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Effect of Statins on Liver Enzymes and Lipid Profiles in Patients with Hyperlipidemia: A Biochemical and Physiological Perspective

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Abstract

Hyperlipidemia is a significant risk factor for cardiovascular diseases, necessitating effective lipid-lowering strategies. Statins, as HMG-CoA reductase inhibitors, are widely prescribed for this purpose. However, concerns regarding their impact on liver enzymes persist. This study aimed to evaluate the effects of statin therapy on liver function tests and lipid profiles in hyperlipidemic patients.

In this study, 120 hyperlipidemic patients were assigned to receive either atorvastatin 20 mg or rosuvastatin 10 mg daily for 12 weeks. Baseline and post-treatment levels of liver enzymes (ALT, AST, ALP) and lipid parameters (LDL-C, HDL-C, TG, TC) were measured. The atorvastatin group exhibited significant reductions in LDL-C (mean decrease: 45.2 ± 12.3 mg/dL, $p<0.001$) and TG (mean decrease: 30.5 ± 10.8 mg/dL, $p<0.01$), with a mild, non-significant increase in ALT levels (mean increase: 2.1 ± 1.5 U/L, $p=0.08$). The rosuvastatin group showed similar lipid-lowering effects without notable changes in liver enzymes.

These findings suggest that statins effectively improve lipid profiles in hyperlipidemic patients, with minimal impact on liver function tests. The slight elevation in ALT observed with atorvastatin was not clinically significant. Thus, statins remain a safe and efficacious option for lipid management in this population.

Keywords: Statins, Hyperlipidemia, Liver Enzymes

Introduction

Hyperlipidemia, characterized by elevated levels of lipids in the blood, is a significant risk factor for cardiovascular diseases (CVDs). Statins, or HMG-CoA reductase inhibitors, are the cornerstone of lipid-lowering therapy due to their efficacy in reducing low-density lipoprotein cholesterol (LDL-C) and associated cardiovascular events. However, concerns about their potential hepatotoxicity have led to hesitancy in their widespread use, particularly in patients with pre-existing liver conditions.

Recent studies have aimed to elucidate the safety profile of statins concerning liver function. A meta-analysis by Pastori et al. (2022) demonstrated that statin therapy did not significantly increase liver enzymes in patients with non-alcoholic fatty liver disease (NAFLD), suggesting a favorable safety profile in this population [1]. Similarly, a study utilizing data from the National Health and Nutrition Examination Survey (NHANES) found no significant association between statin use and elevated liver enzymes in patients with NAFLD [2].

Despite these findings, the potential for statin-induced liver injury, though rare, cannot be entirely dismissed. The incidence of statin-associated liver injury is estimated to be between 1.9% and 5.5%, with variations depending on the specific statin used [3]. Atorvastatin, for instance, has been associated with a higher risk of transaminase elevations compared to other statins [4-9].

Given these considerations, it is imperative to further investigate the impact of statins on liver function, particularly in populations with hyperlipidemia. This study aims to evaluate the effects of atorvastatin and rosuvastatin on liver enzymes and lipid profiles in patients with hyperlipidemia, thereby providing a biochemical and physiological perspective on their safety and efficacy.[10]

Methodology

A case control study was conducted to assess the effects of atorvastatin and rosuvastatin on liver enzymes and lipid profiles in patients with hyperlipidemia. The study included 120 patients aged 30-65 years with diagnosed hyperlipidemia, defined as LDL-C levels ≥130 mg/dL at Bolan

Medical College. Patients were randomly assigned to receive either atorvastatin 20 mg or rosuvastatin 10 mg daily for 12 weeks.

Sample size calculation was performed using Epi Info software, considering a power of 80%, a significance level of 5%, and an expected difference in LDL-C reduction between groups of 10 mg/dL. The calculated sample size was 60 patients per group.

Inclusion criteria encompassed adults aged 30-65 years with hyperlipidemia and no history of liver disease. Exclusion criteria included patients with known liver disease, alcohol abuse, use of hepatotoxic drugs, or contraindications to statin therapy. Verbal informed consent was obtained from all participants.

Baseline assessments included liver function tests (ALT, AST, ALP) and lipid profiles (LDL-C, HDL-C, triglycerides, total cholesterol). These assessments were repeated at the end of the 12-week treatment period. Data were analyzed using appropriate statistical methods, with significance set at $p<0.05$.

Results

Table 1: Demographic Characteristics of Study Participants

Parameter	**Atorvastatin Group (n=60)**	**Rosuvastatin Group (n=60)**	**p-value**
Age (years)	52.3 ± 8.1	51.7 ± 7.9	0.65
Male (%)	58%	55%	0.72
BMI (kg/m²)	27.5 ± 3.2	27.8 ± 3.5	0.58
Baseline LDL-C (mg/dL)	158.4 ± 12.7	157.9 ± 13.1	0.81

Table 2: Changes in Lipid Profiles After 12 Weeks

Parameter	**Atorvastatin Group**	**Rosuvastatin Group**	**p-value**
LDL-C (mg/dL)	-45.2 ± 12.3	-47.8 ± 11.9	0.28
HDL-C (mg/dL)	+5.1 ± 2.4	+5.4 ± 2.6	0.47
Triglycerides (mg/dL)	-30.5 ± 10.8	-32.1 ± 11.2	0.36
Total Cholesterol (mg/dL)	-50.7 ± 14.5	-52.3 ± 13.9	0.42

Table 3: Changes in Liver Enzymes After 12 Weeks

Parameter	**Atorvastatin Group**	**Rosuvastatin Group**	**p-value**
ALT (U/L)	+2.1 ± 1.5	+1.8 ± 1.3	0.08
AST (U/L)	+1.5 ± 1.2	+1.3 ± 1.1	0.12
ALP (U/L)	+0.9 ± 0.7	+0.7 ± 0.6	0.15

The demographic characteristics were comparable between the two groups. Both atorvastatin and rosuvastatin significantly improved lipid profiles, with no significant differences between the groups. Changes in liver enzymes were minimal and not statistically significant.

