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COMPARATIVE STUDY OF ECG FINDINGS IN SMOKERS AND NON- SMOKERS AMONG PATIENTS IN A TERTIARYCARE HOSPITAL

D.ANJU[1], B. DEEPIKA[2], S. BHAVADHARANI[3], S. HARIPRASADH[4], K. ARUN[5], M. JENIFER[6], R. YAMINI[7], V. RAMNATH[8*]

[1,2,3,4,5,6,7,8*]MEENAKSHI COLLEGE OF ALLIED HEALTH SCIENCES, MEENAKSHI ACADEMY OF HIGHER EDUCATION AND RESEARCH (MAHER) DEEMED TO BE UNIVERSITY, TAMIL NADU, INDIA

ABSTRACT

Smoking is a major preventable cause of cardiovascular disease world wide, accounting for over 7 million deaths annually. Smoking damages the cardiovascular system, leading to atherosclerosis, cardiac remodelling and increased risk of MI, stroke and arrhythmias. ECG is a non invasive tool for assessing cardiac electrical activity and detecting early signs of cardiovascular diseases. Smoking induce ECG changes, such as QT interval prolongation, ST segment depression and T wave abnormalities have been linked to increased cardiovascular disease. To compare the ECG changes between smokers and non-smokers patients among a tertiary care hospital. The study included 100 patients, both smokers and nonsmokers, aged20 to 65, who visited the MMCHCRI outpatient department. According to the criteria, 61of the volunteers were smokers, and the remaining 39 were nonsmokers with no smoking or alcohol consumption. Following at horough examination, all subjects were asked to refrain from smoking for two hours before the ECG recording. The ECG was recorded in the Department of Cardiology lab at MMCHCRI. The following parameters were valuated: heart rate, p wave, PR interval, and QRS complex..The wave duration was measured in seconds using a bar and pie chart. The analysis shows that smokers the age group of >55 have a higher abnormality in ECG with high COPD cases. ECG changes were significantly more prevalent among smokers, including ST segment abnormalities, T wave inversions, QT prolongation, and arrhythmias. These findings reinforce smoking as a modifiable risk factor for cardiovascular disease. Early ECG screening and smoking cessation can play a crucial role in preventing cardiac complications.

INTRODUCTION

ANATOMYOFHUMANHEART

The heart is a hollow, muscular organ that resembles a cone and is roughly the size of a closed fist. At its broadest point, it measuresaround12cm (5inch) in length, 9cm (3.5 inch) in width, and roughly 6 cm (2.5 inch) in thickness. It weights roughly 310 grams for men and 225 grams for women. The functions of the heart are to pump blood and oxygen around the body and deliver waste products (carbon dioxide) back to the lungs to be removed. The heart consists of four chambers, each separated by valves which direct the flow of blood. Conditions affecting the heart include coronary heart disease, angina, heartattack, heart failure, heart valve diseases, abnormal heart rhythms including atrial fibrillation, heart inflammation, congenital heart disease (present from birth) and rheumatic heart disease. FIGURE1.1

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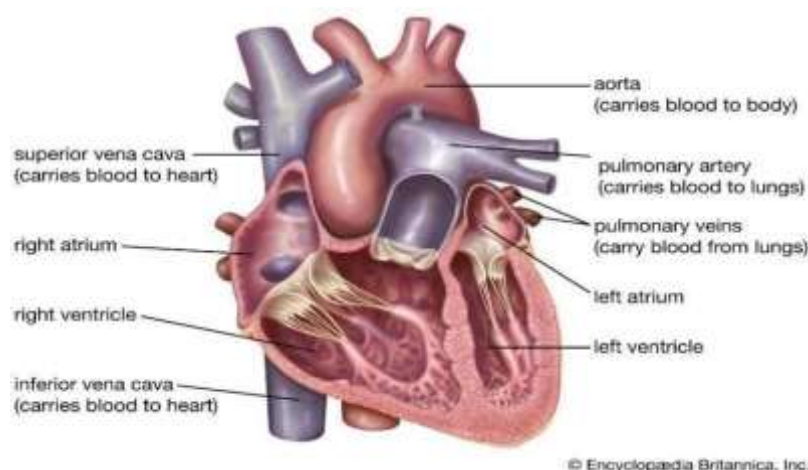
PERICARDIUM

The pericardium is a fibro serous sac which encloses the heart and the roots of the great vessels. It is situated in the middle mediastinum. It consists of the fibrous pericardium and the serous pericardium. Fibrous pericardium encloses the heart and fuses with the vessels which enter/leave theheart. Heart is situated within the fibrous and serous pericardial sacs.

