Original article:

Study of hs-CRP as a prognostic marker in patients with ST elevation acute myocardial infarction

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ABSTRACT:

Introduction: Over the past decade, cardiovascular disease (CVD) has emerged as the single most important cause of death worldwide. Clinical manifestation of *CHD* usually occurs in the form of AMI, Unstable angina, Stable Angina and Sudden death. *hs-CRP* levels partially reflect the extent of myocardial necrosis and can be used to predict in- hospital and long term outcome in patients with AMI.

Material and method: The present cross sectional prospective study of 100 patients was to study hs-CRP as a prognostic marker in cases with ST elevation Myocardial Infarction with approval by Institutional Ethics Committee from September - 2015 to September - 2016. Written consent for participating in this study was taken of all patients.

Result: Maximum number of patients was in the age group of 61 – 70 years (38%) with male preponderance (67%). Chest discomfort (93%) is most common symptoms. Patients with high BMI- $> 25kg/m^2$ (81.25%) and chronic smokers (69.35%); pre-existing Hypertension (74%) and pre-existing DM (75.48%) had high hs-CRP values. Those patients who had complications during hospital stay were found to have high hs-CRP values (90%) and Left Ventricular Dysfunction was the commonest complication (91.42%). Mortality rates were higher with high hs-CRP values. In our study, of all the patients who had heart failure within 3 months of their AMI, 89.23% had high hs-CRP values.

Conclusion: It can be concluded that those patients who have high value of hs-CRP, they suffer from acute as well as chronic long term complications.

Key-words: hsCRP, Acute ST elevation MI

INTRODUCTION:

Acute myocardial infarction is overwhelmingly the most important form of IHD which continues to be the leading cause of death in the industrialized and developing countries like India, despite spectacular progress in their prevention, detection and treatment over the last three decades. AMI has rapidly emerged as the major contributor towards the increasing morbidity and mortality.[1] Development of high sensitivity CRP (*hs-CRP*) assays has improved the role of this acute phase reactant in predicting the first cardiovascular events. *hs-CRP* levels partially reflect the extent of myocardial necrosis and can be used to predict in- hospital and long term outcome in patients with AMI. Other markers that predict future cardiac events include homocysteine, lipoprotein (a), plasminogen activator inhibitor – 1 (PAI-1), fibrinogen and markers of inflammation like hs-CRP, IL-1, IL-6, Serum amyloid A (SAA) and tumor necrosis factor α (TNF-α).[2,3]

WHY hs-CRP IN AMI? [2,3]

- Mounting evidence indicates that smoldering vascular inflammation plays a

central role in the genesis and complications of atherosclerosis.

- The acute phase reactant hs-CRP, a simple downstream marker of inflammation, has now emerged as a major cardiovascular risk marker.

- Cross-sectional studies show strong correlations between elevated hs-CRP and poor short term and long term prognosis in patients with ACS.

- Longitudinal studies implicate elevated hs-CRP levels as a risk marker (or risk factor) for future myocardial infarction, stroke and coronary heart disease in apparently healthy persons.

- Patients with AMI who have higher values (>3mg/L) of hs-CRP on admission are very much prone to develop heart failure in future and related morbidity and mortality as compared to those with normal or near normal hs-CRP levels on admission.

- **The American Heart Association and the Centers for Disease Control and Prevention** issued a statement in **Feb 2016** regarding the use of hs-CRP in clinical practice.
  " Briefly, hs-CRP levels less than 1, 1 to 3, and higher than 3 mg/liter should be interpreted as lower, moderate, and higher relative vascular risk, respectively, when considered along with traditional markers of risk" a finding recently corroborated within the Framingham Heart Study itself and JUPITER studies "

- Screening for hs-CRP should be done at the discretion of the physician as part of global risk evaluation, not as a replacement for LDL and HDL testing.

- Although hs-CRP predicts risk across the entire population spectrum, it likely has greatest usefulness for those at intermediate risk - that is, those with anticipated 10-year event rates between 5% and 20%.

- Elevated levels of hs-CRP predict not only cardiovascular events, but also the onset of type 2diabetes and hypertension. This is perhaps because hs-CRP levels correlate with several components of the metabolic syndrome—including those not easily measured in clinical practice, such as insulin sensitivity and endothelial dysfunction.

- Both hs-CRP and parental history of premature atherothrombosis, the two novel parameters included in the Reynolds Risk Score, have also been shown to improve risk reclassification within the Framingham Heart Study.

