Implantable Cardioverter Defibrillators (ICDs)

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The ICD

- Small Device Implanted in chest
- Single lead attaches in left ventricle
  - Some patients require atrial lead as well
- Detects ventricular arrhythmia
- High energy defibrillation
- Low energy synchronized cardioversion
- Antitachycardic pacing
Treatment

- Ventricular arrhythmias
  - Ventricular Fibrillation
  - Ventricular Tachycardia
- Prevention of sudden death from cardiac infarction
- Used more and more commonly
History

- Developed in 1970
- First human implant 1980
- Defibrillation only
- Implanted in abdomen with thoracotomy to place lead
- General anesthesia
ICD Implanted in Abdomen
Modern Procedure

- Implanted in chest – Subcutaneous or deep to Pectoralis Major
- Transvenous lead
- Local Anesthesia and intravenous sedation
- Incision 5-8cm long
- Programming
- Test device
- Patient discharged within 24-48 hours
ICD Implanted in Chest
Electrocardiogram showing ICD treating Ventricular Fibrillation with high energy shock (34.5J)
Electrocardiogram showing ICD using antitachycardic pacing to steady rhythm for ventricular fibrillation (series of small shocks)
Clinical Trials

- Many clinical trials compare effectiveness of the ICD to antiarrhythmic drugs
- Mortality rates are significantly lower in groups using ICD than control groups using medication alone
  - Amiodarone (most common)
  - Sotalol
  - Metoprolol
Clinical trial results

Trials of ICDs in patients with ventricular tachycardia/ventricular fibrillation

<table>
<thead>
<tr>
<th>Study</th>
<th>Number in Trial</th>
<th>Control Treatment</th>
<th>Mean Follow up</th>
<th>ICD Mortality</th>
<th>Control Mortality</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antiarrhythmics Versus Implantable Defibrillators (AVID)</td>
<td>1016</td>
<td>Amiodarone or sotalol</td>
<td>18 months</td>
<td>25% at 3 years</td>
<td>36% at 3 years</td>
<td>&lt;0.02</td>
</tr>
<tr>
<td>Canadian Implantable Defibrillator Study (CIDS)</td>
<td>659</td>
<td>Amiodarone</td>
<td>36 months</td>
<td>8.3% per year</td>
<td>10.2% per year</td>
<td>0.142</td>
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<tr>
<td>Cardiac Arrest Study Hamburg (CASH)</td>
<td>288</td>
<td>Amiodarone or metoprolol</td>
<td>57 months</td>
<td>36%</td>
<td>44%</td>
<td>0.081</td>
</tr>
</tbody>
</table>

Table 1: Connelly, Derek T. (Aug 2001) Implantable Cardioverter Defibrillators. Heart, 86(2)
Complications

- Infection
- Inappropriate shocks
- Erosion of leads
- Placement of leads
  - Most patients have coronary artery disease or poor left ventricular function
- Complication rate significantly lower in recent years
Patient Adjustment

- Follow up critical
  - At least every 6 months
- Psychological follow up
- Shocks uncomfortable
- Medication usually used in conjunction
- Restrictions and lifestyle changes
Questions?


