# Analysis of biochemical cardiac markers in MI patients in Udaipur in relation to age, sex, social status and lifestyle

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## Abstract

Acute coronary syndrome [ACS] is a well-known and important reason responsible for morbid conditions and is also a mortality factor all over the world. [1] Patients can be categorized easily by their symptoms, and electrocardiogram observations and cardiac biomarkers also holds importance when it comes to diagnostically approach or prognostic approach [4]. The perfect diagnosis of ACS needs most reliable and accurate biomarker tests for diagnoses of necrosis of myocardium. Recently, the gold standard test is troponin which is a biomarker for MI injury and is generally done with creatinine kinase-MB [CK-MB], Myoglobin for quick undelayed diagnosis of the disease [5]. Miscellaneous and some specific markers for myocardial breakdown and necrotic conditions along with some inflammatory and hormonal activity however have both diagnostic as well as prognostic importance at the same time they are inferior to troponin [4-6].

The complicated mechanisms of ACS have lead to the development of various cardiac markers lately. The attest methods of estimations have proliferated and important information have been achieved regarding the pathology and physiological aspects of the diseases[32]. Many other miscellaneous biomarkers have come up during a lot of studies like the inflammatory markers, which are extremely helpful as far as finding out the risk factors. With the developing research in this field, many new ideas are coming up as latest perspectives on path-physiology Risk stratification has been a key part of many studies along with the investigations. With such advancement in this stream, we can now use these markers in clinical medicine and approach for future practices. The use of the new biomarkers in diagnostics is highly recommended.Apart from these, a few more in pipeline have promising future with regards to translational

research designs and vigorous studies in large populations with a positive and promising aspect is yet awaited(26, 27).

IPD and OPD wise distribution shows that the patients whom occur in IPD are due to serious illness or myocardial damage they admitted in IPD department. It is clearly indicate the complication related IHD are very serious in nature and needed to admit in hospital.

**Keywords:** Acute coronary syndrome Biomarkers, Cardiac profile, Myocardial infarction

## Introduction

When we measure many biomarkers along with point of care testing markers we can increase and enhance current diagnostic protocols for assessing patients. Cardiovascular disease has long been the leading cause of death in developed countries, and it is rapidly becoming the number one killer in the developing countries [11].According to current estimates, 61800 000 Americans have one or more types of cardiovascular disease [12]. Every year, almost 1 million patients in different states and 19 million patients from all over the world suffer from ACS and die. They do not exhibit prior symptoms also [13].There is considerable demand for diagnosis and treatment of the pathologic conditions that underlies these sudden cardiac events. This consensus document proposes new directions to prevent infarction and sudden cardiac events [14].

Other forms of thrombosis in no ruptured plaques may be described in the future. In all cases that involve a superimposed thrombus, the underlying lesion may be stenotic or non-stenotic. Non-stenotic necrosis is more prominent than stenotic plaques and is mainly responsible for culprit ruptured plaques [15]. If there is death of patient due to cardiac issue and thrombosis was not seen then it is presumed that coronary spasm or embolism to the distal intramural vasculature, or myocardial damage in relation to prior injury maybe responsible for episode of arrhythmia [16].

There are some well-known biomarkers which are known to be very specific and also sensitivity of them is accurate and they also indicate the particular pathway of the disease and in course of study researchers have used these as substitutes for getting their results during various clinical trials whenever there is a probability of any kind of clinical risk or medical advantages [16, 19]. There has to be a proper check on the different risk factors and complications while we study the interventions of treatments. The treatment intervention may be of using drugs or vaccinations. While studying the reliability and analyzing the result clinically we need to have a clear picture of the surgical device, the agents, modality and also its impact on the specific end point like stroke fractures of different regions relapsing stages which can be due to necrosis of the myocardium [18]. Undoubtedly, the above stated standard can also be not a proper solution for prognosis of some chronic disorders because a vast period of time is essential for the results of treatments to be attained and also the quantity matters in these subjects. We need to study on a large number of population to attain the specific therapeutic competencies and for evaluating the large groups definitely there is requirement of a large study population and more time[26, 29].

**Methodology and Statistical procedure**

**Standard value of z scoring was used**

The factors which were important as high risk factor were the race of the patients, the sex of the patients, and the age factor was extremely important. We have to rule out the impact of age, race and sex as variable factors of risk. Potential deviations and variations in the assay duration in the laboratory were to be counted as variables of risk factors.

There were some patients where the determination of all the risk factors was done twice. In such cases the levels were adjusted and the average was done.

