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Efficacy and Safety of Rosuvastatin versus Atorvastatin in the Treatment of Ischemic Stroke: A Systematic Review and Meta-Analysis Based on Randomized Controlled Trials

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Abstract

This study aimed to compare the efficacy and safety of rosuvastatin and atorvastatin in the treatment of ischemic stroke. Literature published before January 1, 2026 was retrieved from five databases, including PubMed, Web of Science, CNKI, Wanfang, and VIP. Eligible studies were screened according to the predefined inclusion and exclusion criteria. The included studies were comprehensively analyzed based on the primary outcome measures of blood lipid parameters, including low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), and total cholesterol (TC), as well as the secondary outcome measures of carotid atherosclerosis, including intima-media thickness (IMT) and plaque area, together with the neurological deficit score assessed by the National Institutes of Health Stroke Scale (NIHSS). A total of 12 randomized controlled trials were included in the final analysis. The results showed that, compared with atorvastatin, rosuvastatin demonstrated superior effects in reducing blood lipid levels and improving carotid IMT and NIHSS scores. Overall, rosuvastatin exhibited better clinical efficacy in the treatment of ischemic stroke. Although both agents showed broadly comparable effects in lipid lowering, stabilization of carotid atherosclerotic plaques, and improvement of neurological function, rosuvastatin appeared to have a more favorable safety profile than atorvastatin. Nevertheless, further multicenter, large-scale, high-quality randomized controlled trials are still required to confirm its efficacy and safety.

Keywords

ischemic stroke, statins, rosuvastatin, atorvastatin, meta-analysis

1. Introduction

Ischemic stroke is a clinical syndrome caused by insufficient local cerebral blood perfusion, with its primary pathological mechanism involving irreversible necrosis of brain tissue due to ischemia and hypoxia, ultimately resulting in neurological deficits [1]. According to data from the 2019 Global Burden of Disease Study, there

were 12.2 million new stroke cases worldwide, of which 3.94 million occurred in China, with the total number of prevalent stroke cases reaching 28.76 million. Notably, stroke has become the leading cause of disability among Chinese residents and is often accompanied by cognitive impairment, motor dysfunction, and reduced language ability, severely affecting patients' quality of life and social functioning [22].

Ischemic stroke is characterized by high incidence, high disability, and high recurrence rates, accounting for approximately 60%–80% of all stroke cases in China. Its pathogenesis is complex, and substantial interindividual differences exist in clinical manifestations and prognosis, which are influenced by multiple risk factors [10]. Established major modifiable risk factors include hypertension, smoking, diabetes mellitus, and obesity, while dyslipidemia has also been recognized as an important independent risk factor for ischemic stroke. Specifically, elevated low-density lipoprotein cholesterol (LDL-C), increased total cholesterol (TC), and decreased high-density lipoprotein cholesterol (HDL-C) may all promote the progression of carotid atherosclerosis, accelerate plaque formation and rupture, induce thrombosis, and thereby significantly increase both first-ever and recurrent ischemic stroke risk [5]. Therefore, early identification and intervention targeting these risk factors, particularly lipid regulation and stabilization of carotid atherosclerosis, have become critical components of stroke prevention and treatment strategies.

Among various lipid-lowering interventions, pharmacological therapy has been widely used because of its well-established efficacy, with statins being fully validated as first-line lipid-lowering agents in clinical practice [11]. Statins competitively inhibit hydroxymethylglutaryl-coenzyme A reductase, effectively reducing cholesterol synthesis and exerting significant lipid-lowering effects. In addition, they possess multiple pleiotropic effects, including anti-inflammatory activity, improvement of vascular endothelial function, and stabilization of atherosclerotic plaques [13].

