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Comparative Study of Anti-inflammatory effect of Atorvastatin with Rosuvastatin in patients of Acute Myocardial Infarction

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Abstract:*Myocardial infarction is the irreversible necrosis of heart muscle secondary to prolonged ischemia. Inflammation is an important feature of atheromas. An open label, parallel group, prospective comparative clinical study was conducted in in-patient department of Cardiology in Osmania General Hospital to compare the anti-inflammatory effect of atorvastatin with rosuvastatin in 60 myocardial infarction patients. They were divided in to two groups of 30 patients of above 18 years of age of either sex. GroupAreceived Atorvastatin 40mgorallyonceadaydailyfor3 months.GroupBreceivedRosuvastatin20mg orallyonceadaydailyfor3months.CRP and ESR wererecordedatbaseline, 1 week andat1monthof treatment.Lipid profile and liver function tests were done at baseline and after 3 months of treatment. Anyadverseeffectsofthe treatmentwere alsorecorded.Paired t-test to compare within the group and unpaired t-test for intergroup analysis was used, with level of significance 0.05.The group receiving rosuvastatinis found to have greater efficacy in decreasing CRP, ESR and LDL levels and lower incidence of adverse effects compared to the group receiving atorvastatin.*

Keywords: *Atorvastatin, Rosuvastatin, Myocardial Infarction, C reactive protein,Erythrocyte sedimentation rate*

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I. Introduction

Cardiovascular diseases are the number one cause of death globally, more people die annually from cardiovascular diseases than any other cause. An estimated 17.5 million people died from cardiovascular diseases in 2012, representing 31 percent of all global deaths. Of these global deaths, an estimated 7.4 million were due to coronary heart disease.[1]

Acute Myocardial Infarction is overwhelmingly the most important form of ischemic heart disease 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.A large number of asymptomatic individuals are at a serious risk of developing MI because of their genetic predisposition, smoking behavior and sedentary lifestyle. About one third of patients with evolving MI die before they reach the hospital to receive any effective treatment. Thus, Myocardial infarction remains an important public health problem and merits continued attention by clinical researchers, epidemiologists and practicing physicians.[2]

Atherosclerosis is the main underlying cause for the development of Myocardial infarction. Atherosclerosis is an inflammatory disease, not merely the passive accumulation of lipids within artery walls. The chronic inflammatory process involving the arterial endothelium that ultimately results in the complications of atherosclerosis may be caused by a response to the oxidative components of modified low-density lipoprotein (LDL), or to chronic infection, free radicals, or other factors. The association of inflammation with the initiation and progression of atherosclerosis suggests the markers of inflammation. Recently markers of inflammation e.g., acute phase reactants such as C-reactive protein (CRP), are being investigated as predictors of coronary ischemic events suggesting the key role of inflammation in progression of atherosclerosis. C-reactive protein is more consistently associated with greater risk of both first and recurrent coronary events. So, inflammatory processes are also potential targets of therapy in preventing or treating coronary heart disease.[3]

CRP levels partially reflect the extent of myocardial necrosis and can be used to predict in hospital and long term outcome in patients with acute myocardial infarction. Elevated plasma CRP levels in patients with acute coronary syndromes on admission and its persistence after discharge may indicate a state of persistent inflammation with poor short term and long-term prognosis. Recent studies have shown CRP to be a risk predictor for future myocardial infarction, stroke and coronary heart disease in apparently healthy persons.[4,5]

Atherosclerotic plaque growth may be attenuated with therapy aimed at minimizing inflammation. Because increased levels of CRP have been associated with arterial-wall inflammation, the reduction in CRP levels may reduce the extent of endothelial-cell opsonization, macrophage recruitment, and blunting of nitric oxide release. The use of statins may prevent ischemia by both inhibiting deposition of lipids and decreasing inflammation.[6]

Statins apart from their hypolipedemic effect, a wide spectrum of statin mediated actions like attenuation of inflammation, plaque stabilization, improvement of endothelial function, decreasing platelet aggregation and fibrinogen levels, increasing the local production of nitric oxide, decreasing the arterial muscle proliferation, decreasing LDL oxidation in the vessel wall may contribute to potential benefits of statin therapy in myocardial infarction. Such multiple actions of statins which are independent of cholesterol lowering have been collectively termed as "pleiotropic effects." There is now compelling evidence that statin therapy may attenuate the effect of inflammation on risk of cardiovascular events.Several trials have been aimed at developing a correlation between statin-induced reductions in CRP and a subsequent decline in coronary events.[7,8,9]

Hence, this study is planned to compare the anti-inflammatory effects of atorvastatin, which is most commonly giving drug in government hospitals with a new generation drug rosuvastatin in myocardial infarction patients.

1.1 Aims

- To evaluate and compare the anti-inflammatory effects of atorvastatin with rosuvastatin in acute myocardial infarction patients.
- To evaluate and compare the hypolipedemic effects of atorvastatin and rosuvastatinin myocardial infarction patients.
- To evaluate and compare the effects of atorvastatin and rosuvastatin on liver function tests in myocardial infarction patients.
- To compare the adverse effect profile of atorvastatin and rosuvastatin in myocardial infarction patients.

