The interplay between atrial fibrillation and sudden cardiac death

Prof. Dr. Martin Borggrefe
Mannheim
Management of atrial fibrillation

Expected prevalence of apparent AF

- Mayo Clinic data (assuming a continued increase in the AF incidence)\(^1,2\)
- Mayo Clinic data (assuming no further increase in the AF incidence)\(^1,2\)
- ATRIA study data\(^2,3\)

\(^3\) Go AS et al. JAMA 285:2370-2375 (2001)
Management of atrial fibrillation

Burden of disease: AF
The Framingham Heart Study

mortality curves for subjects 55 to 74 years of age

Benjamin et al, Circulation 1998;98:946-952
Worldwide Epidemiology of Atrial Fibrillation
A Global Burden of Disease 2010 Study

Sumeet S. Chugh, MD; Rasmus Havmoeller, MD, PhD; Kumar Narayanan, MD; David Singh, MD; Michiel Rienstra, MD, PhD; Emelia J. Benjamin, MD, ScM; Richard F. Gillum, MD; Young-Hoon Kim, MD; John H. McAnulty, Jr, MD; Zhi-Jie Zheng, MD, PhD; Mohammad H. Forouzanfar, MD; Mohsen Naghavi, MD; George A. Mensah, MD; Majid Ezzati, PhD; Christopher J.L. Murray, MD

Circulation 2014;129:837-847
Global Burden of Atrial Fibrillation

World map showing the age-adjusted prevalence rates (per 100,000 population) of AF in the 21 Global Burden of Disease regions, 2010

Chugh et al. Circulation 2014;129:837-847
Global Burden of Atrial Fibrillation

Incidence of AF: 1990 and 2010. Estimated age-adjusted global incidence (per 100,000 person-years) for men and women for 1990 and 2010.

Chugh et al. Circulation 2014;129:837-847
Global Burden of Atrial Fibrillation

Mortality associated with AF: 1990 to 2010. Estimated age-adjusted mortality (per 100 000 population) associated with AF from 1990 to 2010. UI indicates uncertainty interval.

Chugh et al. Circulation 2014;129:837-847
Global Burden of Atrial Fibrillation

Mortality associated with AF stratified by sex and type of region (developed vs developing)

Chugh et al. Circulation 2014;129:837-847
Global Burden of Atrial Fibrillation

Proportion of global deaths associated with AF in 2010.

Chugh et al. Circulation 2014;129:837-847
Global Burden of Atrial Fibrillation

Disability-adjusted life-years (DALYs) related to AF

Chugh et al. Circulation 2014;129:837-847
The interplay between AF and SCD

Patients With Supraventricular Tachycardia Presenting With Aborted Sudden Death: Incidence, Mechanism and Long-Term Follow-Up

YINSHI WANG, MD, MELVIN M. SCHEINMAN, MD, FACC, WALTER W. CHIEN, MD, TODD J. COHEN, MD, MICHAEL D. LESH, MD, FACC, JERRY C. GRIFFIN, MD, FACC

J Am Coll Cardiol 1991; 18:1711-9

Editorial Comment

Supraventricular Tachyarrhythmias: Not Always So Benign*

JEFFREY L. ANDERSON, MD, FACC

J Am Coll Cardiol 1991; 18:1720-1
The interplay between AF and SCD

SVT and sudden death

13/290 pts with aborted SD

SVT → VF

- WPW syndrome  n = 6
- AVN RT  n = 3
- AF + EANC  n = 4

4.5%
Wolff-Parkinson-White Syndrome in the Era of Catheter Ablation
Insights From a Registry Study of 2169 Patients

Carlo Pappone, MD, PhD; Gabriele Vicedomini, MD; Francesco Manguso, MD, PhD; Massimo Saviano, MD; Mario Baldi, MD; Alessia Pappone, MD; Cristiano Ciaccio, MD; Luigi Giannelli, MD; Bogdan Ionescu, MD; Andrea Petretta, MD; Raffaele Vitale, MD; Amarild Cuko, MD; Zarko Calovic, MD, Angelica Fundaliotis, MD; Mario Moscatiello, MD; Luigi Tavazzi, MD; Vincenzo Santinelli, MD

Circulation 2014;130:811-819
The interplay between AF and SCD

Symptoms after the exclusion of malignant arrhythmias

Malignant arrhythmias (MAs) in untreated patients (noradiofrequency catheter ablation (RFA)) and patients treated with RFA.