At present, rosuvastatin and atorvastatin are commonly used representatives of high-intensity statins for the treatment of ischemic stroke. The former is a new-generation synthetic statin characterized by lower lipophilicity and tissue permeability, a weaker hepatic first-pass effect, and a relatively specific metabolic pathway. In contrast, the latter is a naturally derived lipophilic statin with strong lipophilicity, extensively studied pharmacokinetic characteristics, and more mature clinical application experience [9,14]. Although both agents have distinct features in terms of lipid-lowering magnitude, pharmacokinetic parameters, clinical efficacy, and safety, robust comparative studies with consistent conclusions remain lacking, and their relative advantages in the treatment of ischemic stroke are still under debate.

In recent years, as the role of statins in secondary prevention of ischemic stroke has become increasingly clear, numerous randomized controlled trials have evaluated their clinical benefits. However, studies directly comparing rosuvastatin and atorvastatin remain relatively limited, and the existing evidence shows substantial heterogeneity in sample size, study design, and endpoint indicators, thereby limiting the generalizability and reliability of conclusions. Therefore, this study aimed to systematically retrieve and screen relevant randomized controlled trials to comprehensively evaluate the differences in efficacy and safety between rosuvastatin and atorvastatin in the treatment of ischemic stroke, with the goal of providing high-quality evidence to support individualized pharmacological treatment strategies for this population.

2. Materials and Methods

2.1 Search Strategy

This systematic review was conducted in accordance with the PRISMA 2020 statement. Relevant studies were searched in five databases, including PubMed, Web of Science, CNKI, VIP, and Wanfang, with the search deadline set at February 1, 2026. The search terms included "stroke," "ischemic stroke," "cerebral infarction," "statins," "rosuvastatin," "atorvastatin," and "randomized controlled trial."

2.2 Inclusion and Exclusion Criteria

Inclusion Criteria

1) Original studies published in peer-reviewed journals;

2) Adult participants diagnosed with ischemic stroke;

3) All included studies were randomized controlled trials;

4) The control group received conventional stroke therapy plus atorvastatin, whereas the experimental group received conventional stroke therapy plus rosuvastatin.

Exclusion criteria

1) Meta-analyses, reviews, conference abstracts, case reports, and other non-original studies;

2) Studies with insufficient data that remained unavailable after contacting the authors;

3) Patients with metallic implants, cardiac pacemakers, or cochlear implants;

4) Patients with contraindications to statin therapy.

2.3 Study Selection

The retrieved records were imported into EndNote 9.0 for literature management and duplicate removal. Study titles, abstracts, and full texts were independently screened according to the inclusion and exclusion criteria, and the reasons for exclusion were documented for each study.

2.4 Quality Assessment

Since all included studies were randomized controlled trials, the Cochrane Risk of Bias (ROB) assessment tool was used for methodological quality evaluation. Evidence quality was assessed from multiple aspects, including study objectives, study design, study population, observation or measurement methods, outcome analysis, quality control, and result reporting. After quality assessment, Review Manager 5.3 was used to generate the risk-of-bias summary and individual quality assessment figures.

2.5 Data Extraction and Analysis

Data extraction and analysis were performed for studies that passed quality assessment. Extracted study characteristics included clinical features (i.e., first author and publication year, sample size [experimental/control groups], and treatment conclusions) and outcome measures (blood lipid levels, carotid IMT score, and NIHSS score). After data extraction, Review Manager 5.3 was used to generate forest plots.

3. Results

3.1 Study Selection Results and Characteristics of Included Studies

A total of 2,546 relevant studies were identified through database searches. After duplicate removal, 2,043 studies remained. Following preliminary screening, 117 studies were retained, and after full-text review, 105 studies were excluded. Ultimately, 12 randomized controlled trials meeting the eligibility criteria were included. The total sample size across all included studies was 1,405 patients, including 704 patients in the experimental group and 701 in the control group (Figure 1).

