop atrial fibrillation during ICD life span.

Pacing Clin Electrophysiol 1998;17:295–302.

Atrial tachyarrhythmia in ICD recipient

- Main Cause of Inappropriate Shock
- Paroxysmal AT/AF beget VT/VF
- Asymptomatic AF detected by device in high risk patient of thromboembolism

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Prognostic Importance of Atrial Fibrillation in Implantable Cardioverter-Defibrillator Patients

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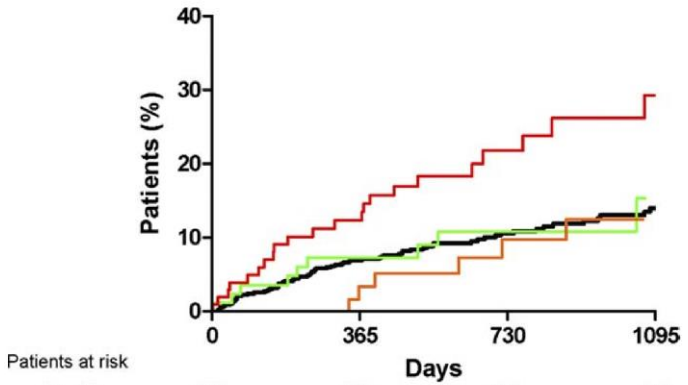
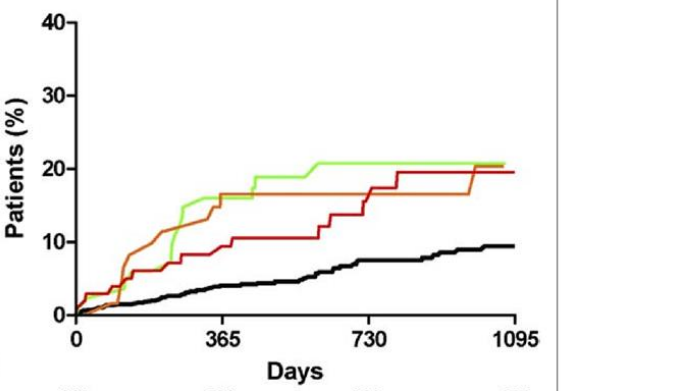


Patients at risk

No AF	663	576	316	172
Paroxysmal AF	84	72	40	18
Persistent AF	64	57	38	20
Permanent AF	102	79	41	20

Figure 3 Appropriate Device Shock

Kaplan-Meier curve for the occurrence of first appropriate shock in patients without a history of atrial fibrillation (AF) (no AF, **black line**), paroxysmal AF **(green line)**, persistent AF **(orange line)**, or permanent AF **(red line)**.



Patients at risk

No AF	663	593	328	175
Paroxysmal AF	84	66	36	15
Persistent AF	64	49	35	19
Permanent AF	102	81	46	22

Figure 4 Inappropriate Device Shock

Kaplan-Meier curve for the occurrence of first inappropriate device shock in patients without a history of atrial fibrillation (AF) (no AF, **black line**), paroxysmal AF **(green line)**, persistent AF **(orange line)**, or permanent AF **(red line)**.

ICD therapy and AT/AF

- Patients with permanent AF exhibited more than double the risk of mortality, appropriate and inappropriate device therapy.
- Patients with paroxysmal or persistent AF did not show a significant increased risk of mortality or appropriate device therapy but demonstrated almost 3 times the risk of inappropriate device therapy.

J Am Coll Cardiol 2010;55:879–85

ICD therapy and AT/AF

- the AF is a marker for worse general cardiac status.

- AF could initiate episodes of ventricular arrhythmias.

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Do Atrial Tachyarrhythmias Beget Ventricular Tachyarrhythmias in Defibrillator Recipients?