Discussion

The present study demonstrates that both atorvastatin and rosuvastatin effectively improve lipid profiles in patients with hyperlipidemia, with minimal impact on liver enzymes. These findings align with previous research indicating the safety and efficacy of statins in lipid management.

A meta-analysis by Pastori et al. (2022) supports the notion that statins do not significantly elevate liver enzymes in patients with NAFLD, reinforcing their safety profile [11]. Similarly, the NHANES-based study found no significant association between statin use and elevated liver enzymes in patients with NAFLD [12-13].

While the incidence of statin-induced liver injury is low, it is essential to monitor liver function during therapy. The observed minimal changes in liver enzymes in this study suggest that routine monitoring may not be necessary in all patients, aligning with current guidelines.

The comparable efficacy of atorvastatin and rosuvastatin in improving lipid profiles suggests that either statin can be effectively used in managing hyperlipidemia. The choice between the two may depend on patient-specific factors, including tolerance, cost, and potential drug interactions.[14-15]

This study's findings contribute to the growing body of evidence supporting the safe use of statins in patients with hyperlipidemia, including those with mild liver enzyme elevations. Further research may focus on long-term outcomes and the effects of higher statin doses.

The current study provides compelling evidence supporting the safety and efficacy of statin therapy, specifically atorvastatin and rosuvastatin, in patients with hyperlipidemia. Both statins significantly improved lipid profiles, with substantial reductions in LDL-C and triglyceride levels, and minimal, non-significant changes in liver enzyme levels. These findings align with previous

research indicating that statins are effective lipid-lowering agents with a favorable safety profile concerning liver function.

The minimal elevations observed in liver enzymes, such as ALT and AST, were not clinically significant and did not necessitate discontinuation of therapy. This observation is consistent with the American Heart Association's scientific statement, which notes that mild to moderate elevations in liver enzymes are common with statin use but rarely progress to severe liver injury. Furthermore, a meta-analysis by Pastori et al. (2022) demonstrated that statin therapy in patients with non-alcoholic fatty liver disease (NAFLD) led to reductions in liver enzyme levels, suggesting a potential hepatoprotective effect.

The concern regarding statin-induced hepatotoxicity has historically led to underutilization of statins in patients with elevated liver enzymes or underlying liver conditions. However, recent studies have challenged this notion. For instance, a cross-sectional analysis of NHANES data revealed that statin use was not associated with elevated liver enzymes in patients with NAFLD, and in fact, statin users had significantly lower ALT levels compared to non-users. This real-world evidence supports the notion that statins are safe for use in patients with mild to moderate liver enzyme elevations.

The lipid-lowering efficacy observed in this study is consistent with the known pharmacological profiles of atorvastatin and rosuvastatin. Both statins effectively reduce LDL-C levels, with rosuvastatin having a slightly higher potency. The significant reductions in triglyceride levels further underscore the efficacy of these agents in managing dyslipidemia. These improvements in lipid profiles are crucial for reducing the risk of atherosclerotic cardiovascular disease, which remains a leading cause of morbidity and mortality worldwide.

It is noteworthy that the study population did not experience any cases of severe liver injury or discontinuation of therapy due to adverse hepatic events. This finding aligns with the low incidence of statin-induced liver injury reported in the literature. For example, a study analyzing data from the Swedish Adverse Reactions Advisory Committee found that the incidence of clinically significant drug-induced liver injury from statins was exceedingly rare. These data collectively suggest that the benefits of statin therapy outweigh the risks concerning liver safety.The implications of these findings are significant for clinical practice. Physicians should feel confident in prescribing statins to patients with hyperlipidemia, even in the presence of mild liver enzyme

elevations. Routine monitoring of liver enzymes remains prudent, but concerns over hepatotoxicity should not preclude the use of statins when clinically indicated. This approach aligns with current guidelines, which recommend statin therapy for primary and secondary prevention of cardiovascular events in appropriate patient populations.

In conclusion, this study reinforces the safety and efficacy of atorvastatin and rosuvastatin in managing hyperlipidemia. The minimal impact on liver enzymes observed supports the continued use of these agents in patients without significant hepatic impairment. Future research should focus on long-term outcomes and the effects of statins in diverse patient populations, including those with more advanced liver disease.

Conclusion

Statin therapy, specifically atorvastatin and rosuvastatin, effectively improves lipid profiles in patients with hyperlipidemia without causing significant changes in liver enzymes. This study reinforces the safety of statins in this population and supports their continued use in managing hyperlipidemia. Future research should explore long-term outcomes and the effects of statins in diverse patient populations.

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