



TeachEngineering

Ignite STEM learning in K-12

Applications of ECG and EMG



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ECG and EMG Review

- **Electrocardiography (ECG) measures the electrical activity of the heartbeat**
- **Electromyography (EMG) measures the electrical activity of muscles**
- **We use and study ECG and EMG to evaluate the health of a patient's heart and their muscles to better understand their physiology**
- **Electrodes are sent through the body in both tests and measured afterwards to see the how the heart or muscles are functioning**

How do we use ECG data?

- **To measure the underlying rate and rhythm mechanism of the heart and diagnose:**
 - **Impaired blood flow to the heart muscle**
 - **Abnormal cardiac rhythm disturbances**
- **The orientation of the heart (how it is placed) in the chest cavity and diagnose:**
 - **Damage to the various parts of the heart muscle**
 - **Increased thickness (hypertrophy) of the heart muscle**
- **All of these signal heart malfunction or disease, but ECG data can help doctors detect abnormalities and mitigate the problem.**

Heart Arrhythmia

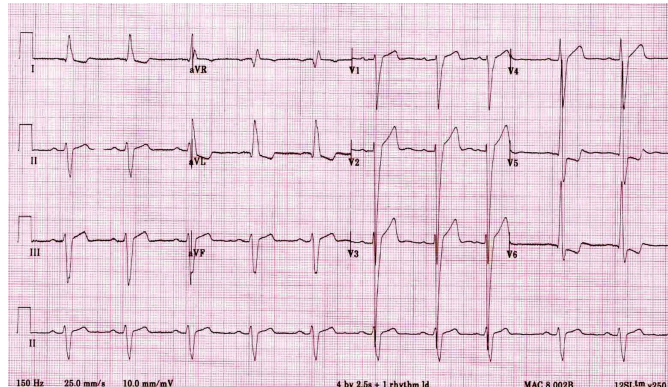
- **Heart Arrhythmia is present when the heart beats at an irregular rate**
 - This can lead to stroke and heart failure
- **By analyzing the data below, doctors can prescribe medication to prevent complications**



https://en.wikipedia.org/wiki/Heart_arrhythmia#/media/File:Ventricular_fibrillation.png

Ventricular Hypertrophy

- **Ventricular Hypertrophy occurs when the heart muscle thickens preventing it from pumping efficiently.**
- **If not identified quickly, it can lead to heart failure, cardiac arrest, and ischemic stroke.**

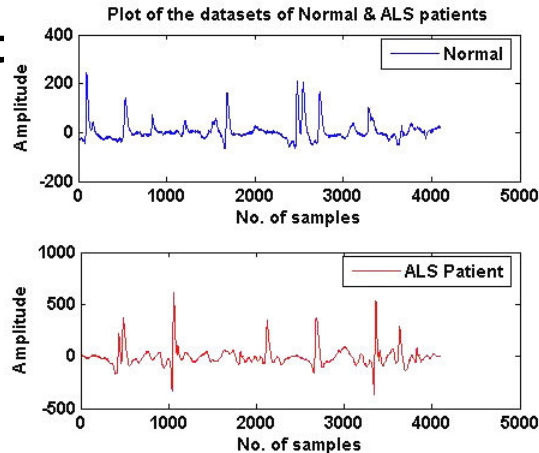


How do we use EMG data?

- **By analyzing EMG data, doctors can tell if muscle weakness is due to problems within the muscle or if there is an underlying nerve condition**
- **EMG data can help diagnose muscular dystrophy, inflammation of muscles, pinched nerves, peripheral nerve damage, and even ALS**
- **The presence, size, and shape of the wave form provide information about what is occurring in the muscle**

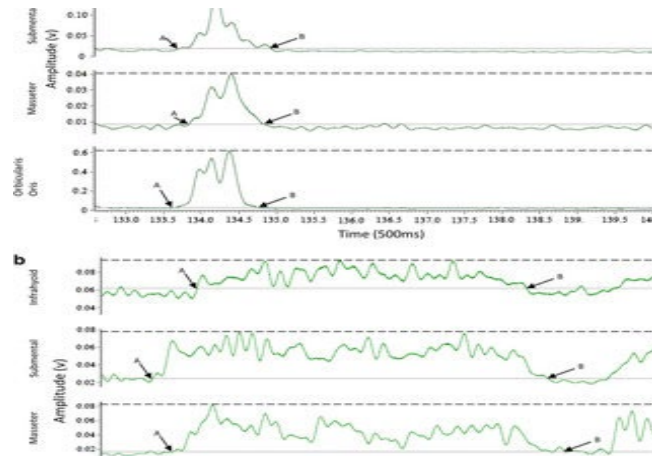
ALS (Amyotrophic Lateral Sclerosis)

- Amyotrophic Lateral Sclerosis (ALS) is a deadly neurological condition associated with weakening muscles and physical deformity
- Although there is no cure, early detection and treatment can help slow progression of t



Muscular Dystrophy

- Muscular Dystrophy is a condition in which the skeletal muscles gradually break down
- It can be fatal, especially in children and adolescents, EMG data is used to identify it so that necessary precautions can be taken



ECG and EMG in daily life

- **ECG tests are becoming more available for the public**
 - The Apple Watch can run an ECG test and give a basic evaluation of the result
- **EMG tests are being used in sports medicine**
 - Trainers of professional athletes use EMG data to evaluate the health of athletes' muscles and tailor workouts for individual athletes



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