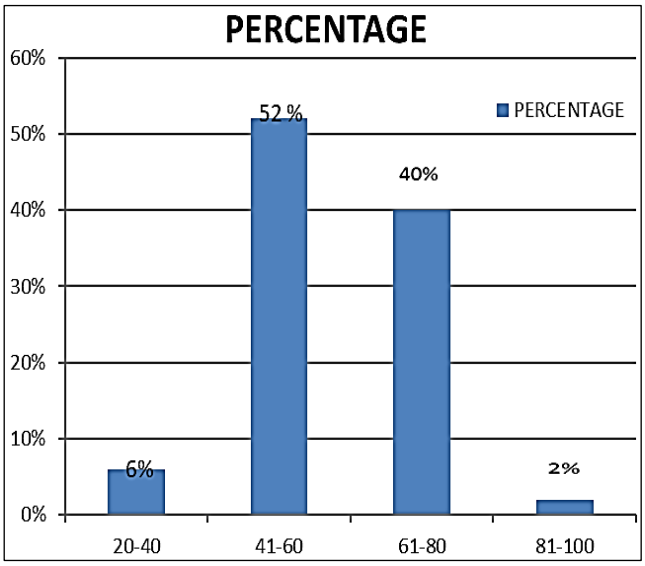
The acute coronary syndrome prevalence according to different groups of age was calculated by and evaluated using a chi-square test.

We also evaluated the impact of smoking cigarettes over the condition of disorder of atherosclerosis.

We also took into account the impact of different variable and multiple numbers of risk factors which can indirectly affect the severity of the disorder and the extent of damage done. Evaluation of all of these was made. Analysis was accordingly done with respect to the duration of lesions according to different races, sexes, and life style habits like cigarette smoking and alcohol consumption. There were also cases and patients which had no factors of risk involved. Comparison of these was also made with the patients who had one risk factor. They were also compared with cases having two risk factors. The comparison of such patients was also done with those having three risk factors involved. 4 risk factors patients were also compared with no risk patients. 2 sided statistical analyses were made.SPS software was used for all analyses.

**Interpretations**

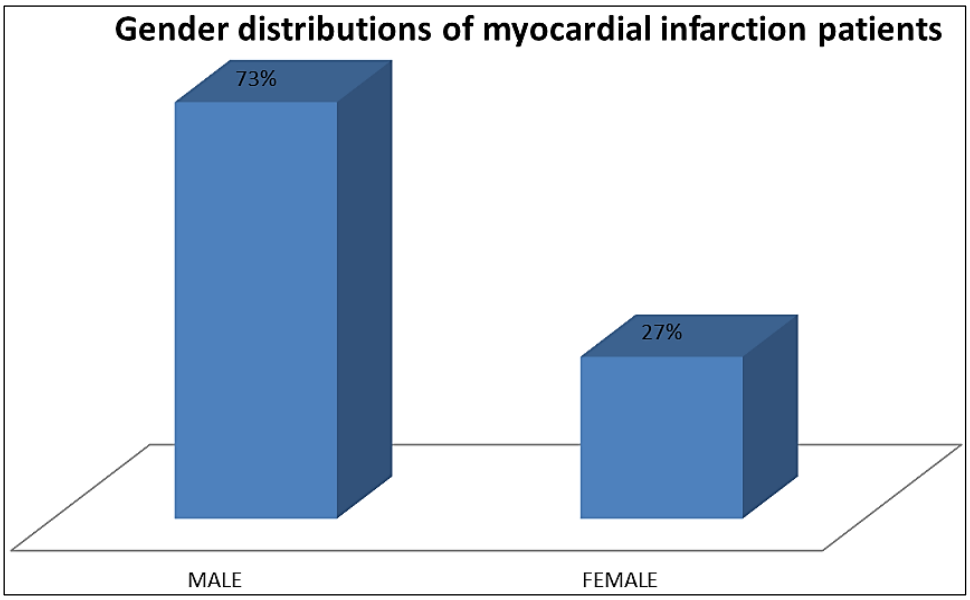
**Distribution of MI patients with respect to age**




**Graphical representation of different age group percentage of patients**

**Category of patients suffering from the disorder with respect to sex**

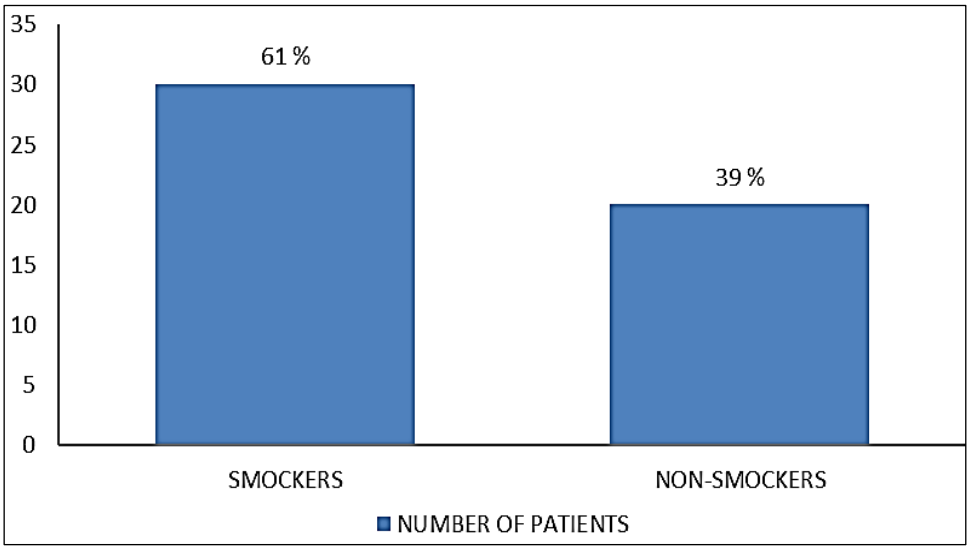
The females are less prone to the disorder.