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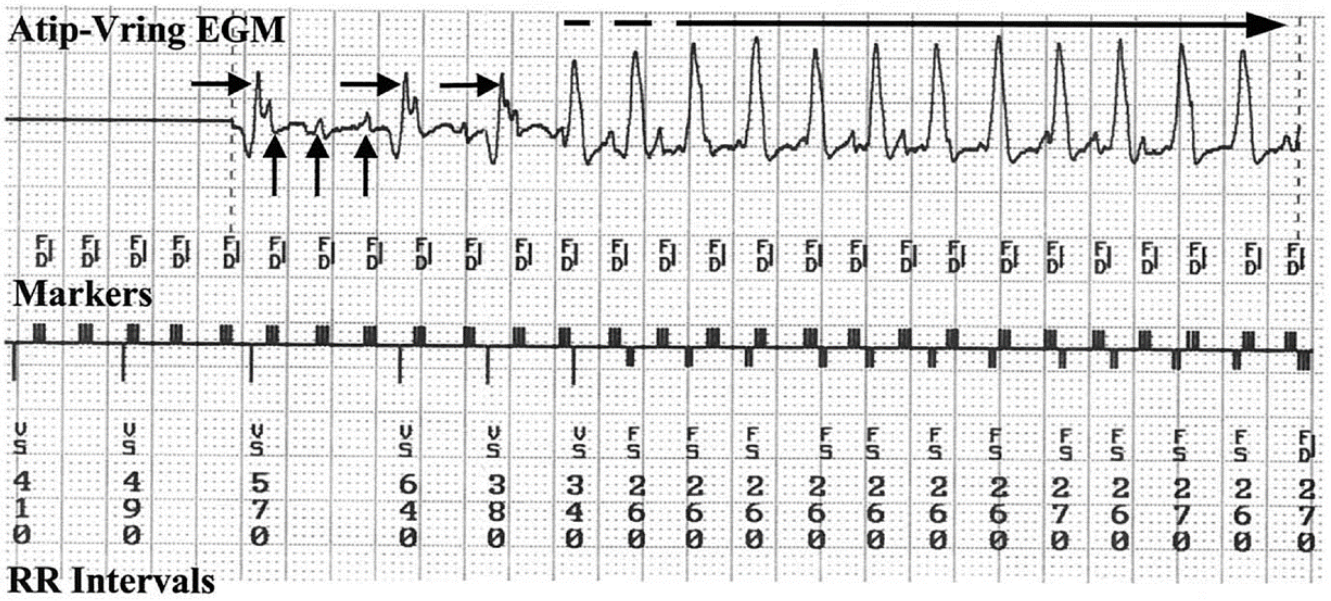

Figure 1. Electrogram (Atip-Vring EGM) recording (0.5 mv/mm) at a chart speed 25 mm/s, showing a typical episode of dual tachycardia in one patient. **Upward markers** indicate atrial events; **downward markers** indicate ventricular events. The **short triple atrial markers** indicate ongoing atrial fibrillation (AF) detection (FD). **Intermediate-height ventricular markers** (VS) indicate sensed R-waves (VS); **short double ventricular markers** indicate ventricular fibrillation (VF) sense (FS); **short triple markers** indicates VF detection (FD). The **vertical arrows** show atrial activation complexes during device-defined AF. The **short horizontal arrows** show R-waves with intrinsic conduction. The ventricular rate accelerates abruptly; at the same time there is a change in the morphology of the ventricular electrogram **(long horizontal arrow)**. The median RR interval of this device-defined VF episode was 260 ms.

AT/AF begets VT/VF

- 8.9% of the episodes of ventricular arrhythmia were accompanied by AF.
- Ventricular arrhythmias are evoked by rapid and uncontrolled atrioventricular conduction.
- Atrioventricular nodal conduction pattern preceding ventricular tachyarrhythmia were short-long-short sequences

New-generation atrial antitachycardia pacing (Reactive ATP) is associated with reduced risk of persistent or permanent atrial fibrillation in patients with bradycardia: Results from the MINERVA randomized multicenter international trial