A shear develops, it invaginates itself into the serous sac, without causing any breach in its continuity. The last part to enter is the region of atria, from where the visceral pericardium is reflected as the parietal pericardium. Thus parietal layer of serous pericardium gets adherent to the inner surface of fibrous pericardium, while the visceral layer of serous pericardium gets Adherent
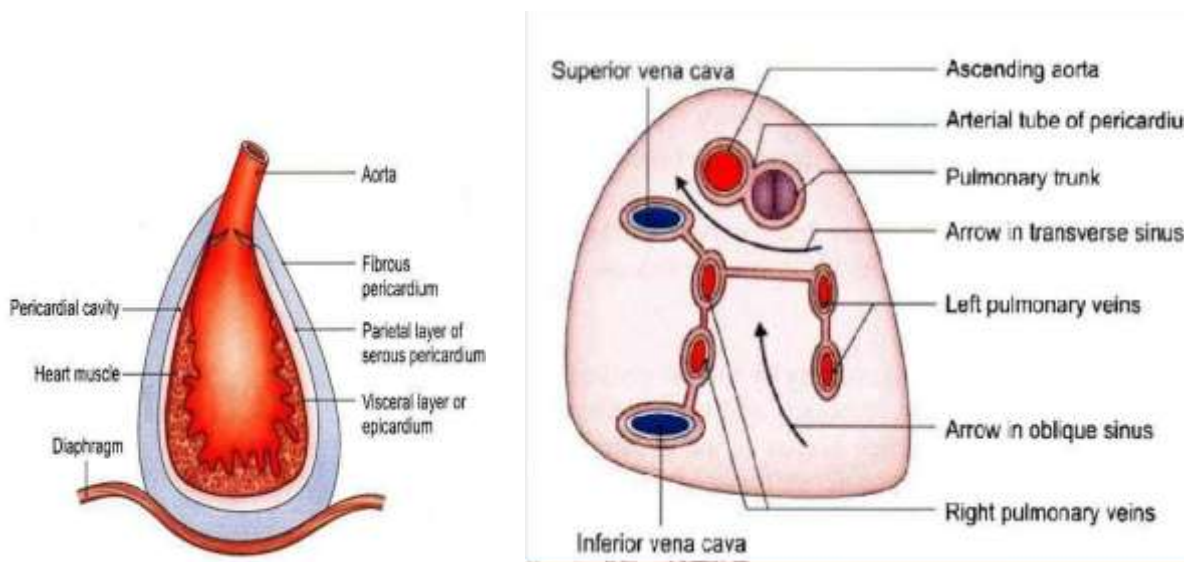

FIGURE1.2: Layersofpericardium&contents

EXTERNALFEATURES

The heart and roots of great vessels are embedded in the pericardial sac, approximately in the mid of the thorax. Thesize of the heart is slightly larger than a clenched fist. The heart is surrounded laterally and posteriorly by the lungs, and anteriorly bound by the sternum and medial sections of the ribs and sterno-costal joints. It has the shape of a three-sided pyramid with an apex (left anterior), a base (posterior), and 4 surfaces: Sterno-costal/anterior (formed by right ventricle), diaphragmatic/inferior (formed by left ventricle and part of right ventricle), left pulmonary (formed by left ventricle, in contact with left lung), and right pulmonary (formed by right atrium).

The heart appears trapezoid in the posterior and anterior views. As such, itconsistsof4 borders: Right (convex), Inferior (horizontal), left (oblique), and superior.

