Review Article

Atorvastatin vs Rosuvastatin in the Prevention of Cardiovascular Events: A Systematic Review

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ABSTRACT

The main objective of this study is to compare any differences in the clinical response to rosuvastatin and atorvastatin in patients with cardiovascular disease. PubMed, SCOPUS, Web of Science, Science Direct, and Clinical Key were systematically searched for relevant literature. Rayyan QRCI was employed throughout this comprehensive process. We included eleven studies with a total of 6168 patients; 3231 (52.4%) patients received Atorvastatin, and 2937 (47.6%) received Rosuvastatin. Regarding ACS patients, Rosuvastatin outperformed Atorvastatin in improving laboratory indices and inflammatory markers and lowering LDL. In STEMI patients undergoing PCI, Atorvastatin was linked to less dysfunctional coronary circulation, better coronary microcirculation in patients with STEMI having primary PCI, and may enhance microvascular coronary perfusion immediately following PCI more effectively than a high-dose rosuvastatin preloading. The one study included patients undergoing CABG and did not find any differences between Atorvastatin and Rosuvastatin in preventing post-CABG atrial fibrillation (AF). These results suggest that when developing treatment plans for patients with cardiovascular disease, physicians may be able to combine atorvastatin with rosuvastatin. Cost considerations, tolerability, and patient-specific characteristics should all be taken into account during the decision-making process.

Keyword: Statins; Atorvastatin; Rosuvastatin; Cardiovascular disease; Coronary syndrome; Systematic review.

Introduction

According to the World Health Organization (WHO), circulatory disorders (CVDs) is one of the most common causes of mortality and prevalent globally.There have been significant efforts made to lower the associated rates of morbidity and death [1].

Medication therapy is the mainstay of controlling CVD, and there are several treatment choices available. Interestingly, statin medication has been shown to reduce mortality in those having coronary artery disease (CAD) that has progressed [2–3].

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A secondary preventive treatment for individuals 75 years of age or younger with atherosclerotic cardiovascular disease (ASCVD) is to begin high-intensity statin medication with the goal of achieving a 50% reduction in low-density lipoprotein cholesterol (LDL-C). These recommendations for dyslipidaemia were published by the American Heart Association/American College of Cardiology (AHA/ACC) in 2013 and 2018 [3]. Statins are frequently administered for the purpose of managing cholesterol levels with relation to CAD prevention, both primary and secondary. Major guidelines for individuals with acute coronary syndrome (ACS) continue to classify statins as IA recommendations (CoR), including individuals suffering from ST-elevated myocardial infarction (STEMI) and non-ST-elevation acute coronary syndrome (NSTE-ACS). It is imperative that these patients start taking statins as soon as feasible, without any limitations, and irrespective of their pre-acute episode baseline cholesterol levels [4-6]. It is unclear, therefore, whether patients with ACS should begin taking statins and whether high-dose statin loading (pretreatment) is clinically beneficial before either immediate or postponed percutaneous coronary surgery (PCI). Because statins have pleiotropic effects in addition to decreasing cholesterol that may act early while awaiting PCI, the biological justification for their early or very early [7] Utilization during the acute angiogenic event's early (unstable) stage is persuasive [8-11]. Their ability to decrease cholesterol and the proven therapeutic effects of rosuvastatin in patients undergoing primary prevention provide evidence for similar clinical benefits. It is crucial to determine whether both statins provide comparable benefits in secondary prevention scenarios that occur in real life, though, since those in secondary prevention have different clinical traits from those in primary prevention, such as a higher prevalence of diabetes [12], vascular revascularization [12], and different concurrent medications. In order to explore any differences in the clinical response to rosuvastatin and atorvastatin we conducted a comprehensive evaluation including only randomized controlled trials (RCTs) in individuals who have already been diagnosed with cardiovascular disease. This investigation has been set out to evaluate and compare rosuvastatin and atorvastatin's efficacy in avoiding cardiovascular events.