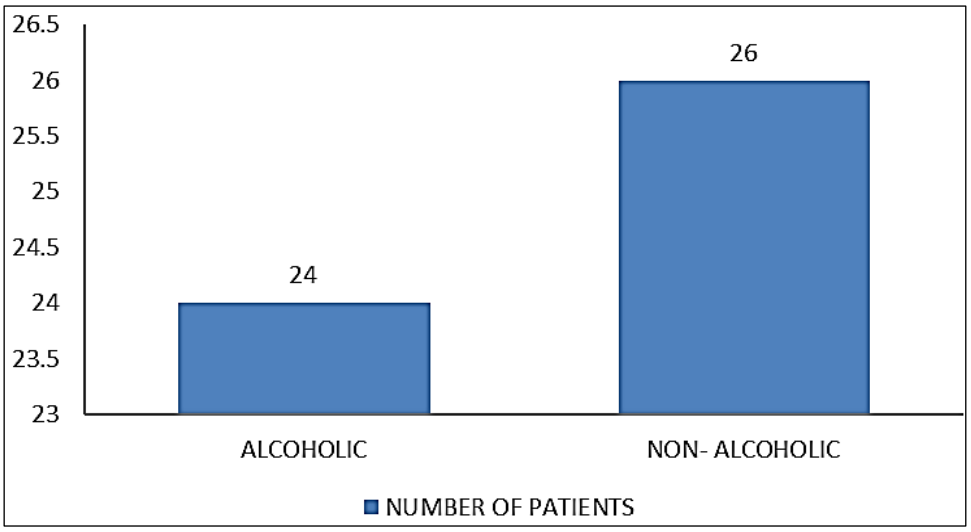

**Gender distributions of myocardial infarction patients**

**Categories made according to the life style habits**

**1. Cigarette smoking cases**



**Graphical representation of smoking and their distribution**




**Graphical representation of social habits of Alcoholism and their distribution**

These enzymes exhibited significant elevation as compared to the control cases.

**The concentration of AST in both groups (cases and controls)**

| Cases | AST |
|---|---|
| Normal (25) | 24.00±5.99 U/L |
| With acute myocardial infarction (AMI) (25) | 55.12±16.54 U/L |

**b) The concentration of LDH in both groups (cases and controls)**

| Cases | LDH |
|---|---|
| Normal (25) | 409±112.22 U/L |
| With acute myocardial infarction (AMI) (25) | 925±164.75 U/L |

**c) The concentration of CKMB in both groups (cases and controls)**

| Cases | CK-MB |
|---|---|
| Normal (25) | 13.66±4.12 nG/ML |
| With acute myocardial infarction (AMI) (25) | 80.3±44.26 nG/ML |

**d) The concentration of CPK-TOTAL in both groups (cases and controls)**

| Cases | CPK-TOTAL |
|---|---|
| Normal (25) | 25.56±3.82 U/L |
| With acute myocardial infarction (AMI) (25) | 330.45± 27.26U/L |

**e) The concentration of TROPONIN I in both groups (cases and controls)**

| Cases | TROPONIN-I |
|---|---|
| Normal (25) | 0.08 ± 0.02nG/ML |
| With acute myocardial infarction (AMI)(25) | 1.52 ± 0.50 nG/ML |

Mean ±S.D. is taken.
P<0.001 on comparing the result with control group.
Unit is expressed in international units per liter (IU/L).

Serum enzyme level seen for AST show standard deviation within the range of 23.94±5.90 U/L, but excessive variation in some patients affected from AMI. These patient show ranges of AST biomarker between 55.12±16.54 U/L that varies more than control group of patients. LDH value were show standard deviation in their value 409±112.22 U/L which was also less than AMI patient's variation that was 925±164.75 U/L in value of IU. CK-MB value was also affected from ACS show standard deviation in their value 13.66±4.12 nG/ML which was also less than AMI patient's variation that was 80.3±44.26 nG/ML in value of nG/ml. CPK-TOTAL value was also affected from ACS show standard deviation in their value 25.56±3.82 U/L which was also less than AMI patient's variation that was 330.45± 27.26 U/L in value of nG/ml. Troponin-I value was also affected from ACS show standard deviation in their value 0.08±0.02 nG/ML which was also less than AMI patient's variation that was 1.52±0.50 nG/ML in value of nG/ml.