1.2 Objectives

- To evaluate and compare the effects of atorvastatin and rosuvastatinon c- reactive protein and erythrocyte sedimentation rate in acute myocardial infarction patients.
- To evaluate and compare the effects of atorvastatin and rosuvastatinon lipid profile values (Total cholesterol, Triglycerides, Low density lipoprotein, High density lipoprotein and Very Low density lipoprotein)in myocardial infarction patients
- To evaluate and compare the effects of atorvastatin and rosuvastatin on liver function tests (Serum biluribin, Alanine transaminase, Aspartate transaminase and Alkaline phosphatase) in myocardial infarction patients
- To evaluate and compare the adverse effect profile of atorvastatin and rosuvastatin in myocardial infarction patients.

II. Patients And Methods

2.1Place of study: The study was conducted at In-Patient Department of Cardiology, Osmania General Hospital, Hyderabad.

2.2 Study design: Open label and parallel group prospective comparative clinical study between atorvastatin and rosuvastatin in myocardial infarction patients.

2.3 Selection criteria of the patient

Inclusion Criteria

1. Adults above 18 years of age, of either sex and those who fulfilled the below criteria for the diagnosis of acute myocardial infarction.

A. clinical history suggesting of ischaemic type of chest pain lasting for more than 20minutes.
B. changes in serial ECG tracings that is presence of Q wave and ST segment elevation.
C. Echo findings suggestive of acute myocardial infarction.

2. Patients who had given informed consent.

Exclusion Criteria

1. Those who were already taking statins and/or other hypolipidemic drugs.
2. Those who had severe cardiac dysfunction, (EF < 30%).
3. Severe anemia.
4. Chronic liver disease.
5. Chronic renal failure.

6. Pregnancy at the time of screening.
7. Lactating women.
8. Those with any history of hypersensitivity or allergy to statins.
9. Patients who did not give written informed consent.

III. Methodology

Approval from Institutional Ethics Committee of Osmania Medical College, Hyderabad was obtained. After selection of patients based on the above criteria, patients were explained about the study in their own understandable language and written informed consent was obtained. After initial screening, the demographic data, medical history, findings of physical examination and clinical examination were recorded in the case report form.

3.1 Treatment

Group A patients received Atorvastatin 40mg orally once a day daily for 3 months.
Group B patients received Rosuvastatin 20mg orally once a day daily for 3 months.

3.2 Follow-up

Follow-upwas done at0, 1 week, 1 month & 3 months oftreatment.
CRP wasrecordedatbaseline, 1 week andat1monthof treatment.
ESR was recorded at baseline, 1 week andat1monthof treatment.
Lipid profile was done at baseline and after 3 months of treatment
Liver function tests wasdoneatbaselineandafter 3months oftreatment.
Anyadverseeffectsofthe treatmentwere alsorecorded.

3.3 CRP: Estimation of C reactive protein estimation was done by Turbox CRP kit by turbidimetry method.

3.4 ESR: Estimation was done by Westergren method.

3.5 Lipid profile:

After the patients had fasted overnight for atleast 8hours, blood was drawn and collected in bottles. Serum was collected by allowing the blood to clot. TC was estimated by the cholesterol oxidase-peroxidase method, TGs by glycerol phosphate- oxidase method, and HDL-C by the phosphotungstate magnesium chloride method. LDL-C and VLDL-C are calculated by Friedewald's formula.

3.6 Liverfunction tests: Serum biluribin is measured by Diazo method.
ALT, AST and ALP are measured by enzymatic methods.

3.7 Compliance: Thepatientswere calledfor review withfilled andemptyblisters ofthetablets.Compliancetostudy medicines ismeasuredby pillcount during eachfollowup.

3.8 Statistical Analysis

All values are expressed in MEAN±SD. Results were analysed using Graph Pad Prism7.0hsoftwareforMacBook Pro. Pairedt-test to comparewithin the group and unpaired t-test for intergroupanalysis was used,with level of significance 0.05.

IV. Observations And Results

Table 1: Age and sexdistributionofpatientsin GroupAand Group B

Parameter	Group A	Group B
Number of patients	30	30
Mean age (years)	54.8 ± 6.66	54.6 ± 5.43
Gender Males Females	 27 3	 26 4

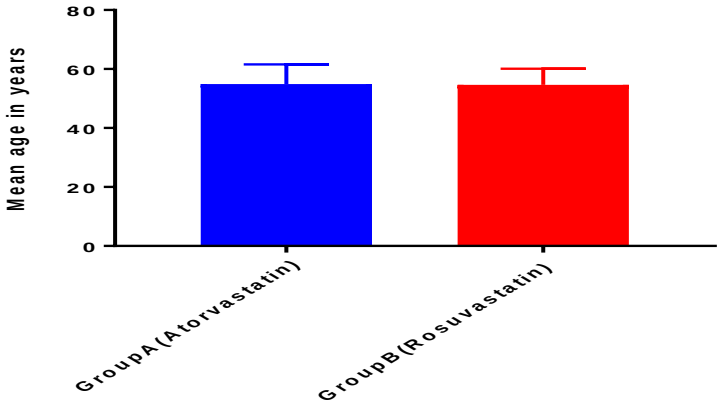

Figure 1: Agedistribution of patientsinGroupAand Group B

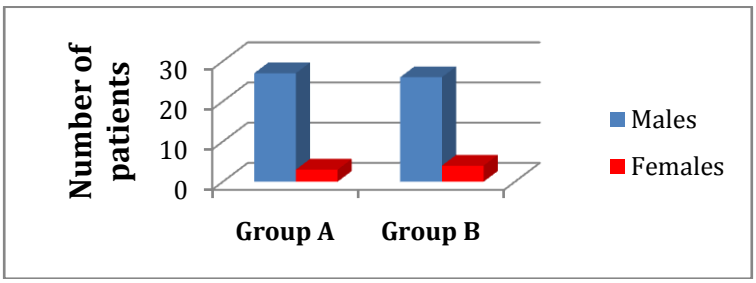

Figure 2: SexdistributionofpatientsinGroupAand Group B

Table2: EffectsofAtorvastatin onCRPinmg/litre,ESRinmm/hour.(MEAN±SD)