CHAMBERS OF THE HEART The cardiac chambers are consists of four chambers namely Right Atrium and Left Atrium (upper chambers) Right Ventricle and Left Ventricle (lower chambers) of the heart. They are separated by the heart valves, the make sure the blood keeps flowing in the appropriate systemic and pulmonary circulation.

RIGHTATRIUM

The right atrium is the right upper chamber of the human heart. It is located superiorly totherightventricleandanteromediallytotheleftatrium.Itreceivesthedeoxygenated blood from the body in the pulmonary circulation and empties the blood into the right ventricle.

RIGHT VENTRICLE

The right ventricle is the lower chamber of the heart which is positioned mostly anterior to the heart. It plays a prominent role is pumping for the oxygen-depleted blood to the lungs. As the deoxygenated blood is received from the right atrium which passes through the tricuspid valve into the lower right chamber (Right Ventricle), that pumps the blood to the pulmonary valve and to the lungs through the pulmonary artery.

LEFT ATRIUM

The left atrium is the left upper chamber of the heart which is located posteriorly left side of the heart. It plays a crucial role by returning oxygen – rich blood from the lungs through the pulmonary vein. And then the blood is pumped to the left ventricle through the mitral valve (bicuspid valve).

LEFT VENTRICLE

The left lower chamber is named as the left ventricle it plays a most prominent role as the integral part of the cardiovascular system. It receives the oxygenated blood from the left atrium and contracts the blood to the aorta (the great arteries) through the aortic valve. Comparing to the other chambers the left ventricle carries the high pressure load because it has to distribute the oxygen-rich blood to the entire body.

AIM AND OBJECTIVES

Aim:
Comparative study of ECG finding in smokers and non-smokers among patients in tertiary care hospital.

Objectives:
To compare the electrocardiographic (ECG) findings and parameters between smokers and non-smokers attending a tertiary care hospital, focusing on differences in heart rate, rhythm abnormalities, ST-segment changes, T-wave inversion, QT interval prolongation, and other relevant ECG markers.

MATERIALS AND METHODOLOGY

METHODOLOGY:

STUDYTYPE:

Prospective

STUDYDESIGN:

Cross-sectional

STUDYPOPULATION:

Adult Patients >18 years , Both smokers and non-smokers

INCLUSION CERTERIA:

Age: > 18with regular smoking

EXCLUSION CERTERIA:

Age >65 with severe respiratory disease, severe psychiatric illness

STUDYAREA:

Department of cardiology, MMCH & RI

SAMPLESIZE:

100

STUDYPERIOD:

3 Months

METHODS:

A single center prospective study was be done on 100 patients Males to assess abnormalities using electrocardiogram in smoker patients. Patients will undergo routine clinical examination, ECG for evaluation. Data was collected and analyzed.

DATAANALYSIS

All the data were arranged and tabulated and analyzed with the following statistical methods,
The results are expressed in percentage. The statistical calculation was done using
MISCROSOFT EXCEL.

AGEGROUPOFPATIENTS UNDERSTUDY:
TABLE1:
The pie chart represents the age-wise distribution of smokers included in the study, which aimed to compare electrocardiographic (ECG) findings between smokers and non-smokersinatertiarycarehospital.Amongthesmokers,27individuals(28%)were intheagegroupof20–25years,20individuals(21%)werebetween35and45years,26 individuals(27%)wereinthe45–55yearscategory,and27individuals(28%)wereaged
above55years.Thedistributiondemonstratesarelativelyevenspreadacrossthe selected age groups, with a slight predominance observed in the youngest (20–25 years) and oldest (>55 years) categories. This pattern suggests that ECG alterations related to smokingmayberelevantacrossabroadagerange,underscoringtheclinicalimportance of

early cardiovascular screening among both young and older adult smokers.