Methods

When conducting the Systematic Studies, PRISMA guidelines for Recommended Reporting Items for Systematic Studies and Meta-Analyses were followed [13]. Study Plan and Length: The implementation of this comprehensive review has been started at February 2024.

Search method: A comprehensive search of the following five primary databases was done in order to find the relevant literature: PubMed, Clinical Key, SCOPUS, Internet of Biology, and Science Direct. We solely examined English-language databases, taking into consideration their distinct needs. By transforming the following concepts as subject sentences or PubMed Search terms, the pertinent studies were located in Scopus; "Atorvastatin," "Rosuvastatin," "Prevention," "Prophylaxis," "Cardiovascular events," together with "Coronary syndrome." The necessary keywords were matched using Boolean operators "AND," "OR," and "NOT" Full-text English documents, publicly available articles, and human trials were among the hunt's results found.

The eligible standards that were advised by PICOS included the following:

1) Patient population (P): Individuals having CVS issues.

2) Intervention (I): Atorvastatin and Rosuvastatin.

3) Outcomes (O): The effect of the medication in the prevention of CVS events.

4) Research methodology (S): From 2019 through 2024, only RCTs were carried out.

Disqualification standards

We did not include the following kinds of articles in our review: correspondence, reviews, abstracts from conferences, case studies, unpublished data, and insufficient data. As soon as the investigators completed the eligibility examination, the authors held a discussion to settle any disputes.

Information extraction: Multiple entries were detected in the search results generated by the method using Rayyan QCRI [14]. To assess the relevance of the titles and abstracts, investigators appended inclusion and exclusion criteria to the aggregated search results. Every paper that satisfied the inclusion criteria was carefully examined by the reviewers. The writers discussed ways to settle disagreements. The approved study was uploaded using an already-generated data extraction form. Information on the work titles, authors, study year, country, gender, participants, duration of follow-up, kind of population, and history of diabetes or hypertension, and the authors obtained the primary outcomes. An assessment of the risk of bias was done on a separate page.

Method for synthesizing information

The summary tables, which included data from pertinent research, provided a qualitative analysis of the elements and research results. After gathering the data for the systematic review, the most effective method for utilizing the information from the relevant study articles was selected.

Potential for partiality in evaluation: The risk of bias in the included controlled studies was evaluated using the Cochrane Group's Risk of Bias (ROB) method [15]. A table with the findings is shown over many color palettes. Green indicates less risk, red denotes significant danger, and yellow indicates that there is insufficient data to assess the possibility of bias.

Results

Search results

(Figure 1) illustrated an overview of the method used to choose researches. After a thorough search, 302 study articles were found; 135 duplicates were eliminated. After evaluating 167 studies for titles and abstracts, 120 were not included. Out of the 47 reports that were asked to be retrieved, there were three articles found. 44 articles were chosen for full-text assessment; fifteen publications were dismissed due to erroneous study results, fifteen because of erroneous community type, and two were editor's letters. In this thorough examination, eleven reliable research papers were discovered. Features of the researches that were included. The sociodemographic information from the collected research publications is displayed in (Table 1). There were eleven studies totaling 6168 people in our results. 3231 (52.4%) patients received Atorvastatin, and 2937 (47.6%) received Rosuvastatin. The eleven studies were RCTs [16-26]. Iran was the site of three studies. [16, 19, 22], two within China [24, 26], the Turkish one [17], an instance in Spain [18], an instance in Pakistan [20], the Korean one [21], one in Saudi Arabia [23], and one inVietnam [25]. (Table 2) exhibits the medical characteristics. The period of follow-up varied from four days [25] up to three years [18, 26]. Seven studies included ACS patients [17-21], three included patients undergoing PCI [16, 23, 24], and one included patients undergoing CABG [22]. Regarding ACS patients, Rosuvastatin outperformed Atorvastatin in improving laboratory indices [19] and inflammatory markers [20] and lowering LDL [25, 26]. In STEMI patients undergoing PCI, Atorvastatin was linked to less dysfunctional coronary circulation, better coronary microcirculation in patients with STEMI having primary PCI, and may enhance microvascular coronary perfusion immediately following PCI more effectively than a high-dose rosuvastatin preloading [23, 24]. The one study included patients undergoing CABG and did not find any differences between Atorvastatin and Rosuvastatin in preventing post-CABG atrial fibrillation (AF) [22]. The risk of bias (ROB) in the included controlled studies was evaluated and the findings is shown over many color palettes to assess the possibility and results of bias (Figs. 2 and 3).