Parameter	**GroupA(Atorvastatin)**		
	Baseline	After 1week	After 1month
CRP	30.2±3.726	24.4±2.847	11.6±1.753
P valuesincomparisonto baseline		<0.0001	<0.0001
ESR	33.36±5.448	28.06±4.711	23.33±3.651
P valuesincomparisonto baseline		<0.0001	<0.0001

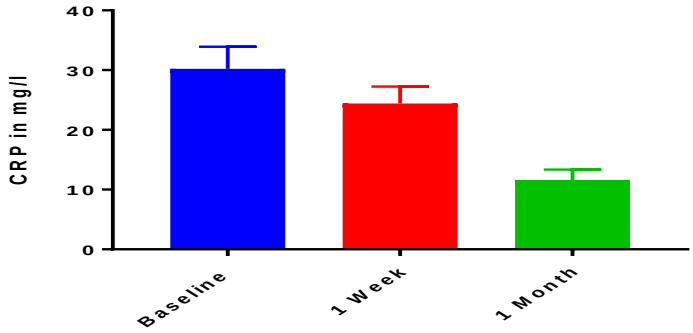

Figure 3: Effectof Atorvastatin on CRP levels

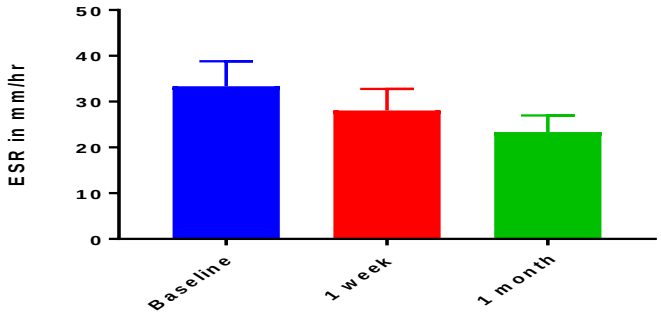

Figure4: EffectofAtorvastatin on ESR

Table3: Effects ofAtorvastatinon lipidprofile(MEAN ±SD)in mg/dl

LIPID PROFILE	**GroupA(Atorvastatin)**	
	0 month	After 3months
TC (mg/dl)	212.8±19.4	190.2±18.5
P values incomparisontobaseline		<0.0001
TG(mg/dl)	169.8±18.5	164.2±17.9
P values incomparisontobaseline		<0.0001
HDL(mg/dl)	41.5±3.51	42.2±2.89
P values incomparisontobaseline		0.0007
LDL(mg/dl)	137.5±22.8	119.0±23.1
P values incomparisontobaseline		<0.0001
VLDL(mg/dl)	33.96±3.69	32.9±3.60
P values incomparisontobaseline		<0.0001

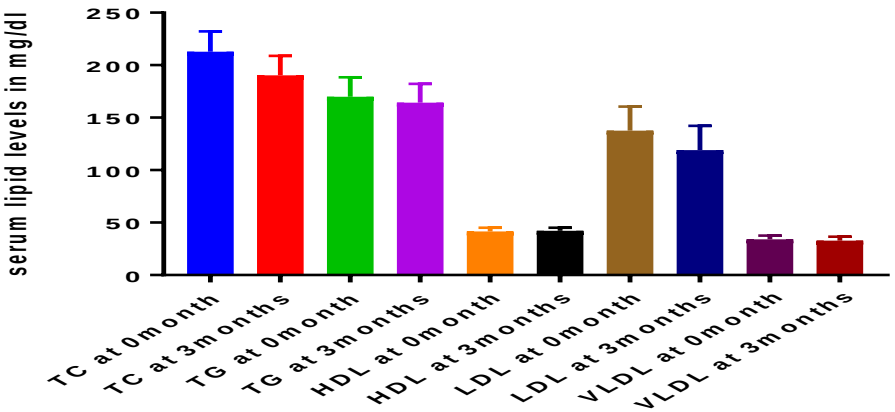

Figure5: Effectsof Atorvastatinon lipidprofile

Table4: Effects ofAtorvastatinon liver function tests (MEAN ±SD)

Liver function tests	**GroupA(Atorvastatin)**	
	0month(baseline)	After 3months
S.Bilirubin(mg/dl)	0.801±0.16	0.807±0.15
P values incomparisontobaseline		0.0741
ALT(IU/L)	19.9±5.42	20.7±5.01
P values in comparison to baseline		0.0002
AST(IU/L)	20.0±4.71	20.1±4.72
P values in comparison to baseline		0.1695
ALP(IU/l)	65.3±10.6	65.4±10.6
P values in comparison to baseline		0.0573

