Sudden Cardiac Arrest/Death

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Sudden Cardiac Death

- Sudden cardiac arrest (SCA) and sudden cardiac death (SCD) refer to the sudden cessation of cardiac activity with hemodynamic collapse.
SCD - Time is the Enemy

Following a cardiac arrest, every minute of delay in applying a defibrillator reduces the chance of survival by 10%.
Sudden Cardiac Death

• Let’s start with Don’s story

Sudden Cardiac Death

• Sudden cardiac arrest (SCA) and sudden cardiac death (SCD) refer to the sudden cessation of cardiac activity with hemodynamic collapse.
  • Vast majority of these events occur in the setting of sustained VT or VF (80%).
    • Bradyarrhythmias also implicated in some cases of SCD (10%?).
  • Typically, these events tend to occur in patients with structural heart disease (SHD), especially coronary heart disease or heart failure, but not always the case.
  • Important to note that SHD may not have been previously recognized.
Sudden Cardiac Death

- SCD has a bimodal distribution, with incidence peaking between birth and six months (sudden infant death syndrome), and between 45 and 75 years of age.
- SCD accounts for more than 350,000 deaths in the U.S. each year
  - SCA claims one life every 90 seconds, taking more lives each year than stroke (130,000), breast cancer (41,000), lung cancer (156,000) or AIDS (7000)…combined together
  - Unfortunately, vast majority of patients who experience SCA die as a result (95% based on some estimates), especially since immediate treatment is not always available.

Mechanism of SCD in CAD

- There are two major mechanisms of fatal ventricular arrhythmias in patients with CAD.
- Acute coronary ischemia
  - Plaque rupture and occlusion of one or more major coronary arteries; usually leads to polymorphic ventricular tachycardia.
  - These patients tend to have normal LV systolic function or mildly depressed LV function.
- Those with ischemic cardiomyopathy as a consequence of prior myocardial infarction are more likely to have monomorphic ventricular tachycardia resulting from re-entrant loops around areas of scarred myocardium.
- Either arrhythmia left untreated will degenerate into ventricular fibrillation.
“re-entrant loops around areas of scarred myocardium”…

Causes of SCD

• 60-70% attributable to CAD, but likelihood of this much lower in younger patients (<40)

• 10% due to congenital artery abnormalities, myocarditis, ARVC, sarcoidosis, especially in younger patients

• 5-10% in the absence of SHD- Brugada, CPVT, LQTS, WPW, etc

• One population that deserves special attention is patients with heart failure (systolic dysfunction). Some estimates report as many as 50% of deaths in CHF patients is related to SCD

• Also, important to recognize that there can be transient or reversible causes of SCD - AMI, AADs, medications/drugs that can prolong QT, electrolyte abnormalities, acidosis, autonomic nervous system activation (stress cardiomyopathy/takotsubo), etc
Risk of Death and Recurrent Ventricular Arrhythmias in Survivors of Cardiac Arrest Concurrent With Acute Myocardial Infarction

Abstract

Aims
Cardiac arrest (CA) is an indication for defibrillation (ICD) in acute myocardial infarction (AMI). We investigated the ventricular arrhythmia in patients resuscitated from CA in the setting of AMI.

Methods
We reviewed a database of 140 AMI and CA survivors from the Antithrombin Deficiency (AT-D) Registry. Patients with acute myocardial infarction (AMI) and cardiac arrest (CA) were included.

Results
Patients and controls were followed for 18±3.2 years. Patients with CA had higher mortality. Furthermore, survival of patients with CA and AMI was significantly worse than that of patients with AMI but no CA, and comparable to those of patients with CA outside the context of AMI. Accordingly, these patients should be considered for ICD implantation.

Stress Cardiomyopathy
### Stress Cardiomyopathy

- Usually reversible and tends to have a good long-term prognosis
- More common in women; occurs under time of high emotional or physical stress
- Etiology remains unclear
- Risk of sudden cardiac death?
  - Acute
  - Long-term, especially if EF recovers
  - Long-term medical management
  - Can it recur?

### Identifying Patients at Risk for SCD

- Identifying patients who are at risk for SCD continues to represent a major challenge.
  - It is well recognized that with the exception of low EF, there is a lack of useful tools that can help identify patients at high risk for SCD.
  - Despite its usefulness, it is recognized that we need still a more refined and robust tool than just low EF to identify patients at risk for SCD
  - NNT - ischemic NNT to prevent one death ranges from 18 to 3
  - NNT for NICM is 25
  - Yearly appropriate shock rate is ~5%
  - Some estimates suggest that as many as half to two-thirds of SCD occur without any prior known history of heart disease
SCD

- Tools available for preventing SCD
  - Drugs – usually not very successful and rarely used without ICD backup in patients at high risk for SCD
  - AED
  - Lifevest/Wearable Cardioverter Defibrillator – usually a temporary measure
  - ICD
Best City to Suffer SCD...

"If you look just at the casino floor, where the response time is less than three minutes, about 60 to 70 percent of those come back after sudden cardiac arrest," said Slattery.

The AED training at MGM is certified by the American Heart Association, incorporating regular "mock drills" where employees reenact the situation, attaching the defibrillator to a mannequin while administering CPR. The drill incorporates three individuals, with each person taking a turn at resuscitating the individual.

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ICD and WCD

>98% first treatment shock success rate

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Primary and Secondary Prevention ICD

- EF <35%
- EF 35-40%, ischemic cardiomyopathy, NSVT
- Patients with structural heart disease, syncope, and inducible VT or VT degenerating to VF on EP study
- **Select** patients with certain conditions who are deemed to be high risk for SCD related to VT/VF
  - LQTS who have TdP or recurrent symptoms despite beta-blocker therapy
  - High-risk HCM patients (family history of SCD, BP drop with exercise, thickness > 30 mm, NSVT, etc)
  - High-risk patients with Brugada syndrome
  - ARVC
- Everything else either secondary prevention in patients who have had prior sustained HD unstable VT or resuscitated VT/VF or sustained VT in the setting of SHD

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WCD/Lifevest Indications

• Primary prevention (EF $\leq$ 35% and MI, NICM, or other DCM), including:
  – After recent MI (Coverage during the 40 day ICD waiting period)
  – Before and after CABG or PTCA (Coverage during the 90 day ICD waiting period)
  – Recently diagnosed nonischemic cardiomyopathy (Coverage during the 3 to 9 month ICD waiting period)
• ICD indications when patient condition delays or prohibits ICD implantation
• ICD explantation