The 12 included studies [3,4,6,8,12,15,16,17,18,20,21,23] were published between 2016 and 2024 and involved sample sizes ranging from 60 to 420 participants, with group allocations ranging from 30/30 to 210/210. The reported outcome measures included lipid parameters (TC, triglycerides, LDL-C, and HDL-C), carotid atherosclerosis indicators (intima-media thickness and plaque area), severity of neurological deficits, treatment efficacy-related indicators (overall response rate and prognostic conversion), quality of life, psychological status scores, as well as several laboratory parameters such as hemorheology and serum inflammatory markers. All studies reported the incidence of adverse events and adopted standard randomization methods, including random number tables and computer-generated randomization. The findings of all 12 studies [3,4,6,8,12,15,16,17,18,20,21,23] were generally consistent, indicating that rosuvastatin showed superior overall efficacy to atorvastatin in the treatment of ischemic stroke, with stronger lipid-lowering effects, better improvement in carotid atherosclerosis, more favorable clinical outcomes, relatively

higher medication safety, and fewer adverse reactions. Some studies further suggested additional benefits in improving patients' emotional status and reducing inflammatory factors (see Table 1).

Figure 1: Flowchart of literature screening

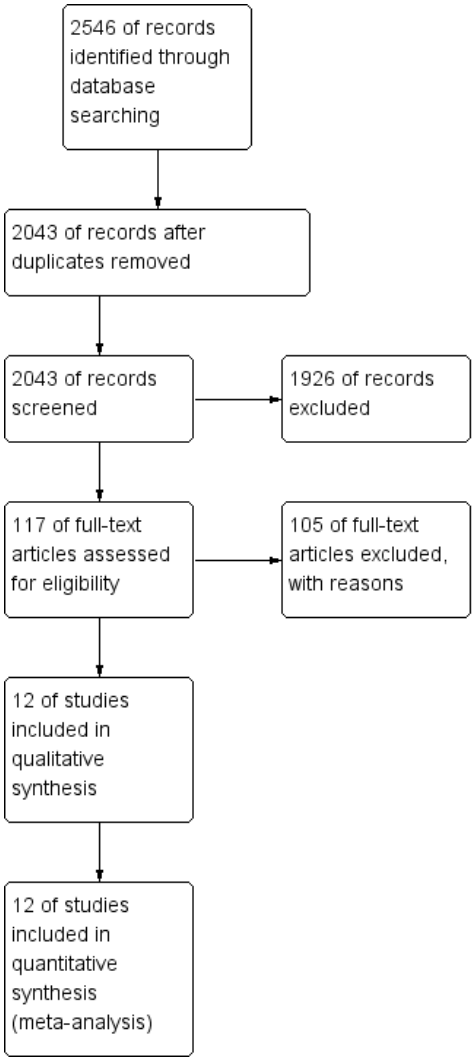


Table 1. Baseline characteristics and outcomes of the included studies

First author /Year	Sample size (Experimental /Control)	Study type	Outcome measures	Main conclusion
Guo Guiying/ 2016	45/45	RCT	Lipid parameters (TC, TG, LDL-C, HDL-C), incidence of adverse events	Compared with atorvastatin, rosuvastatin demonstrated better clinical efficacy in the treatment of ischemic stroke, significantly improved patients' cardiac function indicators, and alleviated stroke symptoms.
Hu Yanyan/2018	60/60	RCT	Overall response rate, NIHSS score, WHOQOL-BREF (quality of life), incidence of adverse events	Rosuvastatin effectively improved the clinical efficacy in ischemic cerebrovascular disease, enhanced patients' quality of life, and showed a low incidence of adverse events with high safety,