S.NO	Agegroup	Numberof patients	Percentage
`1.	20-35	27	27%
2.	35-45	20	20%
3.	45-55	26	26%
4.	55-65	27	27%

SMOKERSANDNON-SMOKERSAMONGPATIENTS:
TABLE:2
This pie chart illustrates the distribution of participants based on smoking status in a studycomparingECGfindingsbetweensmokersandnon-smokers.Outofatotalof100 participants, 62 (62%) were identified as smokers, while 38 (38%) were non-smokers. Thepredominanceofsmokersinthestudypopulationmayprovidevaluableinsightinto the cardiovascular effects of
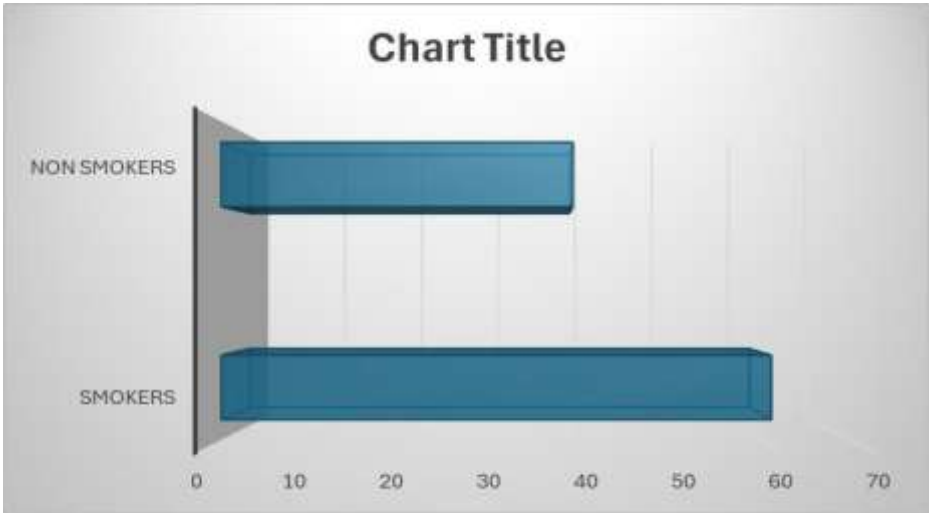

smoking as reflected in ECG parameters.

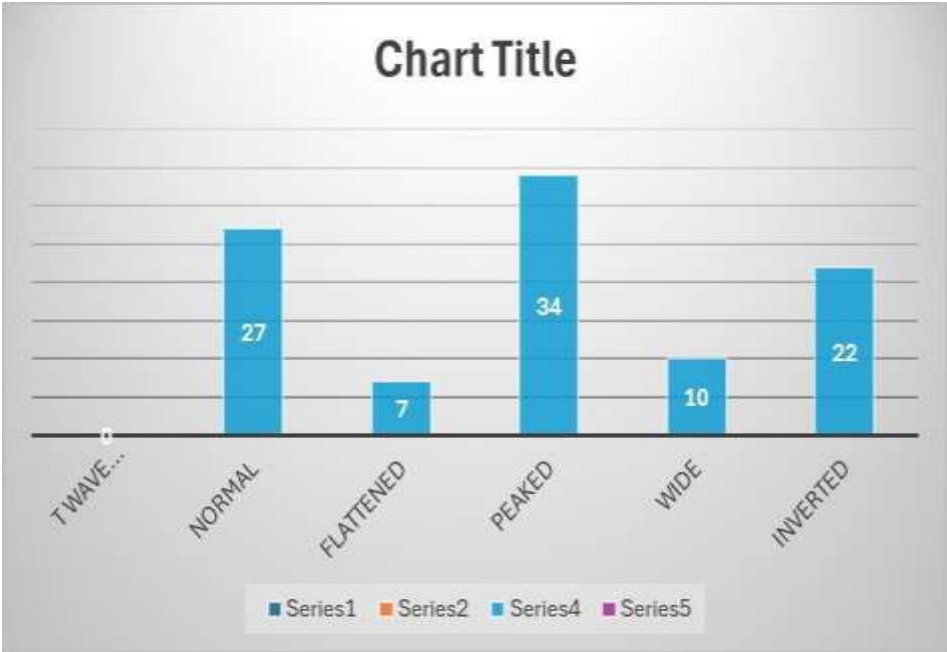| NO	PARTICIPANTS	NUMBEROFPATIENTS	PERCENTAGE
1.	Smokers	62	62%
2.	Non-smokers	38	38%