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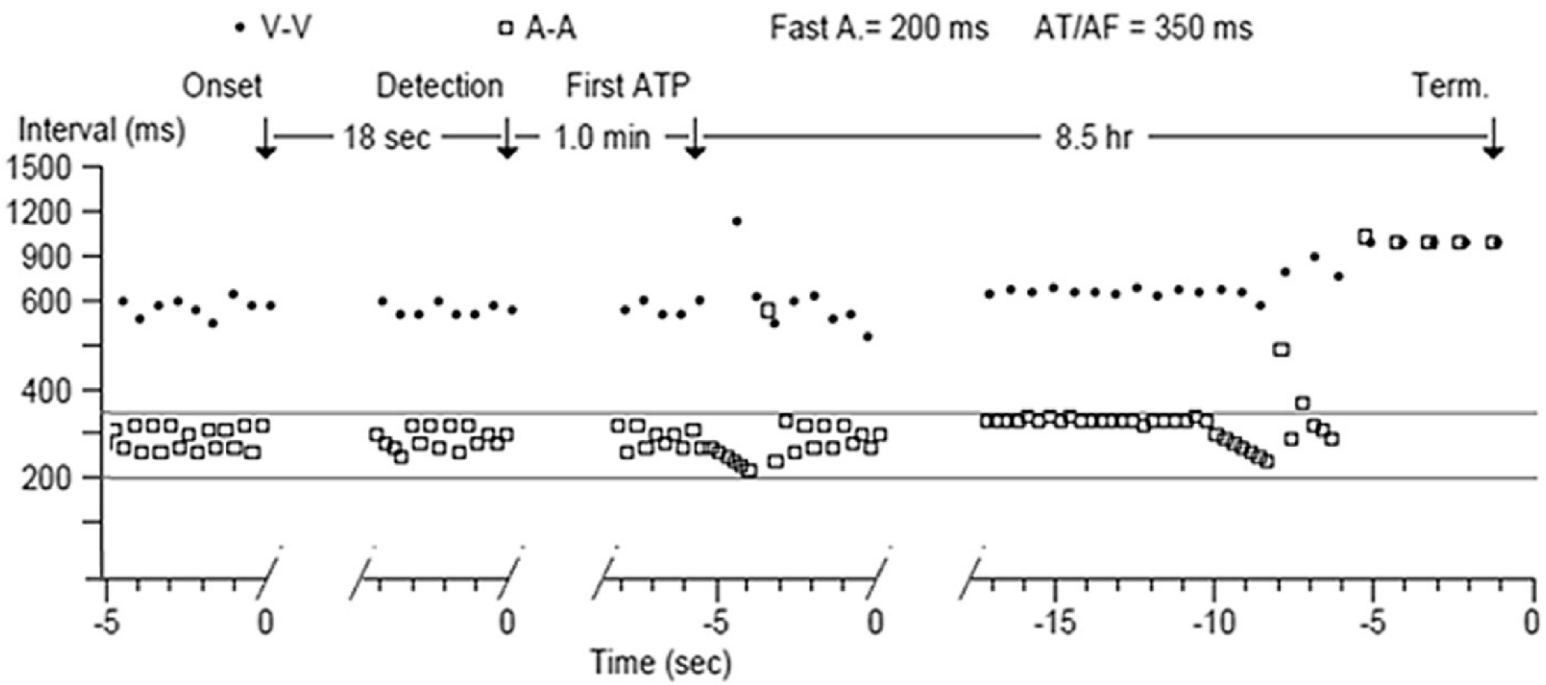
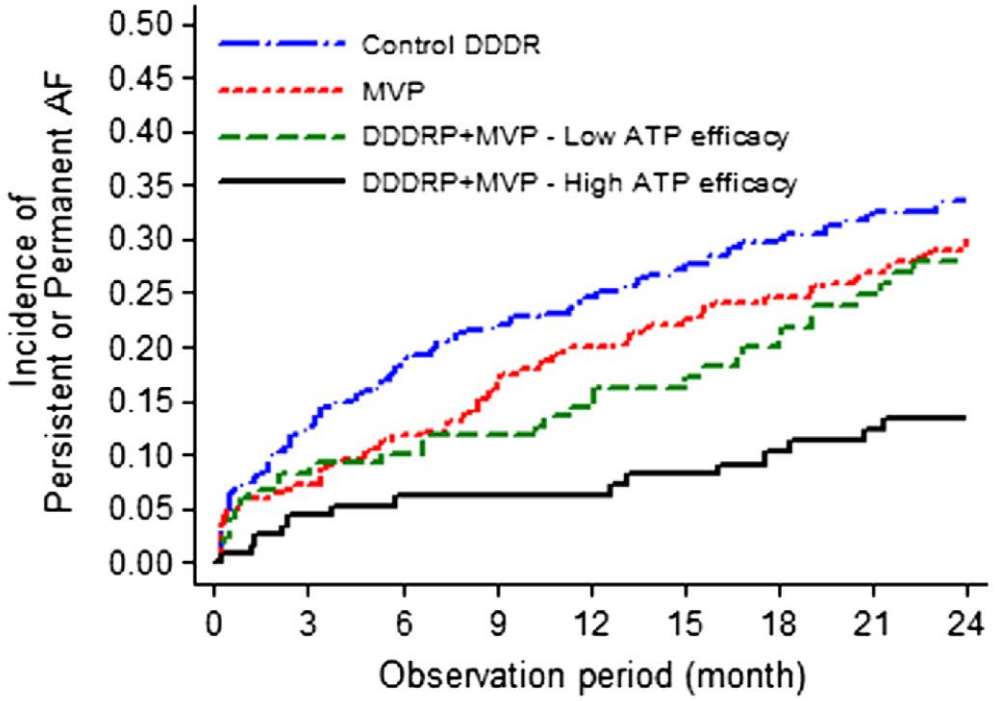
- **MVP**
  - **Managed Ventricular Pacing (MVP):** an atrial-based pacing mode that is designed to switch to a dual chamber pacing mode in the presence of AV block and to reduce unnecessary RV pacing.