Discussion

This comprehensive review reported that Rosuvastatin outperformed Atorvastatin in improving laboratory indices [19] and inflammatory markers [20] and lowering LDL [25, 26] in ACS patients. Borovac et al. in a recent meta-analysis reported a 52% decrease with significant unfavorable cardiovascular and cerebral events within 30 days was linked to rosuvastatin loading (RR 0.48, 95% CI 0.34–0.66) [27]. Although the precise mechanisms behind the cardioprotective benefits of early high-dose statin loading for individuals with ACS having planned percutaneous revascularization are yet unknown. It is hypothesised that statins help the cardiovascular system through pleiotropic effects that extend beyond their primary method of decreasing cholesterol [28]. The groundbreaking CANTOS trial supported the inflammatory theory of atherothrombosis because, When patients have a history of MI and high-sensitivity CRP values > 2 mg/L, which indicate heightened systemic inflammation,Recurrent cardiovascular events were shown to be less common in patients treated with monoclonal antibodies that blocked the inflammatory interleukin-1β pathway, as opposed to placebo [29]. Clinical trials have tried medications that block IL-6 receptors, colchicine, methotrexate, and other immunological and inflammatory pathways in an attempt to avoid adverse cardiovascular events, with varying degrees of efficacy [30]. It's feasible that large dosages of statins given early in the course of ACS will have positive cardiovascular benefits due to their combined anti-inflammatory and lipid-lowering qualities, even if our understanding of these systems is still incomplete. Non-lipoprotein cholesterol (LDL-C) is not lowered by statins, although they do have anti-inflammatory effects and lower CRP levels [31]. Additionally, we discovered that atorvastatin was associated with improved coronary microcirculation in STEMI patients receiving primary PCI, as well as reduced dysfunctional coronary circulation in these individuals, and may enhance microvascular coronary perfusion immediately following PCI more effectively than a high-dose rosuvastatin preloading [23, 24].