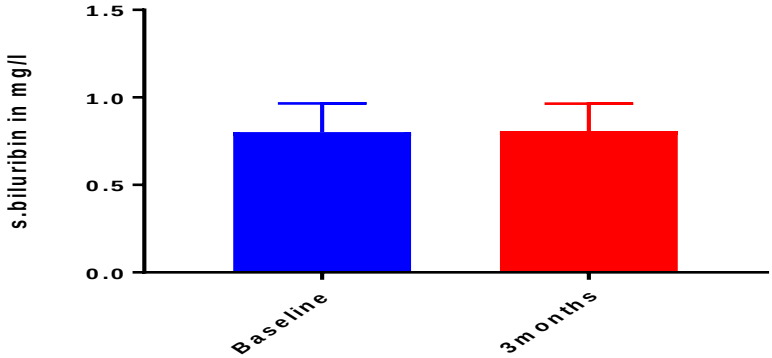

Figure6: Effectsof Atorvastatinon S.Bilirubin

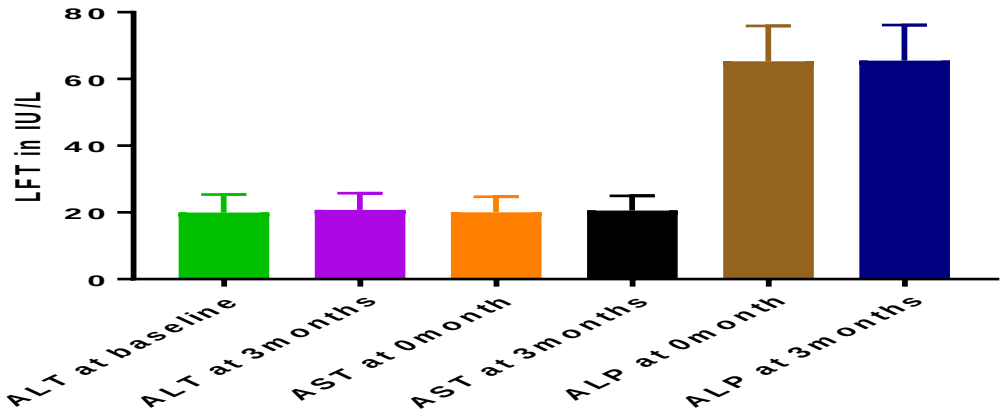

Figure7: Effectsof Atorvastatinon Liver function tests (ALT, AST, ALP in IU/L)

Table5: EffectsofRosuvastatin onCRPinmg/litre,ESRinmm/hour.(MEAN±SD)

Parameter	**GroupB (Rosuvastatin)**		
	Baseline	After 1week	After 1month
CRP	30.3±3.717	24.2±2.8	11.6±1.8
P valuesincomparisonto baseline		<0.0001	<0.0001
ESR	32.8±4.971	27.0±4.748	21.6±2.682
P valuesincomparisonto baseline		<0.0001	<0.0001

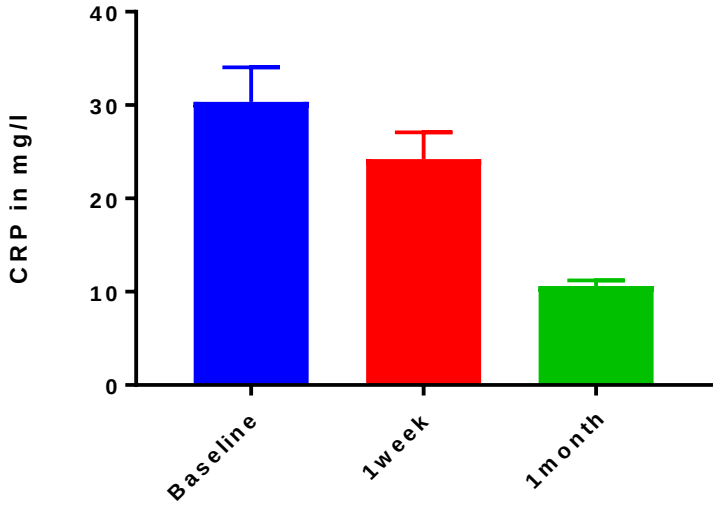

Figure 8: Effectof Rosuvastatin on CRP levels

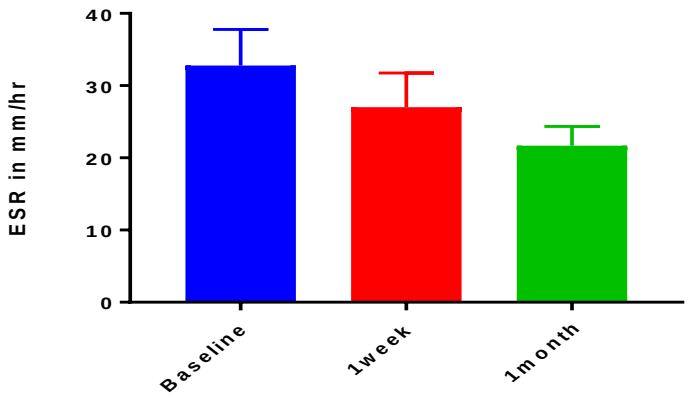

Figure 9: Effectof Rosuvastatin on ESR levels

Table6: Effects ofRosuvastatinon lipidprofile(MEAN ±SD)in mg/dl

	GroupB(Rosuvastatin)	
LIPID PROFILE	0 month(baseline)	After 3months
TC (mg/dl)	210.3±16.68	185.7±16.08
P values incomparisontobaseline		<0.0001
TG(mg/dl)	168.5±17.25	162.9±17.37
P values in comparison to baseline		<0.0001
HDL(mg/dl)	40.3±3.28	41.0±2.8
P values in comparison to baseline		0.0054
LDL(mg/dl)	136.1±17.1	108.5±16.1
P values in comparison to baseline		<0.0001
VLDL(mg/dl)	33.6±3.45	32.4±3.49
P values in comparison to baseline		<0.0001