- The use of statin therapy to reduce vascular risk in individuals with elevated hs-CRP, even when LDL-C levels are low, represents a fundamental change in treatment strategies for the prevention of cardiovascular disease.

This study is designed to evaluate the serum concentration of hs-CRP in AMI and its association with subsequent consequences in hospital morbidity and mortality.

MATERIAL AND METHODS:

Institutional Ethics Committee has approved the study to be conducted. The present cross sectional prospective study was to study hs-CRP as a prognostic marker in cases with ST elevation Myocardial Infarction. It was carried out on **100 patients** who were admitted in our institute, with ST

Elevation Myocardial Infarction meeting the Inclusion and the Exclusion criteria from September - 2015 to September - 2016. Written consent for participating in this study was taken of all patients. All patients were informed and explained about the study. Detailed history & clinical findings of all patients were collected.

ST Elevation Myocardial Infarction was defined according to the European Society of cardiology/ACCF/AHA/World Heart Federation Task Force for the Universal Definition of Myocardial Infarction.

Serum hs CRP levels were measured using immunoturbidimetric test.

Inclusion criteria:

✓ Acute ST Elevation Myocardial Infarction evidenced by History, ECG, Elevated cardiac specific markers, 2D Echocardiography presenting within 12 hours of chest pain in ≤ 70 year age group.

Exclusion Criteria:

■ Patients presenting with non-ST Elevation, enzyme positive Myocardial Infarction.

■ Patient age more than 70 years.

■ Patients presenting 12 hours after onset of chest pain.

■ Individuals with :

o rheumatic disease, vasculitis syndrome, inflammatory bowel disease, chronic liver diseases, chronic renal disorders, cancer, sepsis

o patient critically ill with less than one month duration infectious diseases and surgical procedure in 3 month duration

■ Patient presenting with contraindication for thrombolytic therapy.

The overall recordings were recorded in the computerized proforma as mentioned below.

STATISTICAL ANALYSIS:

Data are expressed as Mean and SD when normally distributed and as median (range) for non-Gaussian variables.

Grading of the patient according to severity of heart failure.[4]

The presence and the degree of heart failure was assessed on the 1st, 3rd and 7th days after admission following the killip's classification. To describe the clinical progression of heart failure during the first 5 days of hospitalization, subjects were divided in to 4 different grades which were named as heart failure progression grades.

HFP Grades (based on clinically evident failure)	
Grade 1	Killips class 1 failure in all examination
Grade 2	Killips class >1 on admission and then improving to killips class 1 within 7 days
Grade 3	Killips class 1 on admission and then worsening to killips class >1 in following days
Grade 4	Killips class >1 in all examination

Follow – Up:

Each patient was called for a clinical check up every monthly and each was followed for a period of 3 months from the date of discharge, except those who expired during this period.

OBSERVATION & RESULTS:

During the study, following observations were made. All analyses were performed using **Windows-based SPSS statistical package (version 16.0)** and **MedCalc statistical software (version 16.8.4***)* and p-values <0.05 were considered significant.

AGE DISTRIBUTION: From the table - 1 it can be seen that

- Highest number of patients (38%) were observed in the 7th decade (i.e. 61 – 70 years) followed by patients (29%) in 6th decade (i.e. 51 – 60 years)

- Only 14% of patients with Acute STEMI were ≤ 40 years of age.

- Mean age of the patients was found to be 55.37 ± 12.028 years.

SEX DISTRIBUTION: From table- 2 it can be seen that Ischemic Heart Disease is more prevalent in males (67%) as compared to females (33%).

AGE DISTRIBUTION IN VARIOUS SEX GROUPS: From table – 3 it can be observed that:

- Before 50 years of age males dominated (28%) as compared to females (5%).

- It is also revealed that after the age of 50 years (i.e. after the mean age of menopause) incidence in female's increased (28%) but still remained less than that in males (39%).

- The mean age of male patients was 52.56 ± 12.02 years while that of female patients was 60.98 ± 12.02 years.

SYMPTOMS DISTRIBUTION: From table -4 it can be seen that most of the patients who had Acute

STEMI presented with complaints of chest pain (93%), Perspiration and feeling of impending doom (84%) and nausea and vomiting (59%). Rests of the symptoms were less frequently encountered as presenting complaints.

DISTRIBUTION OF hs-CRP VALUES IN STUDY GROUP: From table -5 it can be observed that out of total 100 patients of Acute STEMI, high hs-CRP values were observed in 65% patients as compared to 35% with low hs-CRP values. Mean hs-CRP levels were 4.902 ± 2.37 mg/L.