**a) Cases of acute myocardial infarction who show increased level of biomarkers**

| Reference range, number of cases, percent of cases | Aspartate Transaminase (U/L) units per liter |
|---|---|
| Reference range | From 0.0 till 37 |
| (n) | 21 |
| % of cases | 87% |

**b) Cases of acute myocardial infarction who show increased level of biomarkers**

| **Reference range, number of cases, percent of cases** | **Lactate Dehydrogenase (U/L)** |
|---|---|
| Reference range | 135-225 |
| (n) | Twenty one |
| % of cases | More than eighty percent |

**c) Cases of acute myocardial infarction who show increased level of biomarkers**

| **Reference range, number of cases, percent of cases** | **Creatine Kinase MB (ng/ml)** |
|---|---|
| Reference range | From 0.0 to 6.6 |
| (n) | Twenty-four |
| % of cases | More than ninety five percent |

**d) Cases of acute myocardial infarction who show increased level of biomarkers**

| **Reference range, number of cases, percent of cases** | **Creatine Phosphokinasetotal (U/L)** |
|---|---|
| Reference range | From thirty seven till 308 |
| (n) | Twenty one |
| % of cases | More than eighty % |

**e) Cases of acute myocardial infarction who show increased level of biomarkers**

| **Reference range, number of cases, percent of cases** | **Troponinng/ml** |
|---|---|
| Reference range | From 0.0 to .013 |
| (n) | Twenty three |
| % of cases | More than 90 percent |

More than ninety five percent cases suffering from acute myocardial infarction showed elevated range of creatine kinase MBMore than ninety percent of cases had increased range of lactate dehydrogenaseMore than eighty five percent cases observed increased concentration of aspartate transferase activityMore than ninety percent cases reported increased range of Troponin-IHigh range of creatine phosphokinase total was seen in about eighty percent of cases suffering from acute myocardial infarction.

Status of serum biomarker enzymes:

**Assay of cardiac biomarker profile: (CPK Total)**

| **S.N.** | **Cardiac marker** | **Increased in % also** | **Normal in % also** |
|---|---|---|---|
| 1. | CPK (Total) | Twenty one cases<br>More than 80% | Four cases<br>Less than 20% |

**Assay of cardiac biomarker profile: (CKMB)**

| S.N. | Cardiac marker | Increased in % also | Normal in % also |
|---|---|---|---|
| 2. | CK-MB | Twenty four cases<br>More than 95% | One case<br>Less than 5% |

**Assay of cardiac biomarker profile: (TROPONIN I)**

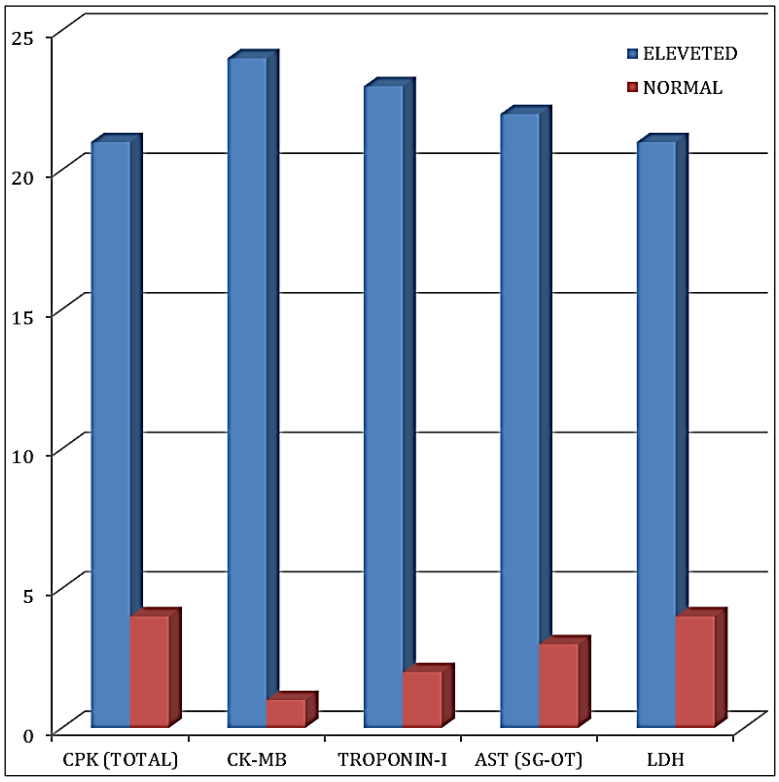
| S.N. | Cardiac marker | Increased in % also | Normal in % also |
|---|---|---|---|
| 3. | TROPONIN-I | Twenty three<br>More than 90% | Two cases<br>Less than 10% |

