



A STUDY OF THE RELATIONSHIP BETWEEN ENVIRONMENTAL TEMPERATURE AND DEATH DUE TO MYOCARDIAL INFARCTION

Pathology

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ABSTRACT

Myocardial Infarction is an acute medical emergency with high prevalence across the world and is a leading cause of death across all age groups. Myocardial infarction is caused by many predisposing factors such as presence of atherosclerotic plaques, hypertension, diabetes, increased age etc. Among environmental factors temperature is an important parameter to be considered while studying the prevalence of myocardial infarction in a geographical region. Our study is focused in investigating relationship between various temperature parameters and occurrence of deaths caused due to myocardial infarction. We collected pathological records of 299 Autopsies across all age groups and gender of people whose primary cause of death is myocardial infarction. We did a comparative analysis between number of deaths, maximum temperature, minimum temperature, temperature difference, average temperature. We finally conclude that prevalence of myocardial infarction increases on both ends of the temperature spectrum and increased difference in temperature in a day. By conducting this study we have observed the effect of temperature on myocardial infarction and use it for other further study and prevention of disease.

KEYWORDS

myocardial infarction, environmental temperature, temperature difference.

INTRODUCTION

Myocardial infarction is an Ischemic Heart Disease leading to death of myocardial tissue due to inadequate blood and oxygen to the coronary arteries supplying the heart. This acute ischemic injury to the heart can occur due to Myocardial ischemia caused by Atherosclerotic Plaque, Increased demand of heart and the hypertrophy of heart muscle, intramural hemorrhage, coronary vasospasm, plaque rupture, arteritis, thrombosis, embolism, and other thrombotic diseases.⁽¹⁾ Myocardial Infarction is a severe medical emergency which needs urgent medical intervention. Myocardial Infarction is a rising concern for the Indian population which has been steadily rising in recent times.

Myocardial infarction has many risk factors including age, sex, race etc. It also depends upon pre-existing conditions such as hypertension, dyslipidemia, excessive stress, diabetes etc. Environmental factors also contribute to occurrence of myocardial infarction such as temperature, humidity etc.⁽²⁾

There is a probable relationship between myocardial infarction and temperature as extreme temperatures on both sides of the spectrum suggest increase in the cases of myocardial infarction. This study aims to establish a relationship between myocardial infarction and temperature and compare the number of cases in extreme versus normal temperature range.

Methodology

This study includes all subjects irrespective of their age, gender, pre-existing conditions, racial profile. Other risk factors causing myocardial infarction are not taken into account while conducting the study temperature is the only determining factor being considered to keep the study focused on the effects of temperature. The statistics used were obtained from the autopsy section of Pathological department from tertiary care hospital.

Our retrospective study took place across the years from January 2023 to April 2025 to study the effect of different temperatures ranges across various seasons. The data collected from the pathology department is also provided in tabular form in table.

A graph was then plotted to observe the relationship between the given parameters to help us extrapolate the data and better interpret it.

Multiple parameters are studied and are tabulated and studied under the headings of Maximum Temperature, Minimum Temperature, Temperature Difference (rounded to nearest 0.5 value for

simplification of data) and Average Temperature on any given day. The temperature data is accurately sourced from official databases and trusted sources to ensure authenticity of the study accurate results.

A graph was plotted by superimposing maximum, minimum and average temperature against number of deaths caused due to myocardial infarction.

RESULTS & OBSERVATION

We recorded total of 299 cases of myocardial infarction at the tertiary care hospital.

Majority of the population considered and processed in the study was middle aged adults averaging the ages 51 and the youngest and the oldest ages we recorded are 16, 86 respectively. The predominant sex that was recorded to die of myocardial infarction in our study was male 265 and female 34 deaths. Temperature corresponding to the date of death was collected and used for creating tables and graphs showing maximum temperature was 45 degree Celsius and minimum temperature was 11 degree Celsius, the majority of death were found in the month of January with average temperature of January in the year 2023 is 21.9 degree Celsius, in the year 2024 most deaths were found in may with average temperature of may being 31.1 degree Celsius, in the year 2025 most deaths were found in January with average temperature in January being 21 degree Celsius.

Table 1:- Shows Year And Month Wise Representation Of The Mean Temperature And The Respective Count Of Cases.

Year	Month	Mean temperature(in degree Celcius)	Number of deaths in the month
2023	January	21.9	24
	February	25.8	13
	March	29.2	11
	April	33.1	15
	May	32.4	18
	June	32.7	14
	July	30.2	5
	August	30.6	11
	September	32.2	1
	October	28.7	10
	November	26.9	13
	December	23.3	13
2024	January	21.3	8

	February	24.2	10
	March	27.8	5
	April	31.3	6
	May	31.2	16
	June	30.6	8
	July	29.5	6
	August	29	10
	September	29	7
	October	29.4	9
	November	26.8	8
	December	23	10
2025	January	21	17
	February	24.4	8
	March	27.3	12
	April	31	10

Table 2:- Shows The Distribution For Myocardial Infarction Cases And The Rounded Figure Of Daily Temperature Difference