First author /Year	Sample size (Experimental /Control)	Study type	Outcome measures	Main conclusion
				indicating important clinical value.
Jiang Longjiao/2021	40/40	RCT	Overall response rate, prognostic outcomes (recurrence rate, incidence of coronary events, infarction rate, and hemorrhage rate), incidence of adverse events	Rosuvastatin improved clinical symptoms in transient ischemic attack, reduced recurrence, infarction, and coronary event rates, and showed significant efficacy worthy of wider clinical application.
Guo Jin/2018	40/40	RCT	Lipid parameters (TC, TG, LDL-C, HDL-C), NIHSS score, BI index, cerebral blood flow velocity (ACA, MCA, PCA), hemorheological indicators (whole blood high-shear viscosity, whole blood low-shear viscosity, hematocrit), incidence of adverse events	Compared with atorvastatin, intensive lipid-lowering therapy with rosuvastatin showed significant efficacy in acute cerebral infarction and had a favorable safety profile.
Liu Lin/2021	51/49	RCT	Lipid parameters (TC, TG, LDL-C, HDL-C), inflammatory factors (CRP, IL-6, TNF-α), HAMD score (depression), incidence of adverse events	Compared with atorvastatin, rosuvastatin showed more pronounced efficacy in improving depressive symptoms in patients with ischemic cerebrovascular disease and had higher safety, making it more suitable for elderly cerebral infarction patients with comorbid depressive symptoms.
Qiu Shuijian/2020	49/49	RCT	Prognosis (Rankin Scale), chemokines, adiponectin, incidence of adverse events	Compared with atorvastatin, rosuvastatin significantly improved the short-term favorable prognosis rate in acute cerebral infarction, reduced chemokine levels, increased adiponectin levels, and showed a lower incidence of adverse events.
Yao Lina/2018	43/42	RCT	Lipid parameters (TC, TG, LDL-C, HDL-C), carotid IMT, hs-CRP, NIHSS score, mRS score, incidence of adverse events	Rosuvastatin showed stronger lipid-lowering effects and was more effective in stabilizing atherosclerotic plaques.
Luo Jin/2022	46/46	RCT	Lipid parameters (TC, TG, LDL-C, HDL-C), carotid IMT, plaque area, NIHSS score, overall response rate	Rosuvastatin showed more significant effects in improving lipid levels, carotid atherosclerotic plaques, and carotid intima-media thickness, more effectively relieved clinical symptoms, and demonstrated strong clinical applicability and reference value.
Ou Yan/2024	210/210	RCT	Lipid parameters (TC, TG, LDL-C, HDL-C), NIHSS score, overall	Rosuvastatin showed higher safety and clinical effectiveness,

First author /Year	Sample size (Experimental /Control)	Study type	Outcome measures	Main conclusion
			response rate, incidence of adverse events	with a lower incidence of adverse events.
Wang Hongjie/2020	40/40	RCT	Lipid parameter (LDL-C), carotid IMT, incidence of adverse events	Rosuvastatin showed significant clinical efficacy, better post-treatment lipid levels, a more pronounced lipid-lowering effect, and a lower incidence of adverse events.
Wang Chaobin/2022	50/50	RCT	Lipid parameters (TC, TG, HDL-C, LDL-C), overall response rate, serum biomarkers (MIF, CKLF1, FN), incidence of adverse events	Rosuvastatin demonstrated relatively superior therapeutic effects, higher safety, and important benefits in improving patients' physiological indicators.
Guo Xinghong/2022	30/30	RCT	Carotid IMT, plaque area, SAS/SDS scores (anxiety/depression), GQOL-74 (quality of life), overall response rate, incidence of adverse events	Both atorvastatin and rosuvastatin were effective in patients with transient ischemic attack, but rosuvastatin showed more significant effects, a lower probability of adverse events, improved quality of life, and alleviated negative emotions after better disease control, supporting its clinical promotion.

Note: RCT, randomized controlled trial; TC: Total Cholesterol; TG: Triglyceride; LDL-C: Low-Density Lipoprotein Cholesterol; HDL-C: High-Density Lipoprotein Cholesterol; NIHSS: National Institutes of Health Stroke Scale; mRS: modified Rankin Scale; CRP: C-Reactive Protein; IL-6: Interleukin-6; TNF-α: Tumor Necrosis Factor-α; HAMD: Hamilton Depression Scale; ACA: Anterior Cerebral Artery; MCA: Middle Cerebral Artery; IMT: Intima-Media Thickness; MIF: Macrophage Migration Inhibitory Factor; CKLF1: Chemokine-Like Factor 1; FN: Fibronectin