**Assay of cardiac biomarker profile: (AST)**

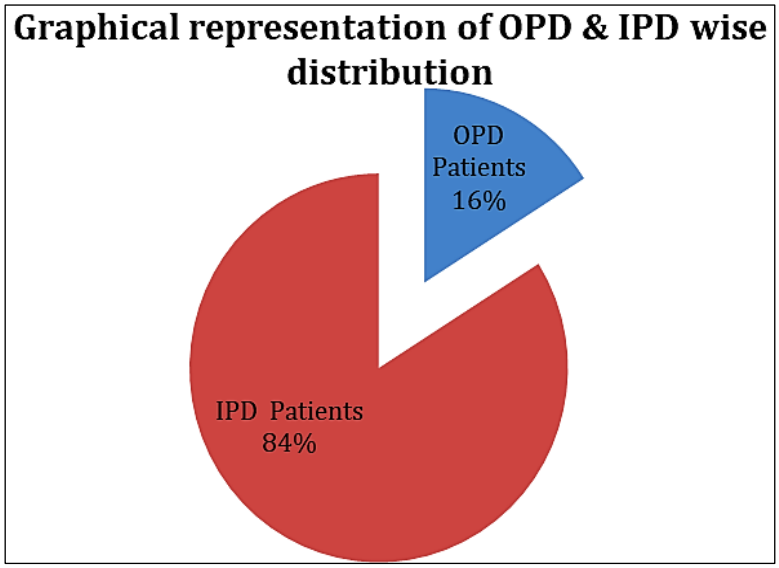
| S.N. | Cardiac marker | Increased in % also | Normal in % also |
|---|---|---|---|
| 4. | SG-OT | Twenty two cases<br>More than 85% | Three<br>Less than 15% |

**Assay of cardiac biomarker profile: (LDH)**

| S.N. | Cardiac marker | Increased in % also | Normal in % also |
|---|---|---|---|
| 5. | LDH | Twenty one cases<br>More than 80% | Four cases<br>Less than 20% |



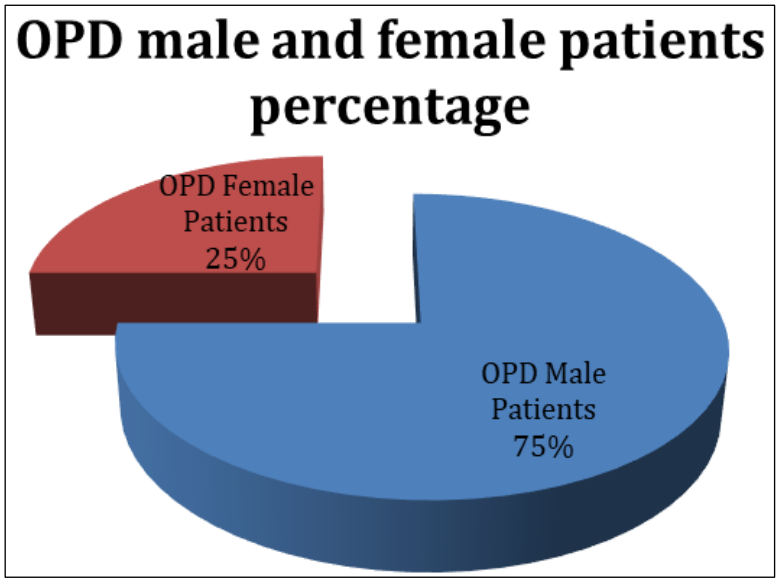
**Graphical representation of cardiac biomarker analysis in patient's sample OPD & IPD wise distribution:** IPD and OPD distribution shows that the patients which occur in IPD are due to serious illness or it may be due to myocardial damage they admitted in IPD department.



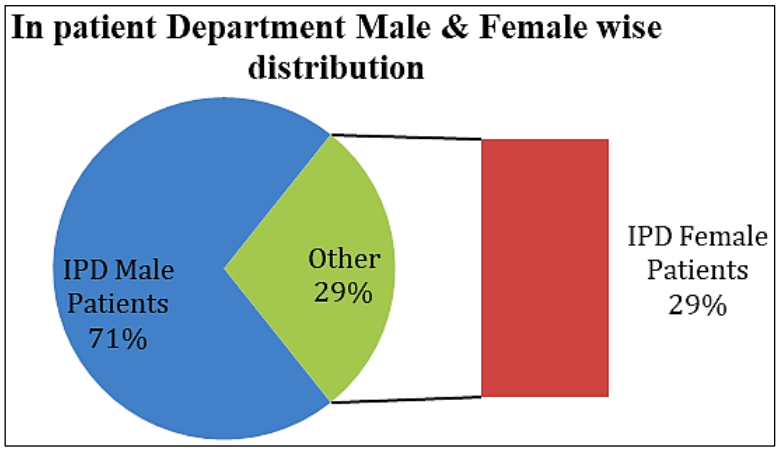

IPD patients are more prone to develop MI and it may cause due to the sever raise level of cardiac biomarker in IPD patient.