DISTRIBUTION OF PATIENTS ACCORDING TO PROBABLE RISK FACTORS:

BODY MASS INDEX (BMI): Out of 100 patients, 32 patients had BMI values more than 25 kg/m^{2}. From table - 6 it is clearly seen that out of 32 patients with high BMI, 81.25% patients had high hs-CRP values > 3mg/L while out of 68 patients with normal BMI only 57.35% had high hs-CRP levels.

Out of 100 patients, 44 had sedentary life style.

LIFESTYLE: According to table - 7, out of 47 patients who had sedentary life style 74.46% had hs-CRP levels > 3mg/L while out of 53 patients who had active life style 56.60% had hs-CRP values higher than 3mg/L.

FAMILY HISTORY: Out of 100 patients studied, 36 patients had a strong family history while 64 patients had no family history. It can be seen from the table - 8 that out of 34 patients who had a strong family history, 63.88% had hs-CRP levels > 3mg/L while out of 64 patients who had no significant family history, 65.62% had high hs-CRP levels.

SMOKING: Out of 100 patients 62 patients had habit of chronic smoking of either a bidi or a cigarette while 38 patients had no history of smoking. From table - 9 it can be seen that out of 62 patients who had habit of smoking, 69.35% has hs-CRP

values > 3mg/L while out of 38 patients who did not have habit of smoking 57.89% has hs-CRP > 3mg/L.

PRE-EXISTING HYPERTENSION: Out of 100 patients studied, 50 patients had a history of pre-existing hypertension while other 50 had no such history. Thus from table - 10 it is evident that out of 50% patients who had pre-existing hypertension 74% of them had hs-CRP>3mg/L while out of 50 patients who were non-hypertensive only 66% had hs-CRP levels > 3mg/L.

PRE-EXISTING DM: Out of 100 patients admitted, 50 patients had history of pre-existing DM (Type 2). It can be seen from table - 11 that out of 50 patients who had previous DM, 75.48% had hs-CRP > 3mg/L while out of 50 patients who didn't have pre-existing DM 53.20% had hs-CRP > 3mg/L.

COMPLICATIONS: Out of 100 patients, 40 patients had some or other complication during their respective hospital stay while 60 patients did not experience any complications. According to table - 12, it is evident that out of 40 patients who had complications during their hospitalization, significantly higher patients 90% were having hs-CRP values > 3mg/L while only 10% patients had hs-CRP values < 3mg/L.

HEART FAILURE PROGRESSION: Thus it can be observed from table - 13 that out of 31 patients who had HFP Grade I, only 22.58% had hs-CRP levels > 3mg/L. Comparing this to 14 patients who had HFP Grade III and 34 patients who had HFP Grade IV about 92.80% and 97.05% respectively had hs-CRP levels > 3mg/L.

LEFT VENTRICULAR DYSFUNCTION: On echocardiographic evaluation of 100 patients admitted under present study, LV Systolic dysfunction (Poor EF < 40%) was found as under:

Out of 100 patients studied 57 patients had LVEF > 40% while 43 patients had LVEF < 40%. Out of the 57 patients whose LVEF were > 40%, only 45.61% had high hs-CRP levels of > 3mg/L. On the other hand out of 43 patients who had LVEF < 40%, 90.70% had high hs-CRP levels of > 3mg/L and only 9.30% had low hs-CRP levels of < 3 mg/L. (table – 14)

MORTALITY RATE: It can be observed that out of the 12 patients which expired in the study, 91.66% were having hs-CRP >3mg/L. (table -15)

TABLE 1: AGE DISTRIBUTION

AGE	NO. OF PATIENTS
≤ 20	01
21-30	04
31-40 years	09
41 – 50 years	19
51 – 60 years	29
61 – 70 years	38
TOTAL	100

TABLE 2: SEX DISTRIBUTION

SEX	NO. OF PATIENTS
MALE	67
FEMALE	33
Total	100

TABLE 3: AGE DISTRIBUTION IN VARIOUS SEX GROUPS

AGE GROUP/SEX	MALE	FEMALE	TOTAL
≤ 20	01	00	01
21-30	04	00	04
31-40	08	01	09
41 – 50	15	04	19
51 – 60	21	08	29
61 – 70	18	20	38
TOTAL	**67**	**33**	**100**

TABLE 4: SYMPTOMS DISTRIBUTION

SYMPTOMS	NO. OF PATIENTS
CHEST PAIN	93
PERSPIRATION	84
PALPITATION	21
BREATHLESSNESS	26
NAUSEA/VOMITING	59
GIDDINESS	23
OTHERS	08