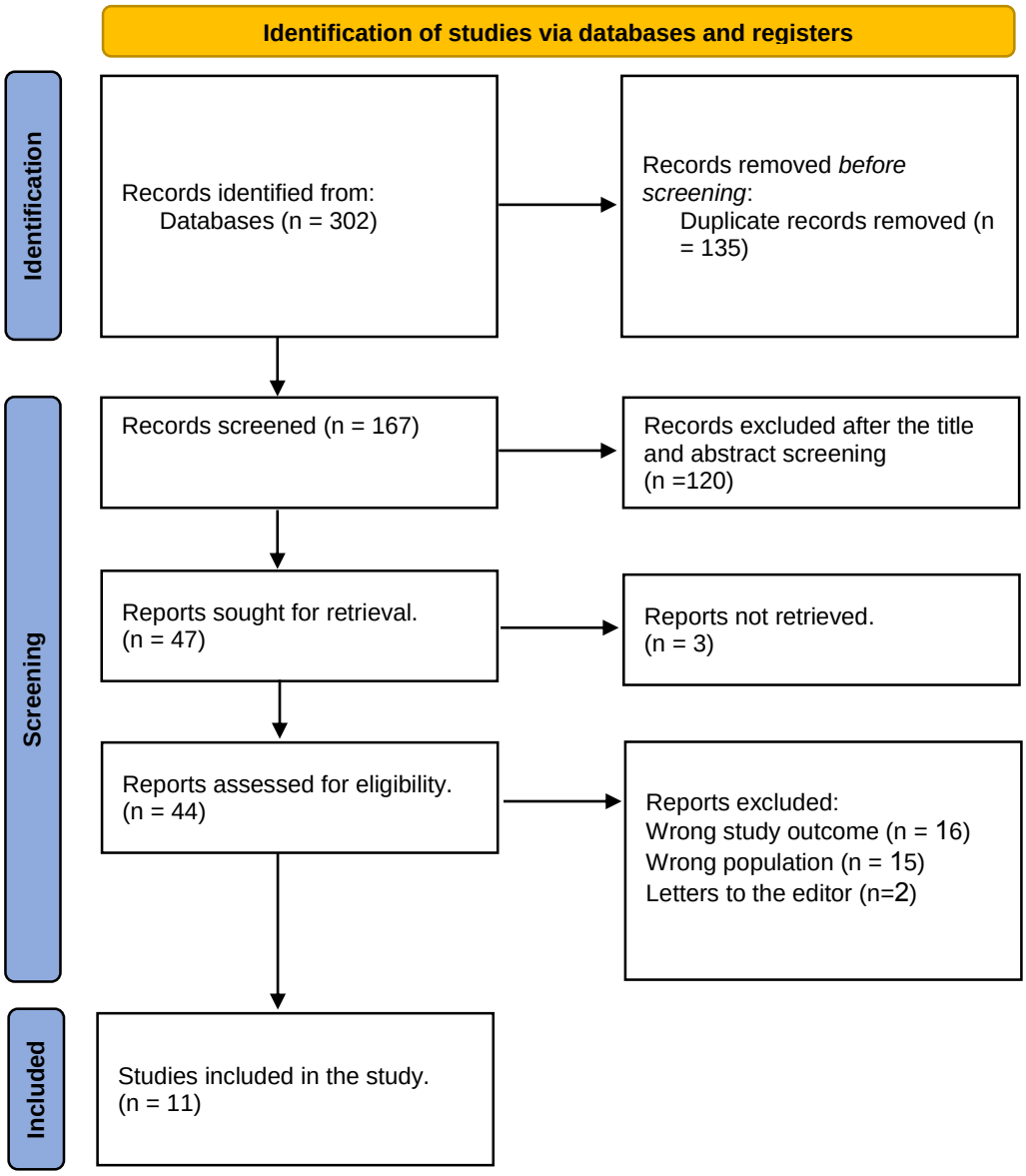

Figure 1: PRISMA flow chart illustrating the summed up of choosing studies.