**OPD Male &Female wise distribution:** Male and female wise distribution are as follows patients in OPD it shows that male patients in OPD are more prone to have raise cardiac biomarker enzyme level. It also show males have higher incidence of develop ischemic heart diseases.

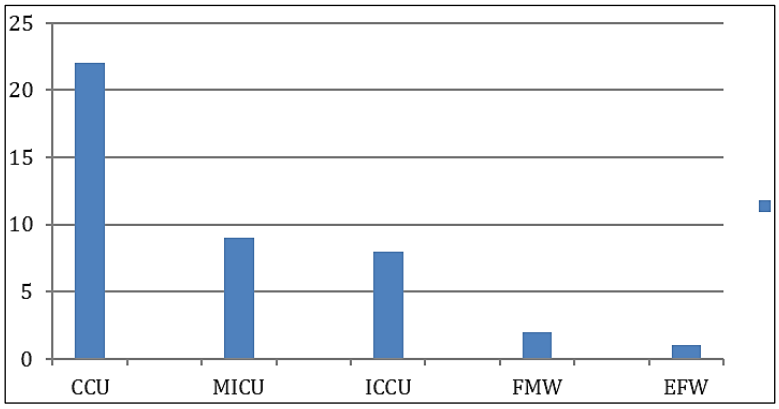
**Graphical representation of OPD male female patient's distribution**



**IPD Male &Female wise distribution:** IPD male and female wise distribution also shown as the OPD result in which males was more prone to develop raise cardiac biomarker level and raise incidence to develop acute myocardial infarction (AMI).




**IPD ward wise distribution of patients**




**Discussion**

There are different basis on which the acute myocardial disorder is diagnosed. One basis is the presentation of clinical signs and symptoms by the patient. Another base for diagnosing the disease may be alterations in the ECG. A very important base for the diagnosis of ACS may be the important and characteristically altered activity of the biomarker enzymes.

In cases of acute myocardial infarction, there is raised activity of all serum biomarker enzymes. This kind of association of the markers with the AMI is due to the mechanism of releasing enzymes in the circulation through the myocardium. There are various factors which affect the amount of appearance of the enzymes in the circulation. They also have impact on the rate of decrease in the enzyme level in the myocardium. There should also be a relative balance between the supply of O2 to the myocardium and demand of oxygen by the myocardium.

There is also a possibility that there is involvement of sources other than myocardium. Both the factors are responsible for the concentration of enzymes in the circulation.

One factor is the enzymes releasing from the myocardium itself and the other factor is the enzymes in circulation by some other sources. They affect the rate of appearance of enzyme in circulation or serum.

Some studies show that there is a metabolic impact which results in the elevated levels of the biomarker enzymes in the circulation.

There may be full or half reversibility in some cases. The raised concentration of creatine kinase MB can explain the mechanism of damages and side complications of the cells involved. These effects can be as outcome effects of any other mechanism and not less oxygen availability or necrosis of myocardial tissue or cell.

There is a less sensitivity of LDH assay and the increased concentration of the circulating enzyme with regard to the criterion of diagnosis.

**The criterion of age in relation to MI**

We took total fifty cases. Out of the total cases three patients were falling in the age group range of twenty to forty. The approximate percentage of this group was 6%. The age range of 20-40 was around six percent.26 (52%) patients were in the age of 41 – 60, 20 (40%) were in the age range -61 -80 and 1 (2%) patient was in the age of 81-100 years due to the decrease life span of cardiac patients cause less number of patients after the eighty years of life span. The criterion of age distribution revealed the fact that patients who were more than forty years of age were more affected. This category of patients was likely to suffer more from the disorder.Quoting about the survival of age groups we found that during the damage done to myocardium the eighty years old patients could not survive after the attack. The percentage of survival was quite less. Our study show similar result also matches with P K shah and Mamta *et al*. pattern.

**Category of MI patients according to the sex or gender**

We studied fifty patients suffering from the MI attack. Also taking accounts the control group, 36 (72%) fell in male category and 14 (28%) fell in female category.

The study of the research according to sex category proved that the females were less likely to suffer from the attack of myocardial infarction in comparison to other category of males.

Males are mostly prone to ACS and cardiac diseases then females. This study results match with PK shah results in which, there were 17 males and 3 females in control. 41 males and 9 females were screened in abnormal cases (myocardial infarction).

**Other miscellaneous factors like social status**

**Cigarette smoking**

Among the fifty MI cases, sixty percent were smokers. This means thirty patients had the habit of smoking. The other category was of non-smokers. Around forty percentages of total cases fell in the category of non-smokers. This means the cases in this category were twenty.