Pappone et al. Circulation 2014;130:811-819
Does Atrial Fibrillation Beget Ventricular Fibrillation in Patients with Acute Myocardial Infarction?

RAJIV SANKARANARAYANAN, M.B.B.S, M.R.C.P.,* MICHAEL A. JAMES, M.D., F.R.C.P.†
BOGDAN NUTA, M.R.C.P.,‡ MANDIE TOWNSEND M.B.B.Ch., M.R.C.P.,§ SUJATA KESAVAN,
M.B.B.S., M.R.C.P.,¶ STEPHANIE BURTCHAELL, B.Sc., R.N., ** RUSSELL HOLLOWAY,††

PACE 2008; 31:1612-1619
The interplay between AF and SCD

Survival

n = 500 pts with AMI

Sankaranarayanan et al. PACE 2008; 31:1612-1619
The interplay between AF and SCD

Outcomes of the Various Subsets of Patients in the Study Population with Respect to Mortality and Ventricular Arrhythmias

<table>
<thead>
<tr>
<th></th>
<th>AF on Admission, n = 67</th>
<th>New-onset AF, n = 57</th>
<th>All Patients with AF, n = 124</th>
<th>Patients without AF, n = 376</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mortality</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In-patient</td>
<td>23 (34%)</td>
<td>13 (23%)</td>
<td>36 (29%)</td>
<td>38 (10%)</td>
</tr>
<tr>
<td>P &lt; 0.001</td>
<td></td>
<td>P = 0.005</td>
<td>P &lt; 0.001</td>
<td></td>
</tr>
<tr>
<td>1 year</td>
<td>35 (52%)</td>
<td>21 (37%)</td>
<td>56 (45%)</td>
<td>61 (16%)</td>
</tr>
<tr>
<td>P &lt; 0.001</td>
<td></td>
<td>P = 0.0001</td>
<td>P &lt; 0.001</td>
<td></td>
</tr>
<tr>
<td>5.5 year</td>
<td>43 (64%)</td>
<td>30 (53%)</td>
<td>73 (59%)</td>
<td>103 (27%)</td>
</tr>
<tr>
<td>P &lt; 0.001</td>
<td></td>
<td>P &lt; 0.001</td>
<td>P &lt; 0.001</td>
<td></td>
</tr>
<tr>
<td>Ventricular tachycardia</td>
<td>13 (19%)</td>
<td>12 (21%)</td>
<td>25 (20%)</td>
<td>65 (17%)</td>
</tr>
<tr>
<td>P = 0.73</td>
<td></td>
<td>P = 0.46</td>
<td>P = 0.50</td>
<td></td>
</tr>
<tr>
<td>Ventricular fibrillation</td>
<td>11 (16%)</td>
<td>5 (9%)</td>
<td>16 (13%)</td>
<td>24 (6%)</td>
</tr>
<tr>
<td>P = 0.01</td>
<td></td>
<td>P = 0.57</td>
<td>P = 0.03</td>
<td></td>
</tr>
</tbody>
</table>
The interplay between AF and SCD

New-onset atrial fibrillation predicts malignant arrhythmias in post-myocardial infarction patients—
A Cardiac Arrhythmias and Risk Stratification after acute Myocardial infarction (CARISMA) substudy

