Detecting the Body’s Electrical Signals

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Information from ECG

• Heart rate, rhythm
• Pattern of conduction
• Diseases
  – arrhythmias
  – conduction abnormalities
  – hypertrophy (not always bad)
  – ischemia
  – necrosis

ECG Leads

• Lead = any 2 electrodes on skin
• potential differences between electrodes
• Recording electrode indicated as (+)
• Reference electrode indicated as (-)
• pd = (recording elec) – (reference elec)
• Between 1 and 15 leads!
• 12-lead ECG is standard

Normal 12-lead ECG
Elathoven's original string galvanometer required a room full of equipment.
Question
What would happen to the amplitude of a wave if the mass of tissue undergoing depolarization doubled?

amplitude would approximately double due to doubling of charge density

Question
What would happen to the amplitude of the wave if depolarization were perpendicular to the lead rather than parallel to the lead?

amplitude would be zero
Key rules of electrocardiography
• Depol toward lead → positive wave
• Repol toward lead → negative wave
• Depol perpendicular to lead → 0 amplitude
• ↑ tissue mass → ↑ amplitude
Lead I ECG

P-wave: atrial depolarization
QRS complex: ventricular depolarization
T-wave: ventricular repolarization

Precordial Leads

- 6 leads in transverse plane
  - V1, to right of sternum over right ventricle
  - V6 on left side over lateral wall of left ventricle
- Record activity front to back, back to front
- Reference is sum of std limb leads

Axis of ventricular depolarization

- Net direction of depolarization
- Usually toward lower left quadrant
- Pathologies shift the axis:
  - left ventricular hypertrophy
  - right ventricular hypertrophy
  - death of tissue, e.g., heart attack
- Pregnancy shifts the axis
There is a complicated hypothesis which usually entails an element of mystery and several unnecessary assumptions. This is opposed by a more simple explanation which contains no unnecessary assumptions. The complicated one is always the more popular one at first, but the simpler one, as a rule, eventually is found to be correct. This process frequently requires 10 to 20 years to complete.

J.H. Northrop

The reason for this long time lag was explained by Max Planck. He remarked that “Scientists never change their minds, but eventually die.”

J.H. Northrop