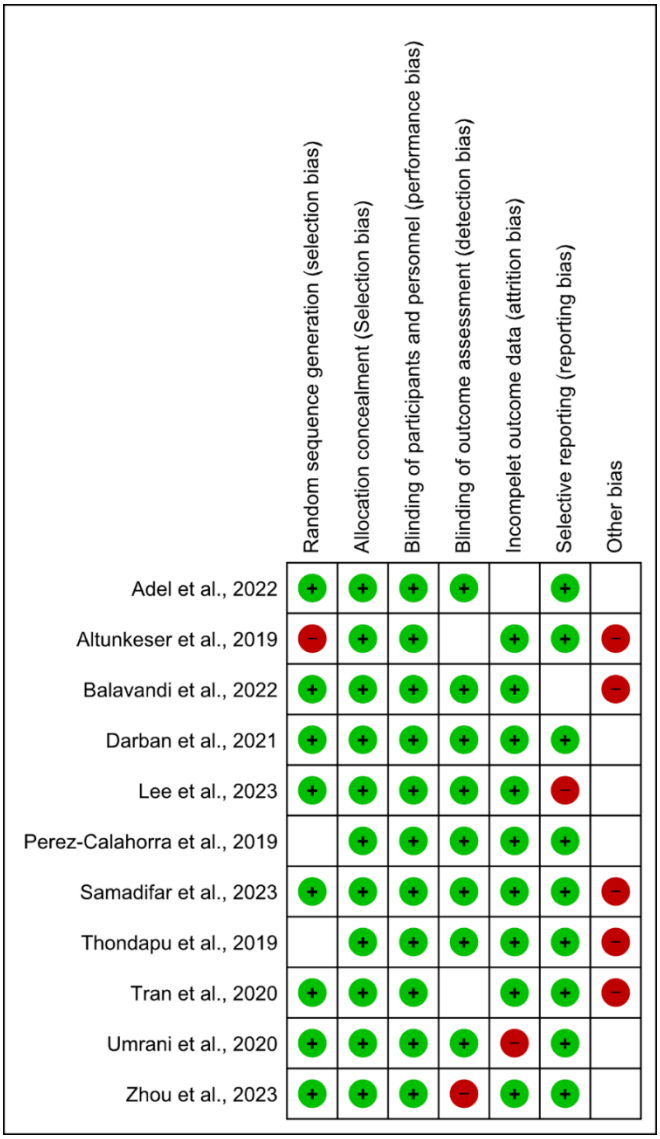

Figure 2: Risk of bias summary.

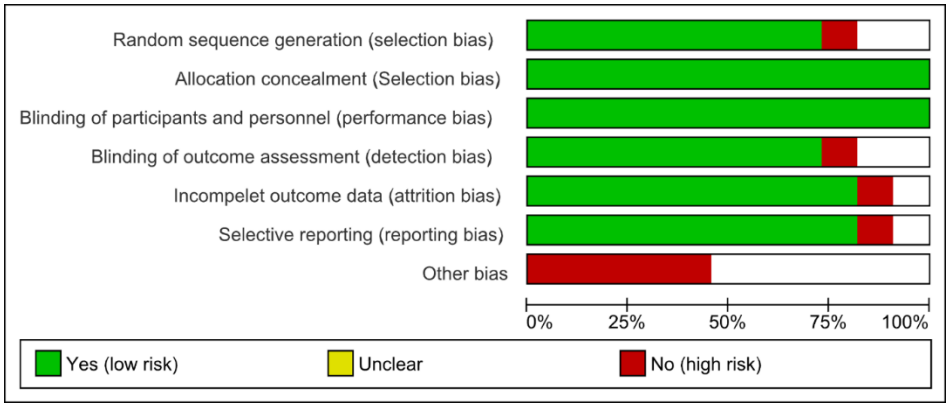

Figure 3: Risk of bias results.

Table 1: Sociodemographic characteristics of the included participants.

Study	Study design	Country	Groups	Participants	Mean age	Gender (Males)
Darban et al., 2021 [16]	RCT	Iran	Atorvastatin	30	60.8 ± 6.5	19 (63.3)
			Rosuvastatin	30	61.4 ± 6.7	16 (53.3)
Altunkeser et al., 2019 [17]	RCT	Turkey	Atorvastatin	53	58.13 ± 11.297	47 (88.7%)
			Rosuvastatin	53	59.08 ± 12.436	45 (84.9)
Perez-Calahorra et al., 2019 [18]	RCT	Spain	Atorvastatin	243	60.9 ± 11.1	190 (78.2)
			Rosuvastatin	164	60.9 ± 9.9	113 (68.9)
Balavandi et al., 2022 [19]	RCT	Iran	Atorvastatin	40	59.1 ± 1.7	20 (50)
			Rosuvastatin	40	57.9 ± 1.8	20 (50)
Umrani et al., 2020 [20]	RCT	Pakistan	Atorvastatin	54	51 ± 12	30 (55.6)
			Rosuvastatin	59	51 ± 12	31 (52.5)
Thondapu et al., 2019 [21]	RCT	Korea	Atorvastatin	19	54.2	13 (68%)
			Rosuvastatin	24	57.5	14 (58%)
Samadifar et al., 2023 [22]	RCT	Iran	Atorvastatin	100	60.13±9.40	75 (75)
			Rosuvastatin	100	59.30±8.42	75 (75)
Adel et al., 2022 [23]	RCT	Saudi Arabia	Atorvastatin	33	53.2 ± 9.9	26 (78.8%)