- **DDDRP**
  - **Atrial Prevention Pacing:** three algorithms of **atrial pacing** designed to recognize and respond to potentially proarrhythmic intrinsic events that could trigger an AT/AF episode.
  - **Atrial Antitachycardia Pacing (aATP):** low voltage atrial pacing during regular atrial tachyarrhythmia intended to restore sinus rhythm. Reactive ATP re-arms in the event of changes in cycle length rate or regularity and in the event of long duration episodes.


• V-V
▫ A-A
Fast A.= 200 ms
AT/AF = 350 ms
Onset
Detection
First ATP
Term.
Interval (ms)
18 sec
1.0 min
8.5 hr
1500
1200
900
600
400
200
-5
0
0
-5
0
-15
-10
-5
0
Time (sec)

Incidence of permanent or persistent AF



Number at risk

Control DDDR	280	239	215	205	188	176	164	155	133
MVP	268	242	223	205	191	182	168	155	121
DDDRP+MVP - Low ATP efficacy	121	108	105	100	94	90	85	74	50
DDDRP+MVP - High ATP efficacy	118	108	102	102	95	91	84	79	61

Are all AHRE real? AWARE Trial (N=1642)

- Appropriate: 73%
  - AF – 42%
  - Aflutter – 27%
  - Atrial Tachycardia – 4%
- Inappropriate: 27%
  - RNRVAS – 17%
  - Noise – 5%
  - Farfield R-wave oversensing – 3%
  - Sinus tachycardia – 2%

Management of AT/AF in ICD pt

- AT/AF is associated with higher mortality and ICD therapy in ICD pt
- Antiarrhythmic Drug for AT/AF
- ICD therapy programming with prolonged detection and higher rate cut off is necessary to avoid inappropriate therapy
- ICD with ATP for AT/AF
- AF ablation for AT/AF induced VT/VF ?

AF and cryptogenic stroke

- “clinically unrecognized and asymptomatic AF as a potentially important cause of stroke,”

AF and cryptogenic stroke

- The CRYSTAL-AF (CRYptogenic Stroke and underlying Atrial Fibrillation) trial
  - a prospective, randomized, multicenter, global study, in which long-term cardiac monitoring using an ICM for detection of AF in 441 patients with cryptogenic stroke.
  - AF was detected in 8.9% of ICM patients (compared to 1.4% in the ECG control group) at 6 months.
  - long-term follow-up at 3 years, AF was detected in 30% of patients by ICM, compared to only 3% in the conventional ECG group

Incidence of CIED-detected SCAF

Study	Year	CIED	Incidence of AF
TRENDS [1]	2010	PM/ICD	28%
TRENDS [2]	2012	PM/ICD	30%
ASSERT I [3]	2012	PM/ICD	34.7%
HEALEY [4]	2013	PM	55.3%
CRYSTAL-AF [5]	2014	ILR	12.4%
IMPACT [6]	2015	ICD	34.8%
ASSERT II [7]	***2016***	***ILR***	***34.4%***

CIED-detected AHREs and Stroke Risk

Study	Year	TE EVENT RATE	HAZARD RATIO
ITALIAN REGISTRY [1]	2005	1.2%/YR	3.1
TRENDS [2]	2009	1.2% OVERALL	2.2
CRT- REMOTE [3]	2012	2.0% OVERALL	9.4
ASSERT I [4]	2012	1.69%/YR	2.5
SOS [5]	2014	0.39%/YR	2.1
ASSERT II	***2016***	-	**-**