Anne-Christine Huth Ruwald, MD, a,b Poul Erik Bloch Thomsen, MD, PhD, c Uffe Gang, MD, PhD, a
Rikke Mørch Jørgensen, MD, PhD, d Heikki V. Huikuri, MD, PhD, c and Christian Jons, MD, PhD, a

Am Heart J 2013; 166:855-863.e3
The interplay between AF and SCD

Risk of ventricular tachycardia and AF

The interplay between AF and SCD

The association between new-onset AF and specific subtypes of ventricular tachyarrhythmic events

<table>
<thead>
<tr>
<th>End point</th>
<th>Events</th>
<th>All AF</th>
<th>AF &gt;30 s</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>HR</td>
<td>95% CI</td>
</tr>
<tr>
<td>Non-sustained ventricular tachycardia*</td>
<td>38</td>
<td>3.83</td>
<td>1.91-7.70</td>
</tr>
<tr>
<td>VF†</td>
<td>10</td>
<td>1.34</td>
<td>0.31-5.77</td>
</tr>
</tbody>
</table>

The interplay between AF and SCD

Association Between Atrial Fibrillation and Appropriate Implantable Cardioverter Defibrillator Therapy: Results from a Prospective Study

GERIAN C. GRÖNEFELD, M.D., OLIVER MAUSS, M.SC., YI-GANG LI, M.D., THOMAS KLINGENHEBEN, M.D., and STEFAN H. HOHNLOSER, M.D., FACC

J Cardiovasc Electrophysiol 2000;11: 1208-1214
The interplay between AF and SCD

Freedom from appropriate device therapy

The interplay between AF and SCD

Cycle lengths of the ventricular arrhythmia

The interplay between AF and SCD

Atrial Fibrillation Is an Independent Risk Factor for Ventricular Fibrillation: A Large-Scale Population-Based Case-Control Study
Abdennasser Bardai, Marieke T. Blom, Daniel A. van Hoeijen, Hanneke W. van Deutekom, Henk J. Brouwer and Hanno L. Tan

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://circep.ahajournals.org/content/early/2014/09/18/CIRCEP.114.002094
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Flowchart of case inclusion

- Resuscitations performed, n = 5154
  - Excluded: OHCA from non-cardiac causes, n = 824
- OHCA from cardiac causes, n = 4330
  - Excluded: no VF on the ECG, n = 1821
- OHCA with documented VF, n = 2509
  - GP approached for medical information, n = 1950; response rate = 77%
- Final study cohort, n = 1397 cases
  - Age and sex matched controls (up to 5 controls per case), n = 3474 controls

Bardai et al. http://circep.ahajournals.org/content/early/2014/09/18/CIRCEP.114.002094
The interplay between AF and SCD

**AF and sudden death**

<table>
<thead>
<tr>
<th>1397 VF cases</th>
<th>AF : 215 pts (15.4%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3774 controls</td>
<td>AF : 90 pts (2.6%)</td>
</tr>
</tbody>
</table>

AF increases risk for VF: OR 3.1

Bardai et al. http://circep.ahajournals.org/content/early/2014/09/18/CIRCEP.114.002094
The interplay between AF and SCD

AF and sudden death

Possible mechanisms (I)

- Embolic
- Cerebral bleeding
- AF facilitates VT/VF
- AF = marker of more severe disease
- Antiarrhythmic drugs

AF intrinsically increases VF risk
(genetic mutations for both AF/VF)

AF → coronary perfusion ↓ ischemia → EMD (VF)

Bardai et al. http://circep.ahajournals.org/content/early/2014/09/18/CIRCEP.114.002094
The interplay between AF and SCD

AF and sudden death

Possible mechanisms (II)

- Enhanced AV nodal conduction (pts with DCM + LSB)
- Rapid heart rate
- Increased sympathetic flow
- Irregularity of HP activation
- Hemodynamic compromise (LVEDP ↑ Stretch → VF)

Bardai et al. http://circep.ahajournals.org/content/early/2014/09/18/CIRCEP.114.002094