			Rosuvastatin	33	55.4 ± 8.7	28 (84.4)
Zhou et al., 2023 [24]	RCT	China	Atorvastatin	415	61.98 ± 12.76	341 (82.17%)
			Rosuvastatin	182	60.51 ± 11.6	157 (86.26%)
Tran et al., 2020 [25]	RCT	Vietnam	Atorvastatin	48	62.4 ± 12.2	34 (70.8%)
			Rosuvastatin	48	63.6 ± 11.8	31 (64.6%)
Lee et al., 2023 [26]	RCT	China	Atorvastatin	2196	65 ± 10	1570 (71.5%)
			Rosuvastatin	2204	65 ± 10	1602 (72.7%)

Table 2: Medical characteristics of the included participants.

Study	Type of patients	Groups	DM	HTN	Follow-up duration (months)	Main outcomes
Darban et al., 2021 [16]	Patients undergoing PCI	Atorvastatin	3 (10%)	2 (6.8%)	4	In patients undergoing PCI, large doses of rosuvastatin and atorvastatin improve hs-CRP levels and lipid profiles similarly. Furthermore, there are similarities in the effects of these drugs on people who have never taken a statin before and those who have.
		Rosuvastatin	6 (20%)	1 (3.8%)		
Altunkeser et al.,	ACS patients	Atorvastatin	11 (20.8%)	15 (28.3%)	1	In patients with ACS, high-dose atorvastatin and rosuvastatin therapy

2019 [17]		Rosuvastatin	11 (20.8%)	11 (20.8%)		regimens show similar effects on levels of PCSK9, TG, HDL-C, oxidized LDL, and LDL-C.
Perez-Calahorra et al., 2019 [18]	ACS patients	Atorvastatin	75 (30.9%)	118 (48.6%)	36	They advocate the use of rosuvastatin and atorvastatin as clinically similar treatments for secondary prevention of atherosclerotic cardiovascular disease (ASCVD) because they did not identify any discernible clinical differences between high dosages of either drug.
		Rosuvastatin	52 (31.7%)	92 (56.1%)		
Balavandi et al., 2022 [19]	ACS patients	Atorvastatin	NM	NM	3	Following rosuvastatin treatment, the patient's health has improved dramatically in all laboratory indices ($p < 0.05$). Given that rosuvastatin has a stronger impact on improving laboratory variables than atorvastatin does, prescribing this medication is advised to improve the condition of CVD patients.
		Rosuvastatin	NM	NM		
Umrani et al., 2020 [20]	ACS patients	Atorvastatin	NM	NM	1	In individuals with ACS, rosuvastatin considerably outperformed atorvastatin in lowering inflammatory markers, including ESR and hsCRP.
		Rosuvastatin	NM	NM		
Thondapu et al., 2019 [21]	ACS patients	Atorvastatin	9 (47%)	12 (63%)	6-12	Patients receiving daily doses of rosuvastatin 10 mg or atorvastatin 20 mg demonstrated plaque stabilization despite ongoing reduction in LDL levels, indicating either nonlipid-mediated effects of statin therapy or the necessity of maintaining low LDL levels for vascular structural alterations.
		Rosuvastatin	14 (58%)	18 (75%)		
Samadifar et al.,		Atorvastatin	30 (30%)	53 (53%)	3	About 29% of our patients experienced AF 48 hours following CABG despite taking

