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Analysis of ECG Signal for Detection of Human Heart Failure with the Optimized Study of Human Heart Valve

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ABSTRACT

This paper is just an introduction to electrocardiogram (ECG) monitoring. The objectives are to know about ECG, describe how cardiac contraction is related to ECG with reference to system of the heart. Indications given by the ECG monitoring, importance of modern bedside cardiac monitor. Procedure of ECG monitoring and study of human heart valve. Heart disease (HD) is very lethal and, relative to other causes of death, claims a disproportionately high number of lives throughout the globe. It is crucial to have an early and reliable detection procedure in order to save lives from the HD. Clinical test characteristics, the signal from an electrocardiogram (ECG), the signal from the heart sound, the signal from impedance cardiography (ICG), magnetic resonance imaging, and computed tomography are all able to diagnose HD in a patient (CT).

Key words: Electrocardiogram (ECG), Modern Intensive care unit (ICU), Arterial Blood Pressure (ABP), Pulmonary Artery (PA), Phonocardiogram, Internal Phonocardiogram, Systolic Intervals, Hypovolemia.

Introduction:

An electrocardiogram (ECG) is a quick test that can be used to examine the electrical activity and rhythm of your heart. Each time the heart beats, sensors affixed to the skin are utilised to detect the electrical signals. • Arrhythmias, which occur when the heart beats too rapidly, too slowly, or irregularly.

• Coronary heart disease, in which a buildup of fatty substances prevents or disrupts the heart's ability to receive blood.

• A heart attack, where the blood supply to the heart is suddenly cut off.

• Cardiomyopathy, in which the walls of the heart thicken and expand.

ECG testing can be done to determine how electrically the heart is working. Chest pain (heart attack), such as ST raised myocardial infraction (STEMI) [1] or non ST elevated myocardial infraction (NSTEMI)[2], are some reasons for doing an ECG. symptoms as breathlessness, murmurs[3], fainting convulsions, and strange turns. Monitoring of medications (such as treatment of drug-induced QT prolongation and management of overdose) (e.g., tricyclic overdose). changes in electrolytes, such as hyperkalemia monitoring during surgery when any type of anaesthetic is used. This covers both intraoperative and postoperative monitoring in addition to preoperative evaluation. Critically sick patients may benefit from short-term continuous monitoring using ECG. Holtermonitors, internal and external defibrillators, pacemakers, or biotelemetry are all options for continuous monitoring. [4].

Previous studies in normal subject and patientswith heart disease showsthe change in systolic time intervals reflects alterations in left ventricular performance .

The SA node is the source of the typical sinus rhythm, which has a resting heart rate of 50 to 100 beats per minute (Figure 6.12(a)). When the rate is below the lower limit it is referred to as sinus bradycardia, and when it is over the higher limit it is referred to as sinus tachycardia. Even in the absence of external disturbances like physical or mental stress, the heart rate is fundamentally regular but not entirely so while the body is at rest. These little fluctuations in heart rate are brought about by a constant balancing act between the two autonomic nervous system subsystems that affect the SA node's firing rate: higher parasympathetic activity lowers the rate, whilst increasing sympathetic activity raises the rate.

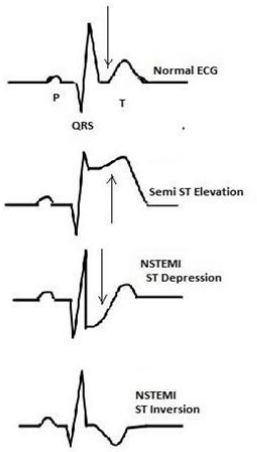

Fig. 1 Thrombosis Advisor on Acute Coronary Syndrome

Material and Methods:

Using microelectrodes, the cardiac potential can be measured. Research has established that a resting ventricular myocyte's membrane potential is approximately -90 mV. A typical ECG and its waves are obtained by placing electrodes on each leg arm and six electrodes on the chest (P, Q,R,S and T). Repeating waves signify the atrium and ventricle's sequential depolarization and repolarization. When the atrioventricular (AV) valve opens and the ventricle fills with blood, the P wave reflects the depolarization of the left and right atrium muscles. The QRS, which signifies ventricular muscle depolarization, arrives 0.16 seconds after the Pwave. During this time, the ventricles contract, causing the ventricular pressure to rise quickly. The T wave reflects repolarization of both ventricles and they begin to relax. NormallyECG's are recorded on paper with a vertical calibrationof 1 mV /cm and a speed of 25 mm / sec.In a normal record of ECG,a Q R S follows each P wave.