TABLE 5: DISTRIBUTION OF hs-CRP VALUES IN STUDY GROUP

GROUP	hs-CRP	NO. OF PATIENTS
A	< 3 mg/L	35
B	> 3 mg/L	65

TABLE 6: hs-CRP AND ITS CORRELATION WITH BMI

PATIENTS	hs-CRP < 3mg/L	Percentage %	hs-CRP > 3 mg/L	Percentage %
BMI > 25kg/m2	06	18.75%	26	81.25%
BMI≤ 25kg/m2	29	48.33%	39	57.35%

TABLE 7: hs-CRP AND ITS CORRELATION WITH LIFE STYLE

PATIENTS	hs-CRP < 3mg/L	Percentage %	hs-CRP > 3 mg/L	Percentage %
Sedentary Life Style	12	25.53%	35	74.46%
Active Life Style	23	43.39%	30	56.60%

TABLE 8: hs-CRP AND ITS CORRELATION WITH FAMILY   HISTORY

Family History	hs-CRP < 3mg/L	Percentage %	hs-CRP > 3 mg/L	Percentage %
Positive	13	36.11%	23	63.88%
Negative	22	34.37%	42	65.62%

TABLE 9: CORRELATION OF hs-CRP WITH SMOKING

PATIENTS	hs-CRP < 3mg/L	Percentage %	hs-CRP > 3 mg/L	Percentage %
Smokers	19	30.64	43	69.35
Non – Smokers	16	42.10	22	57.89

TABLE 10: hs-CRP IN PREEXSISTING HYPERTENSION

PATIENTS	hs-CRP < 3mg/L	Percentage %	hs-CRP > 3 mg/L	Percentage %
Hypertensives	13	26	37	74
Non-Hypertensives	22	44	28	66

TABLE 11: hs-CRP IN PREEXISTING DM TYPE 2

PATIENTS	hs-CRP < 3mg/L	Percentage %	hs-CRP > 3 mg/L	Percentage %
DM	13	24.52	40	75.48
No DM	22	46.80	25	53.20

TABLE 12: CORRELATION OF hs-CRP WITH COMPLICATIONS

Complications	hs-CRP < 3mg/L	Percentage %	hs-CRP > 3 mg/L	Percentage %
Yes	4	10%	36	90%
No	31	51.66%	29	48.33%

TABLE 13: hs-CRP AND ITS ASSOCIATION WITH HFP GRADES

Heart Failure Grades	hs-CRP < 3mg/L	Percentage %	hs-CRP > 3 mg/L	Percentage %
Grade – I	24	77.41%	07	22.58%
Grade – II	09	42.85%	12	57.14%
Grade – III	01	07.14%	13	92.80%
Grage – IV	01	02.94%	33	97.05%

TABLE 14: CORRELATION OF hs-CRP VALUES WITH LV DYSFUNCTION

Ejection Fraction	hs-CRP < 3mg/L	Percentage %	hs-CRP > 3 mg/L	Percentage %
> 40%	31	54.38%	26	45.61%
< 40%	4	9.30%	39	90.70%

TABLE 15: ASSOCIATION OF hs-CRP VALUES WITH MORTALITY

Mortality	hs-CRP < 3mg/L	Percentage %	hs-CRP > 3 mg/L	Percentage %
Patients Expired	01	8.33%	11	91.66%

TABLE 16: ASSOCIATION OF hs-CRP VALUES WITH FUTURE HEART FAILURE

Failure within 3 months with hs-CRP levels ≥ 3mg/L	Percentage %	No Failure witnessed within 3 months with hs-CRP < 3mg/L	Percentage %
58	89.23%	07	10.77%

TABLE 17: MEAN AGE GROUP IN VARIOUS STUDIES

	Present Study	H. Rashidinejad et al[5]	Chaithra S.P et al[6]
Mean Age (Years)	55.37 ± 12.02	60.62 ± 11.81	54.5 ± 12.28

TABLE 18: SEX DISTRIBUTION IN VARIOUS STUDIES

SEX	Present Study	Framingham Heart Study[7]	Chaithra S.P et al[6]
Male	67%	65.81%	72%
Females	33%	34.19%	28%