- ASSERT II:
  - CHA_2DS_2-VASc=4.14±1.36
- Most patients with implanted devices who experience ischemic stroke do not have AF immediately preceding the stroke

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Duration of device-detected subclinical atrial fibrillation and occurrence of stroke in ASSERT

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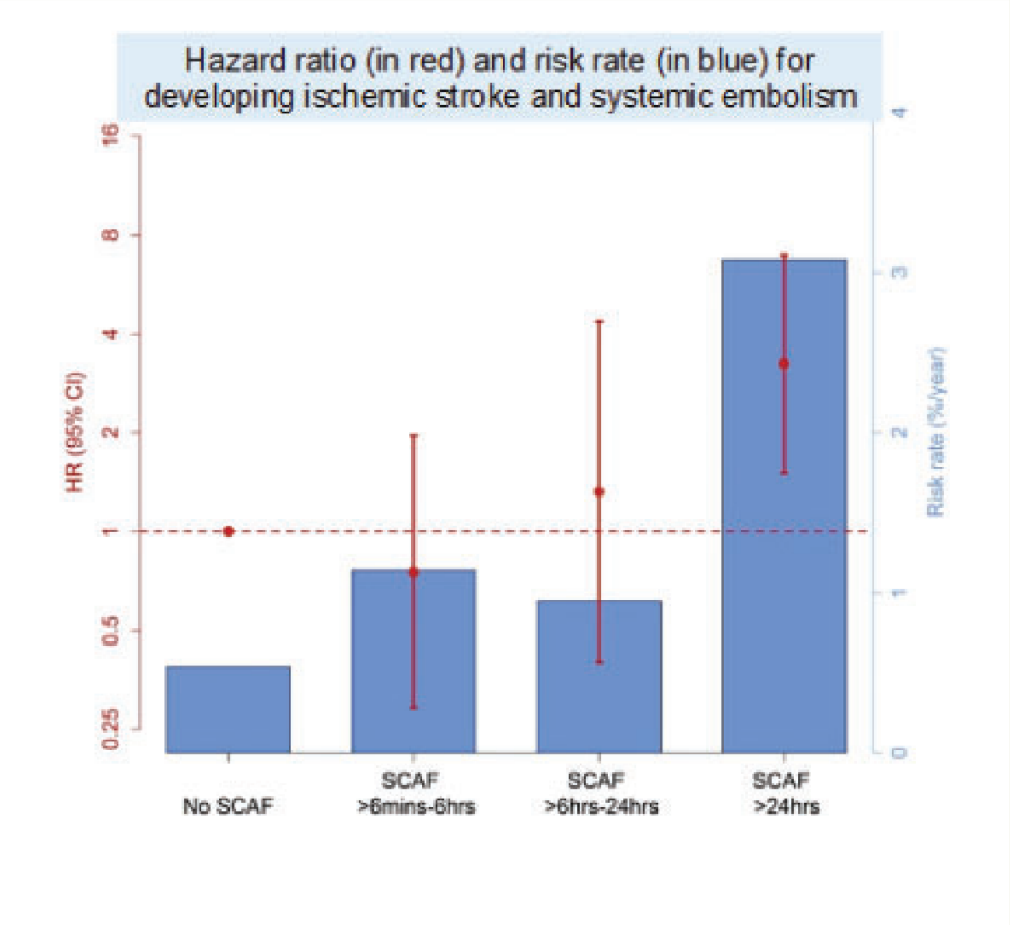

Summarizing Figure SCAF >24 h is associated with comparable risk of ischemic stroke and systemic embolism as clinical AF. In this figure the hazard ratio from time dependent Cox model (long term effect, red) and the risk rate from the landmark analysis (blue) of ischemic stroke and systemic embolism are depicted.

Significant AHR episode

- The risk of ischemic stroke or systemic embolism in patients with SCAF between 6 min and 24 h was not significantly different from patients without SCAF.

- SCAF >24 h is associated with an increased risk of ischemic stroke or systemic embolism.

AHE episode in ICD pt

- Time relation to AF development and thromboembolism is unclear.

- According to CHA2DS2-VASc score, AHR episode duration >24 hr should be considered anticoagulation.

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