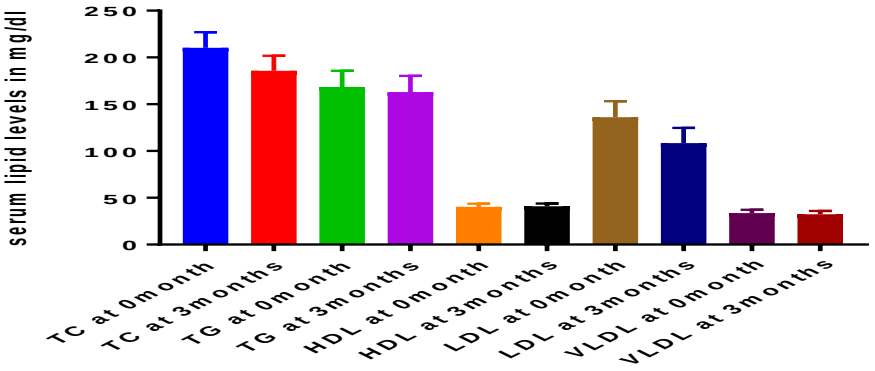

Figure10: Effectsof Rosuvastatinon lipidprofile

Table7: Effects ofRosuvastatinon liver function tests (MEAN ±SD)

	GroupB(Rosuvastatin)	
Liver function tests	0 month	After 3months
S. Bilirubin(mg/dl)	0.758±0.18	0.766±0.17
P values incomparisontobaseline		0.2165
ALT(IU/L)	20.4±5.39	20.5±5.16
P values in comparison to baseline		0.3545
AST(IU/L)	20.5±4.04	20.6±4.07
P values in comparison to baseline		0.5575
ALP(IU/l)	64.9±9.48	65.1±9.29
P values in comparison to baseline		0.4551

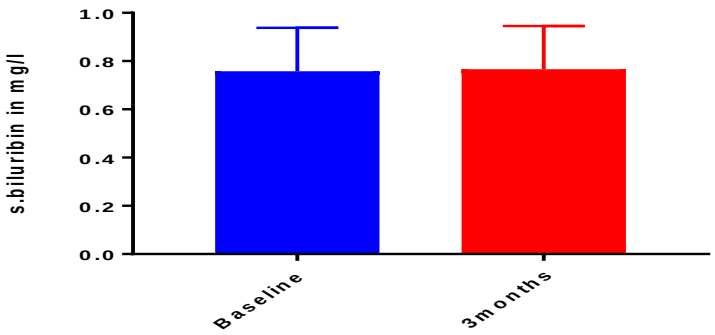

Figure11: Effectsof Rosuvastatinon S. Bilirubin

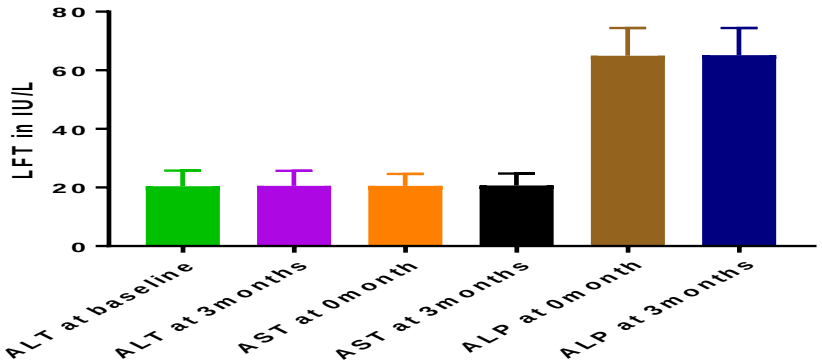

Figure12: Effectsof Rosuvastatinon Liver function tests (ALT, AST, ALP in IU/L)

Table8: Averagedifferencebetween baseline andafter1monthvaluesofCRP, ESR (MEAN ±SD)

PARAMETER	GROUPA	GROUPB	pvalue
CRP	18.6± 1.9	19.7 ± 3.0	<0.05
ESR	10.0±1.7	11.2± 2.2	<0.05

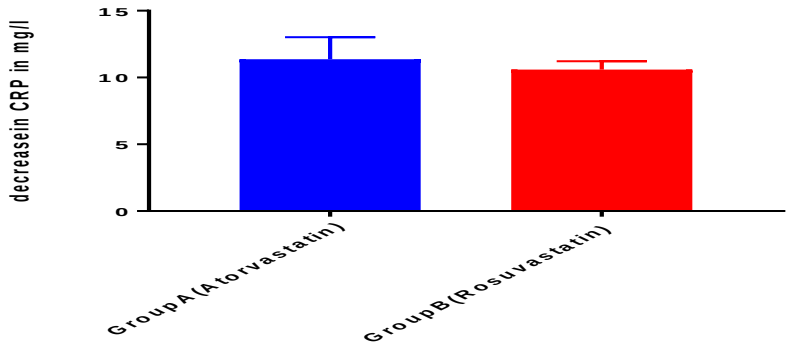

Figure 13: Decreasein CRPvalues in each group

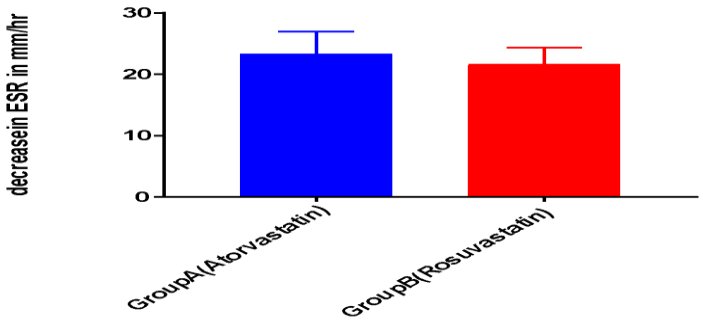

Figure 14: Decreasein ESR values in each group

Table9: Averagedifferencebetween baseline andafter3monthsvalues ofLipid profile (MEAN ±SD)