3.2 Quality Assessment Results

Among the 12 included studies, all participants were randomly assigned using standard randomization methods, such as random number tables and computer-generated randomization, and all outcome data were complete. In 10 studies, the method of allocation concealment was unclear. Eight studies explicitly reported blinded outcome assessment in the experimental design, whereas one study did not adopt a double-blind design, which may have introduced a certain degree of reporting bias. Most studies showed no other sources of bias, while one study demonstrated baseline imbalance bias. Overall, the methodological quality of the included studies was moderate (Figures 2–3)

Figure 2: Risk-of-bias graph of the included studies

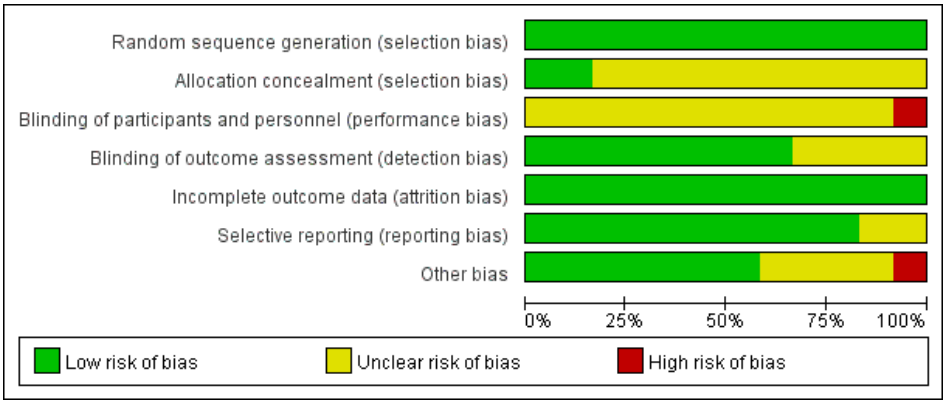
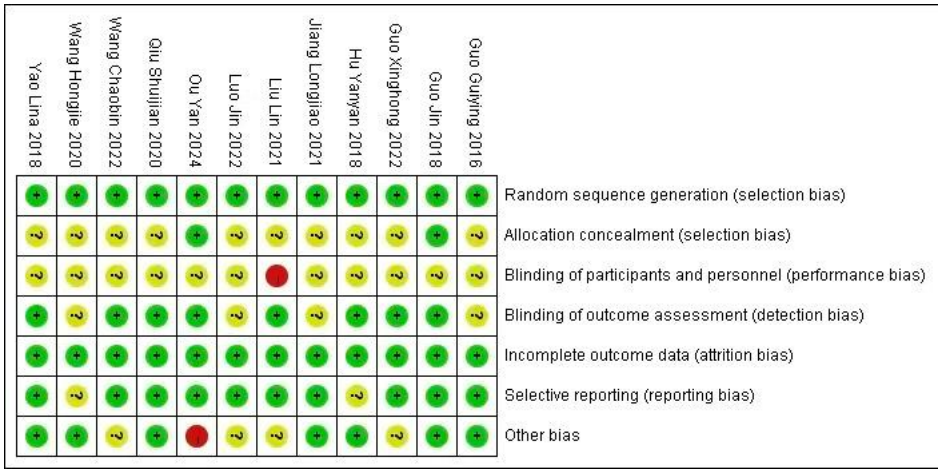