2023 [22]	Patients undergoing CABG	Rosuvastatin	24 (24%)	52 (52%)		statins. There was no discernible difference between atorvastatin and rosuvastatin in terms of preventing post-CABG AF.
Adel et al., 2022 [23]	Patients undergoing PCI	Atorvastatin	15 (45.5%)	14 (42.4%)	12	For statin-naïve STEMI patients, a single high-dose atorvastatin pretreatment prior to primary PCI may enhance microvascular coronary perfusion immediately following PCI more effectively than a high-dose rosuvastatin preloading.
		Rosuvastatin	13 (39.4%)	10 (30.3%)		
Zhou et al., 2023 [24]	Patients undergoing PCI	Atorvastatin	191 (46%)	106 (25.54%)	NM	Atorvastatin was linked to less dysfunctional coronary circulation and better coronary microcirculation in patients with STEMI having pPCI as compared to rosuvastatin; however, these effects did not translate into better in-hospital outcomes. Therefore, more research is required to determine whether different statin kinds have an impact on patient outcomes when pPCI is performed on STEMI patients.
		Rosuvastatin	89 (48.9%)	38 (20.88%)		
Tran et al., 2020 [25]	ACS patients	Atorvastatin	39 (81.3%)	16 (33.3%)	4 (days)	In Vietnamese individuals with ACS, rosuvastatin is more effective than atorvastatin in reaching LDL-c goals of less than 1.8 mmol/L after 4 days.
		Rosuvastatin	32 (66.7%)	9 (18.8%)		
Lee et al., 2023 [26]	ACS patients	Atorvastatin	743 (33.8%)	1439 (65.5%)	36	The composite outcome of all causes of mortality, myocardial infarction, stroke, or any coronary revascularization showed similar efficacy for rosuvastatin and atorvastatin. Compared to atorvastatin, rosuvastatin was linked to decreased LDL cholesterol levels but a greater risk of newly developed diabetes mellitus that required antidiabetics and cataract surgery.
		Rosuvastatin	725 (32.9%)	1498 (68%)		

Previous clinical trials have demonstrated that high-dose statin usage can avoid procedural myocardial damage during elective PCI in individuals with stable CAD [32] and lower MACCE in patients with ACS undergoing PCI [33]. Less is known, though, about when to start these medications and at what dosage when a cardiac event is first presenting acutely [34]. When Patti et al. presented a collaborative Meta-analysis at the patient level [35], the use of preprocedural statins was found to significantly reduce periprocedural MIs and serious complications at 30 days in a heterogeneous patient group having PCI, which further strengthened the favorable signal. The advantageous consequences of atorvastatin [36] as well as rosuvastatin [37] in ACS patients receiving PCI, additional reviews have demonstrated the effect of loading on periprocedural cardiac damage and MACCE. A meta-analysis of fifteen randomized controlled studies found that high dosage statin medication prior to PCI significantly improved coronary blood flow as determined by post-procedure TIMI flow grade, compared to the control group [38]. Statins have pleiotropic effects, which are non-lipid-lowering mechanisms that include platelet aggregation prevention, plaque stability, anti-thrombotic and anti-inflammatory properties, and enhanced endothelial function. [39, 40]. All of these positive effects on coronary blood flow and myocardial perfusion are made possible by these processes. Hydrophilic (atorvastatin) and lipophilic (statins) are thought to have different pleiotropic effects since the former are hepatoselective and may be less pleiotropically effective, whilst the latter are broadly dispersed among extra-hepatic tissues [41]. RCTs are still the gold standard in evidence-based medicine, although they are frequently impractical because of their high cost and lengthy execution. Simulation-based clinical trials can offer important information about the expected results of treatment variation when RCT data is lacking but is still required to guide optimal clinical practice. This systematic review has several limitations, starting from the qualitative nature of the review. The included RCTs were conducted in variable follow-up durations that ranged from 4 days to 36 months. Additionally, this review did not discuss the variability in statin doses.

Conclusion

These results suggest that when developing treatment plans for patients with cardiovascular disease, physicians may be able to combine atorvastatin with rosuvastatin. Cost considerations, tolerability, and patient-specific characteristics should all be taken into account during the decision-making process.

Conflict of Interest

None

Funding

None

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