The results that were obtained proved that the patients who did not have the habit of smoking were less likely to suffer from the attack of MI as compared to the other category of smokers who are more likely to get the attack.
Males are more prevalent to smocking and they mostly acquire heart and lung diseases due to these unhealthy habits in society.
This study results of social habits match with the result and outcome of Ridkan *et al*. and Shweta S *et al*. which proved that non-smokers are less prone to the attack in comparison to smokers.

**Drinking alcohol**

Among the fifty total cases of MI/myocardial infarction more percentage was of patients who consumed alcohol in comparison to the other group who did not take alcohol.
The results obtained proved that patients who were taking regular alcohol as a habit were drastically affected and the patients who were not taking the drink were less affected.
The reason behind this is that the males are more prone to the habit of taking alcohol and they mostly acquire liver diseases due to these unhealthy habits in society. This study results of social habits of alcoholism match with the result and outcome of Shweta Sand Ridkan *et al*. outcomes. In Shweta S outcome represented Among the 108 myocardial infarction patients 66 (61.1%) were alcoholic and 42 (38.8%) were non-alcoholic. It shows that alcoholics were more affected than non-alcoholics.

**Statistical analysis of cardiac biomarker result and outcome:** Serum enzyme level of AST show standard deviation within the range of 23.94±5.90 U/Lits standard variation cause in some patients that directly fluctuation in its value in AMI patient 55.12±16.54 U/L that varies more than control group of patients. LDH value were show standard deviation in their value 409±112.22 U/L which was also less than AMI patient's variation that was 925±164.75 U/L in value of IU. CK-MB value was also affected from ACS show standard deviation in their value 13.66±4.12 nG/ML which was also less than AMI patient's variation that was 80.3±44.26 nG/ML in value of nG/ml. CPK-TOTAL value was also affected from ACS show standard deviation in their value 25.56±3.82 U/L which was also less than AMI patient's variation that was 330.45± 27.26 U/L in value of nG/ml. Troponin-I value was also affected from ACS show standard deviation in their value 0.08±0.02 nG/ML which was also less than AMI patient's variation that was 1.52±0.50 nG/ML in value of nG/ml. this pattern of statistical analysis match with Mamta *et al*., and P K shah result analysis.
The research proves that there was significant increase in the serum level of all types of biomarker enzymes.
In the study, out of total cases of AMI majority exhibited increased CK-MB. Twenty-four cases fell in the increased range. This was approximately more than ninety percent of the total cases. Less than 5 percent showed a normal level of the biomarker enzyme.

Aspartate Transaminase enzyme showed increased range than normal in about eighty eight percent patients. Twenty-two cases reported high range of the biomarker. Less than fifteen percent cases reported a normal level of the biomarker enzyme.

The level of Troponin in the serum in AMI patients was reported as more than ninety percent elevated as twenty three patients had increased troponin in their serum. Only two patients were falling in the normal range with respect to troponin level. This was approximately eight percent of the total cases.

More than eighty percent of the AMI patients had elevated level of CPK total. Twenty-one cases out of the total reported with increased CPK. Less than twenty percent of cases showed normal range of the biomarker enzyme.

Talking about lactate dehydrogenase enzyme the number of cases of AMI which reported normal level was only four that is about sixteen percent. Rest of the patients with AMI reported a high elevated range of LDH in their serum. This accounted for more than eighty percent.

The above stated results and observed values can be compared with the previous studies done by various scientists.

Our study show similar result also matches with P K shah and Mamta *et al*. pattern.

Serum enzyme level of AST show standard deviation within the range of 23.94±5.90 U/L, but there was excessive variation in some patients which affected from AMI. These patient show ranges of AST biomarker between 55.12±16.54 U/L that varies more than control group of patients. LDH value were show standard deviation in their value 409±112.22 U/L which was also less than AMI patient's variation that was 925±164.75 U/L in value of IU.

CK-MB value was also affected from ACS show standard deviation in their value 13.66±4.12 nG/ML which was also less than AMI patient's variation that was 80.3±44.26 nG/ML in value of nG/ml. CPK-TOTAL value was also affected from ACS show standard deviation in their value 25.56±3.82 U/L which was also less than AMI patient's variation that was 330.45± 27.26 U/L in value of nG/ml. Troponin-I value was also affected from ACS show standard deviation in their value 0.08±0.02 nG/ML which was also less than AMI patient's variation that was 1.52±0.50 nG/ML in value of nG/ml. This study results match with PK shah results in which also indicated clear correlation between IHD and elevated biomarker levels.

Serum enzymes level was highly elevated in our study.

Enzymes creatine phosphokinase total (CPK (T), CK-MB, Troponin-I, serum glutamate oxaloacetate (SG-OT), lactate dehydrogenase (LDH) showed significant elevation and increase in comparison to the control. These value and results also match with the result and outcome of Shweta S and Ridkan *et al.* study outcomes.