PARAMETER	GROUPA	GROUPB	p value
TC	22.6± 0.9	24.6 ± 0.6	>0.05
TG	5.6±0.6	5.6 ± 0.12	>0.05
HDL	0.7±0.6	0.7±0.4	>0.05
LDL	18.5±0.3	27.6±1.0	<0.05
VLDL	1.0±0.09	1.2±0.04	>0.05

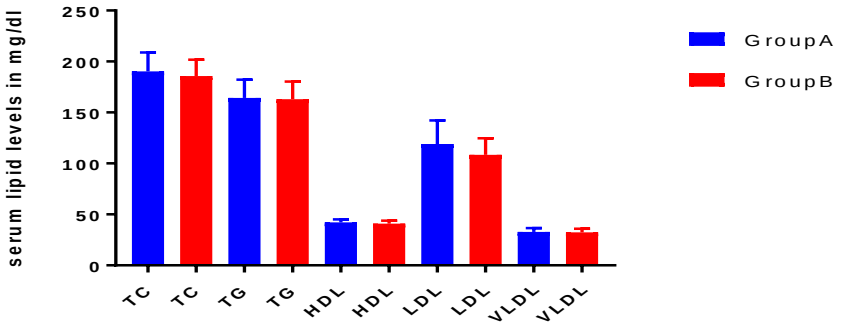

Figure 15: Decreasein lipid profile values in each group

Table10: Averagedifferencebetween baseline andafter3monthsvalues ofLiver function tests (MEAN ±SD)

PARAMETER	GROUP A	GROUP B	P VALUE
S.Biluribin	0.006±0.01	0.008±0.01	>0.05
ALT	0.8±0.41	0.1±0.23	>0.05
AST	0.5±0.27	0.1±0.04	>0.05
ALP	0.1±0.0	0.2±0.19	>0.05

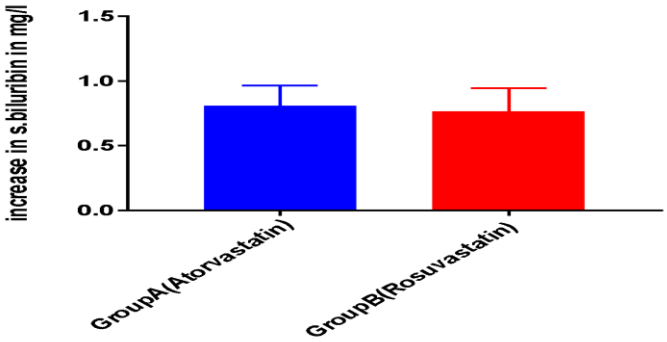

Figure 16: Difference in S.Bilirubin values in each group

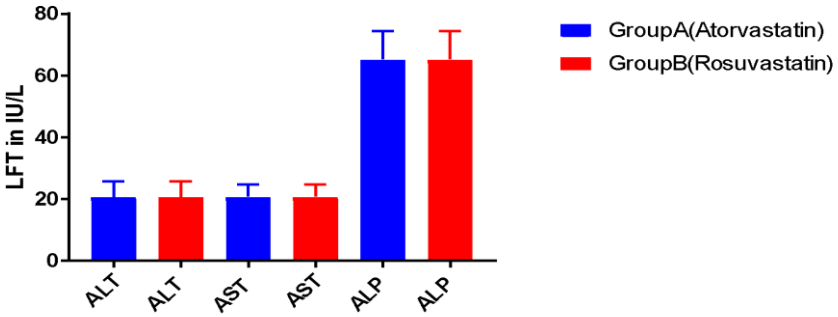

Figure 17: Differencein liver function test values in each group

Table 11: Adverse effects in each group

Adverse effect	**Group A (Atorvastatin)** Number of patients	**GroupB (Rosuvastatin)** Number of patients
Headache	1	1
Constipation	2	1
Diarrhoea	2	1
Abdominal pain	1	0
Dyspepsia	1	0
Pharyngitis	0	1
Myalgia	1	1

V. Discussion

In the present study once daily administration of Atorvastatin 40mg (Group A) decreases CRP from baseline 30.2±3.72 to 24.4±2.84 at 1 week and 11.6±1.75 at the end of one month and also once daily administration of Rosuvastatin 20mg decreases CRP from baseline 30.3±3.71 to 24.2±2.89 at 1week and 10.6±0.62 at the end of one month. The average difference of CRP means between baseline and 1 month is 18.6±1.9 for Atorvastatin(Group A) and 19.7±3.0 for Rosuvastatin (Group B). CRP decreases significantly in both the treatment groups (p value <0.0001). The fall in CRP was more significant in Rosuvastatin treatment group as compared to Atorvastatin treatment group(p value<0.05).