Figure 3: Risk-of-bias summary of the included studies



3.3 Improvement in Blood Lipid Levels

The meta-analysis results for the three lipid parameters, LDL-C, HDL-C, and TC, consistently showed that the rosuvastatin group achieved significantly greater improvement than the atorvastatin group ($P < 0.00001$). For LDL-C, eight studies were included, involving 525 patients in the experimental group and 522 in the control group. The pooled analysis showed MD = 0.34 (95% CI: 0.27–0.40), with moderate heterogeneity observed ($Chi^2 = 18.29$, $df = 7$, $P = 0.01$; $I^2 = 62\%$), and $Z = 9.95$ (Figure 4). For HDL-C, seven studies were included, involving 485 patients in the experimental group and 482 in the control group. The pooled effect size was MD = 0.31 (95% CI: 0.28–0.35), with high heterogeneity ($Chi^2 = 167.39$, $df = 6$, $P < 0.00001$), and $Z = 17.31$ (Figure 5). For TC, seven studies involving 652 patients in the experimental group and 650 in the control group were included. The pooled result showed MD = 0.51 (95% CI: 0.45–0.57), with high heterogeneity ($Chi^2 = 48.81$, $df = 6$, $P < 0.00001$), and $Z = 16.48$ (Figure 6). These findings indicate that rosuvastatin was significantly superior to atorvastatin in reducing LDL-C and TC levels and increasing HDL-C levels. Detailed baseline data of each study are presented in Table 2. Studies by Yao, Guo, Wang, and others [6,20,23] further supported and recommended the clinical lipid-lowering use of rosuvastatin, particularly highlighting its superior effect in reducing LDL-C. Therefore, rosuvastatin may be considered the preferred agent for intensive lipid-lowering therapy in ischemic cerebrovascular disease.