TABLE 19: AGE DISTRIBUTION IN SEX GROUPS IN VARIOUS STUDIES

Age in Yrs	Present Study			Framingham Heart Study[7]			Stamler J. et al[8]			Chaithra S.P et al[6]		
	Males %	Females %	Total %	Males %	Females %	Total %	Males %	Females %	Total %	Males %	Females %	Total %
<40	13	01	09	15.08	0	12.01	14.19	0	11.76	13.9	7.1	12
41 – 50	15	04	19	21.48	16.87	20.75	23.25	15.27	21.00	22.2	7.1	18
51 – 60	21	08	29	28.19	34.89	25.17	27.08	27.08	26.13	25	35.8	28
61 – 70	18	20	43	35.25	48.24	35.48	35.48	35.48	41.11	38.9	50	42

TABLE 20: FREQUENCY OF SYMPTOMS IN OTHER STUDIES

Symptoms	Present Study	Lorel et al[11]	Piyush et al[12]
Chest pain	93%	93.33%	92.5%
Perspiration	84%	89.67%	88%
Nausea/Vomiting	59%	54.545%	50%

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TABLE 21: DISTRIBUTION OF hs-CRP VALUES AMONG OTHER STUDIES

hs-CRP	Present Study	Giuseppe Berton et al [13]	Kalyan N. G. et al [14]	De Beer FC et al [4]
>3mg/L	65%	64.31%	62.02%	60.20%
<3mg/L	35%	35.69%	37.98%	39.80%

TABLE 22: CORRELATION OF hs-CRP AND BMI AMONG VARIOUS STUDIES.

hs-CRP levels in Pt with BMI > 25	Present Study	Saito M et al [17]	Ridker PM et al [18]	Ford ES et al [19]	Pepys MB et al [16]	Vasant BP et al [20]
<3 mg/L	18.75%	20.81%	19.60%	16.18%	16.88%	20.81%
>3 mg/L	81.25%	79.19%	80.40%	83.82%	83.12%	78.76%

TABLE 23: ASSOCIATION OF SMOKING WITH hs-CRP VALUES OBSERVED IN VARIOUS STUDIES

hs-CRP levels in Smokers	Present Study	Danesh J et al [21]	Saito M et al [17]	Ridker PM et al [18]
<3 mg/L	30.64%	35.66%	34.23%	31.19%
>3 mg/L	69.35%	64.34%	65.77%	68.81%

TABLE 24: hs-CRP VALUES AND ITS CORRELATION TO PREEXISTING HYPERTENSION AMONG VARIOUS STUDIES

hs-CRP levels in Hypertensives	Present Study	Saito M et al [17]	Ridker PM et al [18]
<3 mg/L	26%	31.81%	25.96%
>3 mg/L	74%	68.19%	74.04%

TABLE 25: hs-CRP VALUES AND ITS CORRELATION TO PREEXISTING DM TYPE 2 AMONG VARIOUS STUDIES

hs-CRP levels in DM	Present Study	Saito M et al [17]	Ridker PM et al [18]	Ford ES et al [19]	Freeman DJ et al [22]	Vasant BP et al [20]
<3 mg/L	24.52%	27.20%	29.08%	29.76%	30.68%	31.56%
>3 mg/L	75.48%	72.80%	70.92%	70.24%	69.32%	68.44%

TABLE 26: ASSOCIATION OF hs-CRP VALUES WITH COMPLICATIONS IN VARIOUS STUDIES

hs-CRP levels In Comlicated Patients	Present Study	Tommasi et al [23]	Ridker PM et al [18]	Tomado H et al [24]	Vasant BP et al [20]
> 3mg/L	90%	86.13%	83.42%	87.91%	80.36%
< 3mg/L	10%	13.87%	16.58%	12.09%	19.64%

TABLE 26: CORRELATION OF hs-CRP WITH HFP GRADES IN OTHER STUDIES

Hs-CRP Levels	Present Study				Berton G et al [13]			
	Grade I	Grade II	Grade III	Grade IV	Grade I	Grade II	Grade III	Grade IV
<3mg/L	77.41%	42.85%	07.14%	02.94%	86.12%	67.68%	07.91%	4%
>3mg/L	22.58%	57.14%	92.80%	97.05%	13.88%	32.32%	92.09%	96%

TABLE 27: CORRELATION OF hs-CRP VALUES WITH LV DYSFUNCTION IN OTHER STUDIES

Hs-CRP levels in patients with LV Dysfunction	Present Study	Berton G. et al [13]	KiranBabu T. G. et al [25]	Katayama T. et al [26]
> 3mg/L	90.70%	86.30%	88.39%	92.72%
< 3mg/L	9.30%	13.70%	11.61%	7.88%