DIABETICANDNON-DIABETICAMONGPATIENTS:TABLE:3
Thispiechartrepresentsthedistributionofdiabetesamongparticipantsinthestudy.Of

thetotalsample,52participants(52%)werediabetic,while48participants(48%)were non-diabetic. The near-equal distribution allows for meaningful comparison of ECG findings between diabetic and non-diabetic individuals.
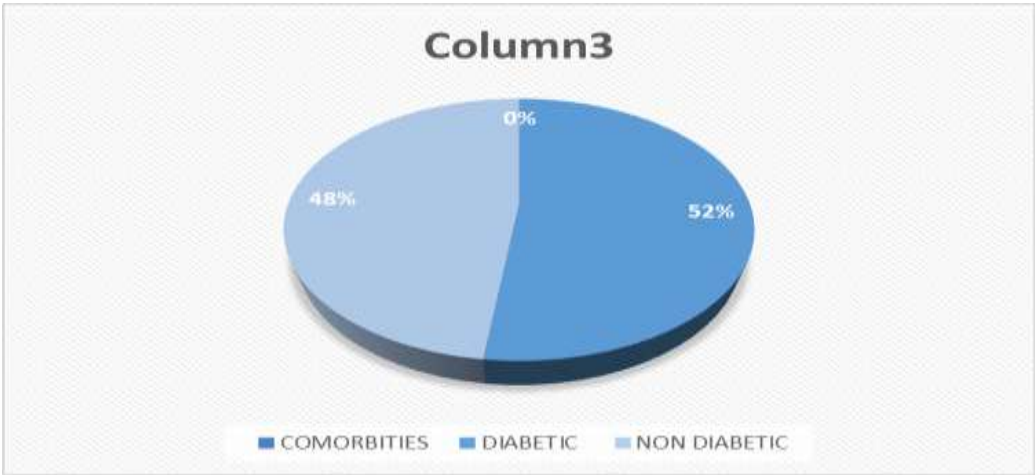
| S.NO	DIABETESMELLITES	NUMBEROFPATIENTS	PERCENTAGE
1.	DIABETIC	52	52%
2.	NON-DIABETIC	48	48%

TWAVEABNORMALITIESAMONGBOTHSMOKERSANDNONSMOKERSTABLE 4:
ThisbarchartillustratesthedistributionofvariousTwavepatternsobservedinthestudy population. Out of 100 participants, 27 (27%) exhibited normal T waves. Abnormal T wavechangesincludedpeakedTwavesin34individuals(34%),invertedTwavesin22 individuals (22%), wide T waves in 10 individuals (10%), and flattened T waves in 7 individuals (7%). The predominance of peaked and inverted T waves may indicate underlying myocardial stress or ischemia, particularly in high-risk groups such as smokersorhypertensivepatients.Thesefindingsemphasizethediagnosticrelevanceof T wave morphology in routine ECG interpretation.

S.NO	TWAVE ABNORMALITIES	NUMBEROFPATIENTS	PERCENTAGE
1.	Normal	27	27%
2.	Flattened	7	7%
3.	Peaked	34	34%
4.	Wide	10	10%
5.	Inverted	22	22%

STSEGEMENT CHANGES AMONG PARTICIPANTS :TABLE 5 :