The two primary phonocardiograph sounds are (S1 and S2). When the atrioventricular (AV) valves (tricuspid and mitral) close at the beginning of systole, the first one, known as S1, is generated. When the aortic valve and pulmonary valve (semilunar valve) close at the end of systole, the second one, known as S2, is created.. A permanent record of these episodes is created via phonocardiography, which enables the identification of murmurs and subaudible sounds. In contrast, the stethoscope does not always capture the occurrence of these murmurs or sounds and is not always able to detect them all. Quantitating the noises made by the heart allows for the provision of information not easily accessible for more complex examinations and offers crucial details regarding the impact of different medications on the heart. The progression of a patient's disease can also be monitored using this method.[5-6]

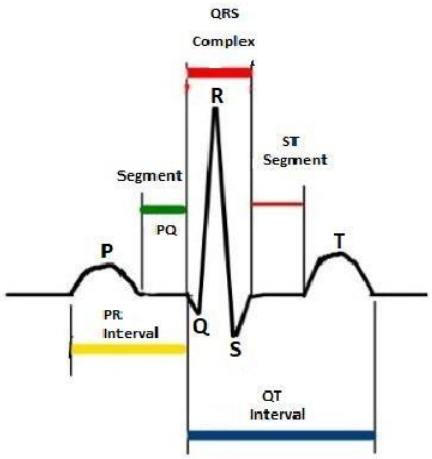

Fig 2: ECG ofa heart in normal sinus rhythm

The electrical potential of the heart is monitored from twelve different angles (referred to as "leads"), typically for ten seconds, in a traditional 12-lead ECG. The overall magnitude and direction of the electrical depolarization of the heart at each point of the cardiac cycle can be measured using this technique. [7] Healthy hearts have an orderly depolarization progression that begins with pacemaker cells in the Sinoatrial node, progresses through the atrioventricular node, descends into the bundle of His and into the Purkinje fibres, and spreads down and to the left throughout the ventricles with each heartbeat. [8]. ECG tracking characteristics result from this regular pattern of depolarization. The structure of the heart and the operation of its electrical

conduction system are both extensively revealed by an ECG to the experienced clinician [9]. The effectiveness of a pacemaker, the size and position of the heart chambers, the presence of any damage to the heart's muscle cells or conduction system, the effects of heart drugs, the rate and rhythm of heartbeats, among other factors, may all be assessed using an ECG [10]. Hypotension or tachycardia increase the risk of cardiovascular collapse brought on by hemorrhagic shock [11]. Hemorrhagic shock, which is indicated by a systolic blood pressure of 90 mmHg or less, is also associated with organ failure. [12]. It has been determined that delayed bleeding control, and frequently late discovery, is to blame for unnecessary trauma deaths.

Result:

The inaccuracy of fundamental science as early indicators of volume status highlights the significance of an accurate and timely indicator to detect early-stage hypovolemia. It is preferable for this marker to be obtained from widely-used patient monitoring equipment in order to lower adoption barriers and promote wider and faster utilisation [13]. While we addressed how useful ECG data is in multi-signal environments, the necessity to create practical and efficient non-invasive techniques for monitoring circulatory changes in humans has increased as a result of recent deep-sea and aerospace missions. The gravitational load brought on by the head-up tilt in the current investigation [14] amply demonstrates the impact on left ventricular function. Systolic time interval measurements would seem to offer a practical, accurate, and time-efficient way to quickly analyse the impact of gravitation on blood circulation in humans.

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