Sudden Cardiac Death

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Approach to Sudden Cardiac Death

- Definition and Etiologies
- Epidemiology
- Emergency medical response
- Risk stratification
- Prevention

Definition

- Sudden, unexpected loss of the pulse
- Related to a primary cardiac etiology
- VT, VF, PEA, Asystole

"If the heart trembles, has little power and sinks, the disease is advancing ... and death is near ..."
—The Papyrus Ebers (circa 3500 BCE)

Etiologies of Sudden Cardiac Death

- Cardiomyopathies
- Coronary Disease
- Other: LQTS, Brugada, IVF, Congenital...

Acute Coronary Thrombosis

Davidson.
http://www.ajmc.com/supplement/managed-care/
Long QT, Short QT, Brugada Syndromes
A Genetic Overlap Situation

- LQTS - 12 genes (K/Na/Ca ions, Ankyrin, Caveolin, Yotiao, syntrophin)
- SQTS – 2 genes (same as LQT 1,2)
- Brugada – same as LQT 3 (reversed phenotype)
- All patients have risk of SCD

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Significant Magnitude, Insignificant Survival

SCA has ↑↑↑ Potential for Prevention

- USA – 180- 250,000/yr
- Survival <5%
- 10-15% of all deaths


SCD More Common with Advancing Age
40% Age<65 years, 40% women


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- The Oregon Sudden Unexpected Death Study

Portland, Oregon USA, (Pop. 1 million)
Feb 1, 2002⇒ 8th Year

Stecker EC, Chugh SS. J Am Coll Cardiol 2006; 47 (6): 1161-6

Current and Future Trends for Mortality Due to SCD

Fox C S et al. Circ 2004;110:522-527

AHA Chain of Survival

Source: Currenese et al., 1991
First Line of Defense: First-Responders

CALL 9-1-1

Good ACLS begins with good BLS

Importance of Early CPR

Most Survivors Are Those Patients....

• Whose collapse is witnessed
• Who receive CPR within 4 - 5 min.
• Who receive ACLS within 10 min.

Lay Rescuer – Automated External Defibrillator (AED)

- AEDs doubled survival in PAD trial, cost issues
- 1 shock then immediate CPR
- Check victim’s rhythm after giving 5 cycles of CPR (~2 min)

Chest Compression W/O Ventilation
Hands-Only (Compression-Only) CPR
Cardio-Cerebral Resuscitation

- Un-trained bystander - hands-only
- If trained - provide either standard CPR or hands-only CPR
- No difference in survival at 30 days


NEJM 351:637-646, 2004
Immediate Post-Resuscitation Measures
Cooling Works

- Do not re-warm stable patients (33 C)
- Active cooling of post VF-arrest pts who are comatose (32-34 deg C)
- Potential complications ⇒ coagulopathy, arrhythmias, hyperglycemia


Act Quickly ⇒ Save Heart Muscle
Early Intervention is the Key

- EKG in the field
- Medications (ASA)
- Thrombolytics
- PTCA

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Randomized Multi-Center ICD Trials
All Based on LV Ejection Fraction

- SCD-HEFT: Appropriate shocks in 20% over four years
- MADIT II- Similar rate

Primary Prevention ICD Indications (Class I)

- Optimal medical therapy
- Reasonable expectation of survival with good functional capacity for >1 yr
- LVEF<35%, NYHA II-III
- LVEF<30%, 40 D post-MI, NYHA I
- LVEF<40%, post-MI, inducible VT/VF

Minority of Patients Actually Use Their ICD

- SCD-HEFT: Appropriate shocks in 20%
- MADIT II- Similar rate


Need for Improved Assessment of Risk
Find the Patient that will Benefit the Most

In the general population, some presently asymptomatic individuals will have future SCA. Can we screen to identify those at risk?

Determinants of Sudden Cardiac Arrest
Multi-factorial (Need for a Risk Score)

- Genome
- Environment
  - Smoking
  - Diet
  - Particulate Matter
- Clinical Conditions
  - CHF
  - LVH
  - QTc
  - DM
- SES, Race, Other
- Drugs

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Chugh SS. Nat. Rev. Cardiol 2010
Prevention of SCD

• Most cardiac arrests are associated with coronary artery disease
• Atherosclerosis risk factors
  – Non-modifiable
    • Age
    • Gender
    • Family history
  – Modifiable

Modifiable Risk factors
Basis of Health Promotion

• Smoking
• High Blood Pressure
• High Cholesterol
• Obesity
• Physically inactive
• Diabetes (high blood sugar)
• Psycho-social factors

ICD vs. Heart Failure Drugs
Absolute Mortality ↓ (Intermediate F/U)

Chain of Survival

Health Promotion  Early Access  Early CPR  Early Defibrillation  Early Advanced Care

Summary

• US 180-250K/yr, World 4-5 Million/yr
• Coronary disease largest contributor, but SCD incidence will rise again
• CPR, defibrillation and cooling
• LVEF not enough, determinants diverse
• Genetic variants contribute to risk/protection
• Modifiable risk factors, drugs, ICD and novel methods of prevention