In MIRACL Study (Myocardial Ischaemia Reduction with Aggressive Cholesterol Lowering) conducted by **Scott Kinlay et al** intensive use of atorvastatin enhances the resolution of the marked inflammatory response associated with acute coronary syndromes. At 16 weeks, CRP was 34% lower with atorvastatin than with placebo.[10]

In a study conducted by **SushanthKhurana et al** CRP levels decreased significantly 35% with Atorvastatin 40 mg daily for 4weeks and the level of CRP also decreased significantly 44% with Rosuvastatin 20mg for 4 weeks.[11]

In **JUPITER trial** (Justification for the use of statins in primary prevention: An Intervention Trial Evaluating Rosuvastatin) of apparently healthy persons without hyperlipidemia but with elevated high sensitivity CRP levels. 20mg Rosuvastatin significantly reduced the incidence of major cardiovascular events.[12]

The results of present study are similar to the previous studies which have used different statins (pravastatin, simvastatin, lovastatin and Atorvastatin) in different doses to show the effect of statin therapy on CRP. In studies comparing statin with placebo, patients with statin had a greater reduction of CRP than those receiving placebo. The percentage reduction was from 13% to 50% with various statins.[13]

In a prospective study of effects of statins on CRP in the effects of Atorvastatin versus Simvastatin on Atherosclerosis progression **(ASAP) trail**, greater reduction in the CRP with Atorvastatin (34%) Simvastatin (9%) after 2yrs were associated with greater decrease in carotid intima- media thickness, on Atorvastatin 80mg/d and Simvastatin 40mg/d.[14]

In PROVE-IT trial (Pravastatin or Atorvastatin Evaluation and Infection Therapy) Intensive lipid lowering with atorvastatin 80 mg daily provided greater protection from death and cardiovascular events compared with pravastatin 40 mg daily in patients recently hospitalized with acute coronary syndromes (ACS). Atorvastatin 80 mg reduces major cardiovascular events by 16% compared with pravastatin 40 mg in ACS patient.[15]

The Pravastatin Inflammation/CRP Evaluation **(PRINCE) study** confirm that statin therapy can significantly reduce serum CRP levels in primary and secondary prevention populations. Following 24 weeks of therapy with a statin, the CRP level was reduced by approximately 13% in primary and secondary prevention populations, whereas placebo treatment of subjects in the primary prevention arm of the study had no effect. These studies, therefore, indicatethat statins are effective in decreasing systemic and vascular inflammation.[16]

The postulated mechanisms by which statins exert anti-inflammatory effect, thereby reducing CRP levels as follows

- statins inhibit lymphocyte adhesion to the intercellular adhesion mollecule-1 and impair T-cell stimulation by directly binding to the lymphocyte function -associated antigen-1 site.
- By inhibiting HMG-CoAreductase, statins inhibit the mevalonate pathway and consequently reduce the intracellular pools of isoprenoids, thereby downregulating the prenylation process.
- A study showed that statins reduce IL-6 induced CRP in human hepatocytes via inhibition of protein grenylation.[45-47]

In the present study once daily administration of Atorvastatin 40mg (Group A) decreases ESR from baseline 33.3±5.44 to 28.0±4.711 at 1 week and 23.3±3.65 at the end of one month and also once daily administration of Rosuvastatin 20mg decreases ESR from baseline 32.8±4.97 to 27.0±4.74 at 1week and 21.6±2.68 at the end of one month. The average difference of ESR means between baseline and 1 month is 10.0±1.7 for Atorvastatin(Group A) and 11.2±2.2 for Rosuvastatin (Group B). ESR decreases significantly in both the treatment groups (p value <0.0001).The fall in ESR was more significant inRosuvastatin treatment group as compared to Atorvastatin (p<0.05).

In another study conducted by Macin SM et al, also Atorvastatin 40mg/day for 30 days decreased ESR levels significantly in patients with Acute coronary syndromes.[17]

In another study conducted by SushanthKhurana et al.atorvastatin and rosuvastatin both decreased ESR levels significantly with no inter-group differences.[11]

In the present study once daily administration of Atorvastatin 40mg (Group A) decreases TCfrom 212.8±19.4 to 190.2±18.5 at the end of 3months.TG was decreased from 169.8±18.5 to 164.2±17.9 at the end of

3 months. HDLwas slightly increased from 41.5±3.51 to 42.2±2.89 at the end of 3 months. LDLwas decreased from 118.7±10.4to112.3±10.3 at the end of 3 months. VLDLwas decreased from 33.96±3.69 to 32.9±3.60 at the end of 3 months. There is significantdecreasein TC, TG,LDL, VLDL atthe endof 3rdmonths($p<0.0001$).and once daily administration of Rosuvastatin 20mg (Group B) decreases TC from210.3±16.68 to 185.7±16.08 at the end of 3 months. TGwas decreased from 168.5±17.25 to 162.9±17.37 at the end of 3 months.HDLwas slightly increased from 40.3±3.28 to 41.0±2.81 at the end of 3months.LDLwas decreased from 120.7±9.88to116.0±9.87at the end of 3 months. VLDLwas decreased from 33.6±3.45 to 32.46±3.49 at the end of 3 months.There is significantdecreasein TC, TG,LDL, VLDL atthe endof 3rdmonths($p<0.0001$). These findings are in accordance with those in literature.[18] There was no inter group differences of lipid profile except for LDL, which was decreased significantly in Group B rosuvastatin treatment group compared to Group A atorvastatin treatment group.