TABLE 28: CORRELATION OF hs-CRP WITH MORTALITY IN VARIOUS STUDIES

hs-CRP levels in Patients that expired	Present Study	Berton G et al [13]	Toshihisa A et al [27]	Wim KL et al [28]	Mariotti et al [29]	Kinjo K. et al [15]
< 3mg/L	8.33%	22.23%	25.38%	21.22%	25.99%	27.00%
> 3mg/L	91.66%	77.77%	74.62%	78.18%	74.01%	73.00%

DISCUSSION:

That most patients with STEMI are in the age group of 61 – 70 years & in our study also we can see that most patients fall in the age group of 61 – 70 years. (38%) (table – 19) . In Indian subcontinent the coronary artery disease is said to peak between 51 – 60 years. As mentioned by Park et al[9] this is about a decade earlier compared to the western developed countries. Our study shows highest incidences in 61-70 years age group may be due to small sample size.

In all the above mentioned studies, incidence in females increased in the post-menopausal age group which is consistent with our present study. In males the coronary risk is more as compared to premenopausal females.

Chest pain is the most common presenting complaint of the patient coming with STEMI. It seems that stimulation of the nerve fibers in the ischemic zone of myocardium surrounding the necrotic central area of infarction probably gives rise to chest pain.[2] Perspiration with feeling of Impending Doom is related to chest pain and correlates with acute left ventricular failure.[2] Nausea and Vomiting occur in more than 50% patients with transmural MI due to activation of vagal reflex as a result of severe chest pain or due to stimulation of left ventricular receptors as a part of Bezold–Jarisch Reflex. These symptoms occur more commonly in Inferior wall MI than in those with Anterior wall MI.[2] (table – 20)

Out of 100 patients enrolled for our study 65% had hs-CRP level more than 3mg/L & only 35% had less than 3mg/L, in Giuseppe Berton et al[13] & Kalyan N. G. et al[14] also had similar results with hs-CRP level more than 3mg/L in 64.31% & 62.02% respectively. (table – 21)

Patients with high BMI (>25kg/m^2) had high hs-CRP levels in almost all studies and are consistent with the present study. Probably adipocytes synthesize and

secrete some of the baseline CRP itself. [16] (table – 22) . Plasma hs-CRP positively correlates with smoking. It values are higher in smoker but they are not significant when compared to nonsmokers. These results are comparable to other above mentioned studies. No significant association was found between smoking &hs-CRP. It may be due to small sample size & study design but it is clinically apparent that mean hs-CRP was higher in smokers than nonsmokers, so our study is consistent with other studies as shown in the table – 23.

Thus the above mentioned study in table – 24, results are consistent with the present study. Hence patients who have pre-existing HT have higher hs-CRP levels. The present study has consistent results with the other studies mentioned above in table – 25. Hence it is evident that patients with pre-existing DM have higher hs-CRP levels than non-DM patients. Presence of elevated hs-CRP in DM supports a possible role of inflammation in the pathogenesis of DM type 2. Patients who had some or the other complications during their hospital stay had higher hs-CRP values, which are consistent with each other. Left ventricular dysfunction was the most common complication observed followed by ventricular tachycardia. Out of all patients who required one or more pressure agents during their hospital stay 88.89% of them had higher hs-CRP levels which is consistent with the findings of Anzai et al. (table – 25)

It can be observed that patients who did not have any HF during the whole period of admission (HFP Grade I), 77.41% had low hs-CRP values. This finding was consistent with finding of Berton G. et al [13]. It is also evident that high first day hs-CRP levels were not only seen in patients with persistent HF (HFP Grade IV) [97.05%] but were also seen in those who passed from killips class 1 to killips class >1 after admission. (HFP Grade III – 92.80%) All the above findings are consistent with study done by Berton G. et al [13]. (table – 26)

All the above studies are in correlation with the present study finding that higher hs-CRP values are directly related to poor LVEF. (table -27) . The finding of table - 28 studies correlates with the present study.

Berton G et al [13] had also found that 80% of patients who had developed failure within 3 months of followup had high hs-CRP levels compared to 20% with low hs-CRP levels. In our study the failure was somewhat at a higher side than that found by Berton G et al [13]. This was probably due to less compliance to treatment in out setup.

CONCLUSION:

hs-CRP is elevated in majority of patient with AMI. hs-CRP is a potent predictor of prognosis in patients with AMI. Elevated hs-CRP levels in patients with AMI indicates poor prognosis and it also increases risk of long term complications and risk of heart failure.

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