This study also evaluated specific ECG changes, notably ST segment elevation and depression,amongsmokersandnon-smokers.Amarkeddifferencewasobservedinthe prevalence of ST elevation, with 42 smokers exhibiting this abnormality compared to only5non-smokers.Similarly,STdepressionwasnoted in 15 smokers, whereas 7 non- smokers demonstrated this finding. These results suggest a significantly higher incidenceofSTsegmentalterationsamongsmokers,potentiallyindicatinganincreased risk of myocardial ischemia or infarction in this group. The findings highlight the detrimental impactofsmoking on myocardial electrical activity and reinforce the need for early ECG screening in individuals with a history of tobacco use.
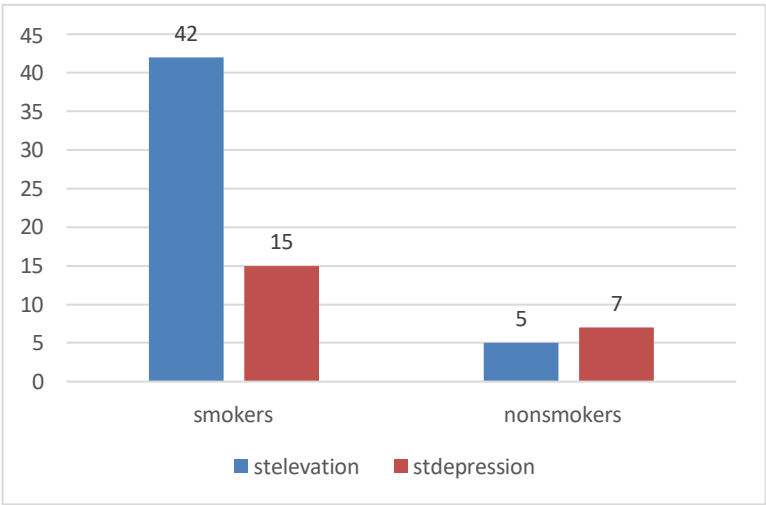
S.NO	STWAVEABNORMALITIES	SMOKERS	NON-SMOKERS
1.	ST elevation	42	5
2.	ST depression	15	7

**ARRTHYMIAABNORMALITIESAMONGPATIENTS:TABLE 6:**
This bar chart illustrates the distribution of various atrial arrhythmias observed in the study population. Among the 100 participants, atrial fibrillation was detected in 21 individuals (21%), atrial flutter in 24 individuals (24%), atrial tachycardia in 28 individuals (28%), and sinus arrhythmia in 27 individuals (27%). The relatively high prevalenceofatrial tachycardiaandsinusarrhythmiamayreflectunderlyingautonomic imbalance, myocardial irritation, or chronic exposure to risk factors such as smoking and COPD. These findings highlight the importance of ECG in identifying arrhythmogenic patterns early, particularly in patients with a history of tobacco use or cardiovascular comorbidities.

S.NO	ARRTHYMIA	NUMBEROFPATIENTS	PERCENTAGE
1.	Atrialfibrillation	21	21%
2.	Atrialflutter	24	24%
3.	Atrialtachycardia	28	28%
4.	Sinusarrythmia	27	27%

COMPARITIONOFCOPDANDSMOKERS:
TABLE7:
ThebarchartshowsthedurationofsmokingandCOPDamong62smokers.Ofthem,26%
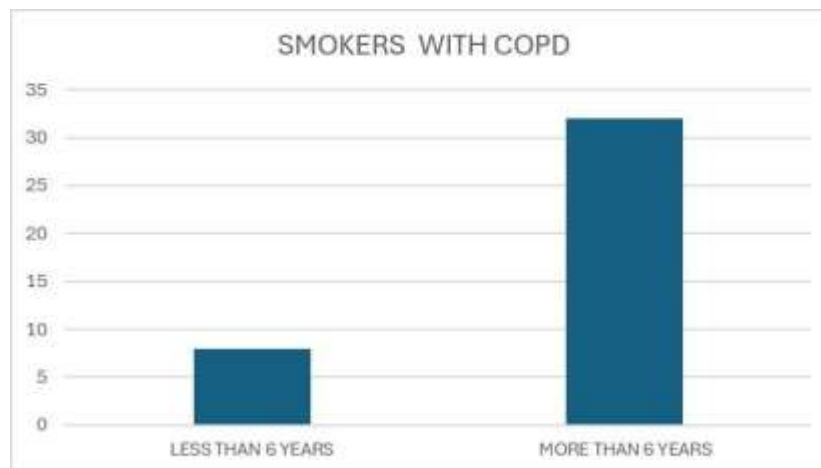
hadsmokedforlessthan6years,while74%hadsmokedforover6years.ForCOPD,40% had it for less than 6 years and 60% for more than 6 years. Among smokers with COPD, 20%hadsmokedforunder6yearsand80%forover6years.Thehighproportionoflong-termsmokerssuggestsacumulativeimpactofsmokingonrespiratoryhealthandhighlights the need for early cardio-pulmonary screening.