This was similar to the study of Davidson M et al. in which LDL was decreased significantly in rosuvastatin treatment group compared to atorvastatin treatment group. Rosuvastatin 5 and 10 mg compared with atorvastatin 10mg were associated with greater LDL cholesterol reductions and HDL cholesterol increases. Total cholesterol and apolipoprotein B reductions and apolipoproptein A-1 increases were also greater with rosuvastatin. Triglycerides reductions were similar.[19]

In another study conducted by v.v.padmavathi et al.rosuvastatin 10mg/day produced reduction in LDL cholesterol levels more significantly than atorvastatin 10 mg per day.[20]

The Reversal of Atherosclerosis with Lipitor (REVERSAL) trial conducted by Steven E. Nissen et al demonstrated the effects of aggressive (atorvastatin 80mg/day) vs moderate (pravastatin 40mg/day) lipid-lowering therapy on coronary atherosclerosis regression or progression using intravascular ultrasound technology. Intensive therapy was associated with no progression in atheroma volume whereas progression persisted with moderate therapy.[21]

In the present study once daily administration of Atorvastatin 40mg (Group A) increases s.biluribinfrom 0.801±0.16 to 0.807±0.15 at the end of 3 months.ALTwas increased from 19.93±5.42 to 20.7±5.01 at the end of 3months. ASTwas increased from 20.0±4.71 to 20.1±4.72 at the end of 3months.ALPwas increased from 65.3±10.6 to 65.4±10.6 at the end of 3months. There is no significantincrease in sbiluribin, AST and ALPlevels atthe endof 3months. ($p>0.05$) and there is significant increase in ALT at the end of 3 months ($p<0.05$).

In the present study once daily administration of Rosuvastatin 20mg (Group B) increases s.biluribinfrom 0.758±0.18 to 0.766±0.17 at the end of 3 months.ALTwas increased from 20.4±5.39 to 20.5±5.16 at the end of 3 months. AST was increased from20.5±4.04 to 20.6±4.07 at the end of 3months. ALPwas increased from 64.9±9.48 to 65.1±9.29 at the end of 3 months. There is no significantincrease in s.biluribin, AST, ALT and ALPlevels atthe endof 3months($p>0.05$).

The incidence of elevated aminotransferase levels across multiple studies performed with different types of statins generally did not exceed 3% of the studied patients sample.[22,23,24]

FDA reviewed current monitoring guidelines, including the National Lipid Association's Liver Expert Panel and Statin Safety Task Force recommendations. The Liver Expert Panel stated that the available scientific evidence does not support the routine monitoring of liver biochemistries in asymptomatic patients receiving statins. The Panel made this recommendation because (1) irreversible liver damage resulting from statins is exceptionally rare and is likely idiosyncratic in nature, and (2) no data exist to show that routine periodic monitoring of liver biochemistries is effective in identifying the very rare individual who may develop significant liver injury from ongoing statin therapy. The Panel believed that routine periodic monitoring will instead identify patients with isolated increased aminotransferase levels, which could motivate physicians to alter or discontinue statin therapy, thereby placing patients at increased risk for cardiovascular events.[23]

In the present study Headache was not edin1 patient of Group A and 1patient of Group B. Constipation was seen in 2 patients of Group A and 1 patient of Group B. Diarrhoea was seenin2 patients of Group A and1 in Group B. Abdominal pain was seen in 1 patient of Group A and none in Group B. Dyspepsia was seen in 1 patient of Group A and none in Group B. Pharyngitis was seen in 1 patient of Group Band none in Group A.1patient from Group Aand1from Group B complained of Myalgia. All these adverse effects were mild in severity and none needed any change or termination of treatment. so, present study showed both atorvastatin and rosuvastatin were well tolerated and free of major adverse effects and drug interactions. Another study conducted by Sushant Khurana et al. evaluated safety of atorvastatin and rosuvastatin in patients of acute coronary syndrome. Most common adverse effects are related to gastrointestinal system like constipation, upper GI discomfort and pain in abdomen.[11]

VI. Conclusion

In the present comparative study, there was no significant difference in between atorvastatin and rosuvastatin on TC, TG, HDL and VLDL but there was significant difference in between atorvastatin and rosuvastatin on CRP, ESR and LDL. It was found that rosuvastatin was more effective in decreasing CRP, ESR

and LDL compared to atorvastatin. And there is no significant difference in between atorvastatin and rosuvastatin on s.biluribin, ALT, AST and ALP values. Among the two groups we found that rosuvastatin has lower incidence of adverse effects.

6.1 Strengths of the present study:

- The present study evaluated the two most commonly prescribed drugs clinically that are atorvastatin and rosuvastatin. It helped to compare the effects of these drugs, unlike the previous studies mentioned, which were conducted on different statins.
- Thepresent studyexcluded the patients who were already taking statins or/other hypolipidemic drugs,sothatthe effect ofthestudy drugscanbeseen without anyinteractions with other hypolipidemicdrugs.
- Thepresentstudy has taken the most promising inflammatory biomarker CRP, a classical acute phase marker to evaluate the anti- inflammatory effect.
- The present study also evaluated the effect of atorvastatin and rosuvastatin on liver function tests.

6.2 Limitations of the study:

- The sample size is small. The sample sizeis60. Hadthesample sizebeen big, the results wouldhave beenmoreaccurate.
- The study has not taken other inflammatory biomarkers like TNF-α, SAA and IL-6.

6.3 Recommendations of further work:

- Study should be carried out with bigger sample size for the results to be more accurate.
- Studies should be carried out for longer duration to evaluate the long-term safety and efficacy of the drugs.

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