Rounded Temperature Difference (in degree celcius)	Number of deaths
2	1
4	4
4.5	3
5	3
5.5	4
6	9
6.5	3
7	4
7.5	2
8	27
8.5	5
9	12
9.5	2
10	16
10.5	3
11	10
11.5	5
12	20
12.5	8
13	26
13.5	6
14	17
14.5	5
15	37
15.5	20
16	13
16.5	5
17	6
17.5	3
18	6
19	8
20	2
20.5	3
21	1

Temperature observations during our study

from January 2023 - April 2025

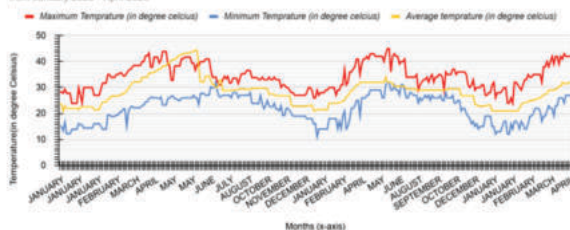


Figure 1:- Shows distribution of Temperature observations seen throughout our study.

By observing the data we can see that extremes of temperature on both ends of the spectrum there is a significant rise in the number of cases both due to extreme heat and cold. The temperature difference between maximum and minimum temperature also points towards the rise in cases probably due to limitations in the patient's ability to adapt to the stress.

Based on the graphical data we can see that the parameters of number of deaths and maximum temperature rise at the same point while number of deaths increase when a low value of minimum temperature is reported.

Other comparison were made between mean temperature of the month and it's relation with the number of cases. By observing the graphical data we can see that number of cases are persistently high in months of extreme hot or cold weather. There is also a rise in number of cases of myocardial infarction when there is a high deviation from the expected temperature generally observed in that month.

DISCUSSION

Myocardial infarction is an acute medical emergency which occurs due to sudden cessation of blood to the myocardial tissues. This medical emergency occurs due to many factors such as age, gender, stress, substance abuse, presence of predisposing factors such as atherosclerotic plaque, plaque rupture, arteritis, aneurysms, thrombosis, embolism, and other thrombotic diseases, environmental factors such as temperature, pollution etc. Though environmental factors do not play a major role in myocardial infarction but factors such as temperature can lead to precipitation of myocardial infarction.

The major mechanism of myocardial infarction is the acute obstruction of blood flow in a coronary artery, primarily caused by the rupture of an atherosclerotic plaque.

Plaque rupture triggers rapid platelet aggregation and thrombus formation, occluding the vessel. This causes ischemia and subsequent necrosis of myocardial tissue.

Compensatory mechanisms, like the RAAS and sympathetic activation, increase heart rate and blood volume (preload). This raises the heart's oxygen demand, further widening the gap between blood supply and demand, exacerbating the necrosis and leading to the full clinical MI.⁽¹⁾

Potential mechanisms to explain the increased risk for incident coronary events in association with decreasing temperature include the stimulation of cold receptors in the skin and therefore the sympathetic nervous system, leading to a rise in the catecholamine level⁽³⁾

Under normal circumstances human body can adapt to temperature changes efficiently but in some cases of increased changes it can lead to excessive stress. Due to large temperature change and limited ability of the body to adapt to these changes, it is possible that this transient vasospasm caused due to the temperature change will lead to the ischemia of the myocardial tissue and precipitate a cardiac event like myocardial infarction.

The data recorded in our study and our observations support our hypothesis that the difference in temperature and the rise or fall of temperature causes deviation from normal and causes an increased rate of myocardial infarction this is caused by increased stress which is responsible for myocardial infarction.

Average temperature and the minimum and maximum temperatures throughout the day also has a major effect on myocardial infarction. cold temperatures has lead to rise in myocardial infarctions which may be due to the cold temperature can cause rise in catecholamine levels and subsequent vasoconstriction, increasing the heart rate and blood pressure which can precipitate myocardial infarction.⁽⁴⁾ Hot weather causes increased physical exertion and stress which will also cause release of cortisol.⁽⁵⁾

The cold temperature can also lead to vasoconstriction which will cause decreased blood flow to the heart which may be exacerbated by a predisposing condition such as plaque or thrombosis which may lead to complete cessation of blood through the vessel and precipitate a cardiac event. Exposure to cold under controlled conditions has been associated with increases in arterial pressure, blood viscosity, and cardiac workload.⁽⁶⁾

On the opposite spectrum of the temperature scale high or hot temperatures going beyond tolerable limit can cause excessive stress on the regulatory mechanisms of the body thus increasing chances of myocardial infarction which may be caused due to increased exertion and a dehydrated state induced by heat which may lead to failing of

compensatory mechanisms like RAAS to restore the circulation which will cause myocardial infarction.

Due to increase in cases of myocardial infarction in recent years, it has been noted by various research studies across the world that temperature plays a role in the occurrence of this medical emergency.

CONCLUSION

It is important to study the effects of temperature in myocardial infarction as temperature influences most of the etiological factors that play a role in precipitating myocardial infarction.

In recent times due to factors like global warming, variation in temperature and weather across the globe reaching new extremes temperature may become an integral factor to be considered for prevention and new research initiatives..

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