S,NO	DURATION OF SMOKINGANDCOPD	SMOKERSWITH COPD	PERCENTAGE
1.	<6YEARS	8	26%
2.	>6YEARS	32	74%

OnesampleT-Test

CONDITION	STATISTIC	Df	p
SMOKERS	33.2	99.0	<.001
DURATIONOF SMOKING	20.5	99.0	<.001
HTN	28.7	99.0	<.001
DM	29.8	99.0	<.001
COPD	30.1	99.0	<.001
DURATIONOF COPD	20.8	99.0	<.001
ARRYTHMIA	21.4	99.0	<.001
TWAVE CHANGEES	28.8	99.0	<.001
STSEGMENT ABNORMALITIES	26.1	99.0	<.001

DISCUSSION

- Nthisstudy 100 patients weretakenforevaluation.

- The study duration was 3 months. The study population consists of 100(100%) male age ranged from 20-65 years.

- Patientsweredividedinto4groups.Agegroupof20-35years-27(27%), 35-45years-20 (20%),45-55years26 (26%) and 55-65years27 (27%)

- Outof100patients,patients62(62%)weresmokers38(38%)werenon smokers.

- In100patients,52(52%)patientshaddiabeticof which38(38%)patientnon- diabetic.

- T wave patterns observed in the study population. Out of 100 participants, 27 (27%) exhibited normalTwaves.AbnormalTwavechangesincludedpeakedT wavesin34individuals(34%),invertedTwavesin22individuals(22%),wideT waves in 10 individuals (10%),and flattened T waves in 7 individuals (7%).

- ST segment elevation and depression, among smokers and non-smokers. A marked difference was observed in the prevalence of ST elevation, with 42 smokersexhibitingthisabnormalitycomparedtoonly5non-smokers.Similarly, ST depression was noted in 15 smokers, whereas 7 non-smokers.

- In the study population. Among the 100 participants, atrial fibrillation was detected in 21 individuals (21%), atrial flutter in 24 individuals (24%), atrial tachycardia in 28 individuals (28%), and sinus arrhythmia in 27 individuals (27%).

- The distribution of participants based on the duration of smoking and COPD. Among the 62 smokers in the study population, 16 individuals(26%) had a smoking history of less than 6 years, while 46 individuals (74%) had been smoking for more than 6 years. RegardingCOPDpatients,outof62,25individuals(40%)hadaCOPDdurationofless than6years,whereas37individuals(60%)hadbeenlivingwithCOPDformorethan6 years. The higher proportion of long-term smokers and COPD patients suggests a potential cumulative effect of chronic exposure to smoking on respiratory health.

CONCLUSION

CG changes were significantly more prevalent among smokers, including ST segment abnormalities, T wave inversions, QT prolongation, and arrhythmias. Thesefindings reinforce smoking asamodifiableriskfactorforcardiovascular disease. Early ECG screening and smoking cessation can play a crucial role in preventing cardiac complications.

Summary
This cross-sectional observational study was conducted over a period of 3 months at MMCHRItocompareECGfindingsin100malepatients—62smokersand38non- smokers—aged 20–65 years. A total of 100 patients who underwent ECG for diagnostic purposes wereincludedafterobtaininginformed consent.
SmokersshowedsignificantlymoreECGabnormalities,including: T wave changes (peaked, inverted)
STsegmentelevationand depression
Arrhythmias(atrialfibrillation,flutter,tachycardia) QT interval prolongation
Smokingduration>6yearswaslinkedwithhigherratesofCOPDandECGabnormalities.
"This study emphasizes that smoking is strongly associated with cardiac electrical disturbances,andhighlightstheimportanceofearlyECGscreeningandsmokingcessation to prevent cardiovascular complications."

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