Figure 4: Forest plot of LDL-C

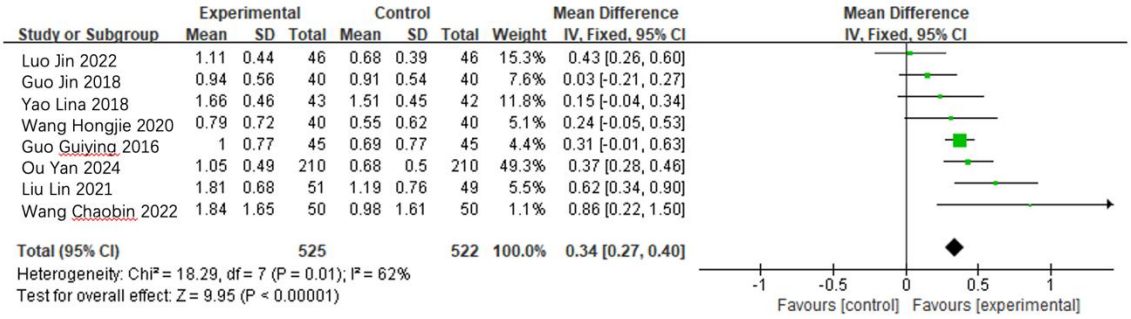


Figure 5: Forest plot of HDL-C

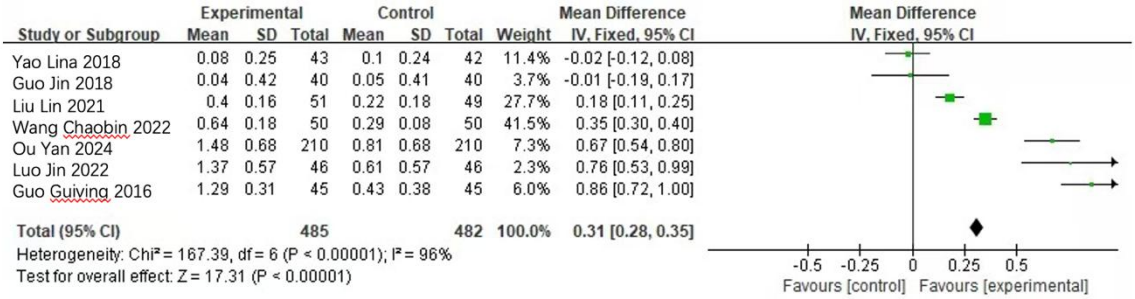


Figure 6: Forest plot of TC

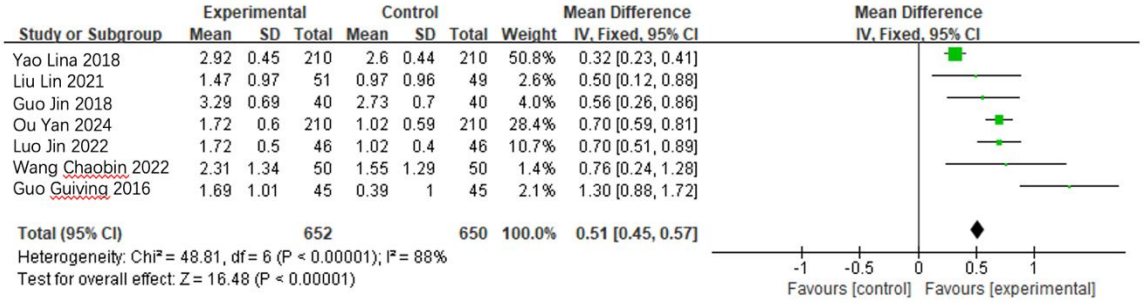


Table 2: Baseline data of primary outcome measures in the included studies

First author/ Year	Blood Lipid Levels (Experimental/Control)						Carotid IMT (Experimental/Control)		NIHSS score (Experimental/Control)	
	LDL-C		HDL-C		TC					
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Guo Guiying/2016	3.81±0.85 /3.81±0.85	2.81±0.21 /3.12±0.18	1.12±0.35 /1.12±0.35	2.41±0.22 /1.55±0.41	5.91±1.12 /5.91±1.12	4.22±0.28 /5.52±0.31	-	-	-	-
Guo Jin/2018	2.69±0.63 /2.71±0.60	1.75±0.46 /1.80±0.45	1.09±0.41 /1.10±0.40	1.13±0.43 /1.15±0.42	4.80±0.79 /4.67±0.79	1.51±0.50 /1.94±0.53	-	-	13.44±2.76 /13.63±3.05	7.32±1.89 /5.45±1.53
Liu Lin/2021	3.84±0.75 /3.65±0.85	2.03±0.59 /2.46±0.63	1.22±0.15 /1.24±0.20	1.62±0.17 /1.46±0.16	5.89±1.08 /5.92±1.10	4.42±0.78 /4.95±0.42	-	-	-	-
Yao Lina/2018	3.72±0.53 /3.78±0.51	2.06±0.29 /2.27±0.34	1.02±0.20 /1.04±0.17	1.10±0.28 /1.14±0.27	5.60±0.51 /5.59±0.46	2.68±0.36 /2.99±0.41	2.45±0.67/2.52±0.70	1.47±0.52/1.53±0.48	7.46±1.70 /7.42±1.65	3.11±1.48 /3.32±1.13
Wang Chaobin/2022	3.85±1.71 /3.86±1.72	2.01±0.12 /2.88±1.48	1.21±0.09 /1.22±0.08	1.85±0.21 /1.51±0.01	6.52±1.02 /6.53±1.03	4.21±1.52 /4.98±1.45	-	-	-	98.0% /74.0%
Ou Yan/2024	3.94±0.51 /3.97±0.54	2.89±0.46 /3.29±0.45	0.83±0.67 /0.87±0.64	2.31±0.69 /1.68±0.72	6.18±0.69 /6.15±0.67	4.46±0.39 /5.13±0.41	-	-	-	93.48% (43/46) /69.96% (32/46)
Wang Hongjie/2020	2.91±0.78 /2.98±0.67	2.12±0.63 /2.43±0.54	-	-	-	-	LICA:0.88±0.14 /0.86±0.10 RICA:0.88±0.14/0.89±0.15 LCCA:1.06±0.24 /1.05±0.22 RCCA:1.07±0.42 /1.08±0.28	LICA:0.82±0.21 /0.85±0.06 RICA:0.88±0.11 /0.86±0.10 LCCA:1.11±0.28 /1.08±0.27 RCCA:1.08±0.24 /1.03±0.20	-	-
Luo Jin/2022	3.89±0.49 /3.86±0.43	2.78±0.35 /3.18±0.34	0.92±0.56 /0.96±0.53	2.29±0.58 /1.57±0.61	6.07±0.58 /6.04±0.56	4.35±0.28 /5.02±0.39	LICA:0.88±0.16 /0.87±0.13 RICA:0.89±0.20 /0.90±0.17 LCCA:1.09±0.24 /1.07±0.26 RCCA:1.12±0.34 /1.10±0.31	LICA:0.81±0.05 /0.85±0.09 RICA:0.81±0.08 /0.87±0.14 LCCA:0.98±0.17 /1.08±0.23 RCCA:1.00±0.19 /1.11±0.28	-	93.48% (43/46) /9.96% (32/46)
Hu Yanyan/2018	-	-	-	-	-	-	-	-	10.08±4.21/9.34±3.46	8.63±4.20 /6.42±3.33
Jiang Longjiao/2021	-	-	-	-	-	-	-	-	-	90.0% /77.5%
Qiu Shuijian/2020	-	-	-	-	-	-	-	-	-	55.10% /40.82%
Guo Xinghong/2022							1.71±0.47 /1.73±0.45	1.14±0.32/1.58±0.41	-	96.67% /80.00%