**OPD & IPD wise distribution:** IPD and OPD distribution shows that the patients which occur in IPD are due to serious illness or it may be due to myocardial damage they admitted in IPD department. This study results match with PK shah results in which also indicated clear correlation between OPD and IPD in that IPD has more elevated biomarker levels then OPD.

**OPD Male &Female wise distribution:** Male and female wise distribution was as follows patients in OPD it shows that male patients in OPD are more prone to have raised cardiac biomarker enzyme level. It also show males have higher incidence of develop ischemic heart diseases it also match with others these results also correlate with the study of Mair J *et al*. it helpful to find out the correct association.

**IPD Male &Female wise distribution:** IPD male and female wise distribution also shown as the OPD result in which males was more prone to develop raise cardiac biomarker level and raise incidence to develop acute myocardial infarction (AMI).These results also similar to study of Panteghini M and Pagani F *et al*., study in which males in OPD are more prone to develop IHD.

**IPD Ward wise distribution of patients**

In IPD patients CCU have more patients of raise cardiac biomarker level and it also helpful in prognosis to assess the patient's situation which affected from acute ischemic heart diseases. In the result we find CCU has most of the patients 22 (50%) of the total, after the CCU MICU has most number of patients which has 9 patient (21.42%). ICCU has most patients after the MICU which was 8 in number and 19.04 percentages of patients. FMW has only 2 patients which percentage 4.76% and last and least patients occur in EFW which was only 1 and their percentage was 2.38%.These outcomes our study also similar to Galvani M and Ottani F*et al*., study and their pattern.

**Summary and Conclusion**

A thorough study is important with respect to the cardiac markers like:

Total creatine phosphokinase (CPK), CPK-MB, LDH (lactate dehydrogenase), SGOT (serum glutamate oxaloacetate), cTn-T (troponin-T), cTn-I (Troponin-I)

All these above are important and significant for proper diagnosis and evaluating the MI (myocardial infarction).

The more risk group was of males as compared to females for cardiac disorder.

cTn-T is more suitable and more reliable biomarker.

For detection of the MI Troponin-T is more reliable cardiac marker.

There was a high and significant increase in the activity of CK-MB in comparison to the activity of other 2 biomarkers for cardiac disorder which are aspartate transferase and lactate dehydrogenase as early bio markers of acute myocardial infarction.

The magnitude of the increased enzyme levels of the biomarker enzymes will decide the extent of myocardial necrosis can be made by the magnitude of elevated serum enzyme levels.

In IPD patients CCU have more patients of raise cardiac biomarker level and it also helpful in prognosis to assess the patient's situation which affected from acute ischemic heart diseases. In the result we find CCU has most of the patients 22 (50%) of the total, after the CCU MICU has most number of patients which has 9 patient (21.42%). Because ischemia and its related sign and symptoms associated with higher fatality rate which not easily subside but with some detection and early diagnosis

strategies prevent its further complicated situation by early detection and cure of disease. Biomarker and cardiac enzyme early detection also helpful in avoid complication regarding to ischemic heart diseases and avoid deaths.

ICCU has most patients after the MICU which was 8 in number and 19.04 percentages of patients. FMW has only 2 patients which percentage 4.76% and last and least patients occur in EFW which was only 1 and their percentage was 2.38%. Cardiac marker elevations in their value are very low in general wards like FMW and EFW. Biomarker elevation also very less amount in female patients which correlate with the study perform by another scientist. Ischemic heart diseases most prevalent in men and it also shows in our study that but the females are less affected from ischemic heart diseases. Cardiac biomarker study and assessment also very important because in ischemic heart diseases we have very less time and early diagnosis and quick decision making play a vital role.

Social habits like drinking and smoking also enhance chances of increase cardiac enzyme level and increase risk to produce ischemic heart diseases. So, needs to avoid these habits to prevent rise in morbidity and mortality associated with MI, in India we have one of the largest population in the world which also make us a mostly affected from IHD. We have lack of medical facility and lack of doctors so we need a proper strategy to prevent valuable human losses. Further research and advance technologies also needed to quick diagnosis it helps in various parameters. We also have most of deaths due to IHD in the world but with effective preventive measures we can subsides this calamity.

Other way round, it can also be stated that important proof which an enzyme can predict is needed for reducing any kind of risk.

All this can lead to providing of safeguards which can stipulate market withdrawal techniques in relation to drug approvals that have a strong basis of increased rate of approvals of the respective authorities.

**Conclusion of study**

The biomarkers are aiding in the field of path physiology, and providing new insights as far as diagnoses is concerned and also to manage serious CVD patients.

Now we have a multiple setting which involves

Multiplex assays

Personalizing biomarker systems

Increased frequency of reporting

Less costing

Multimarker system is almost a new insight into the areas of research. We have been able to overcome inaccurate and less appealing assays.

We recommend optimally best and clinically suited purpose of diagnosis for decreasing the morbidity and rate of mortality which is a serious concern to the population.

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