3.4 Improvement in Carotid IMT

The results showed that patients treated with rosuvastatin exhibited significant improvements in carotid vascular structure and plaque stability. Specifically, the reduction in carotid intima-media thickness (IMT) from baseline was greater in the rosuvastatin group than in the atorvastatin group. In addition, the decrease in plaque area was more pronounced in the rosuvastatin group. Furthermore, vascular wall-related parameters of the internal carotid artery and common carotid artery were better improved following rosuvastatin treatment, and patients' quality of life was correspondingly enhanced. No severe vascular-related adverse events were observed in either group, with only a small number of patients reporting mild local discomfort. Overall, both treatments demonstrated a favorable safety profile.

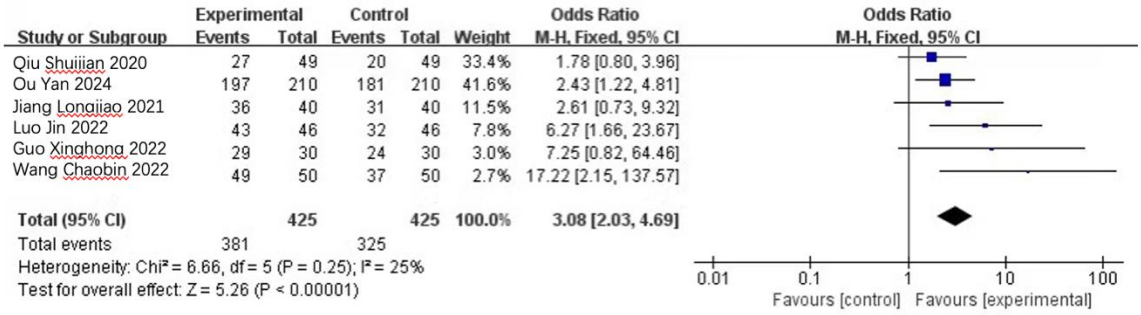
3.5 NIHSS Score Improvement

The results of the included studies showed that rosuvastatin had a slight advantage over atorvastatin in improving neurological deficits in patients with ischemic stroke. Pooled analysis of the changes in NIHSS scores before and after treatment between the two groups revealed certain heterogeneity across the included studies. Some studies demonstrated more significant improvements in NIHSS scores in the rosuvastatin group, while others found that the improvement in this group was slightly weaker than that in the atorvastatin group. Overall, rosuvastatin was more effective in promoting neurological recovery. Although the pooled effect did not reach the conventional statistical significance level of $P < 0.05$, the results still suggested that rosuvastatin had certain potential value in improving neurological impairment in patients with ischemic stroke. Therefore, further studies with larger sample sizes are needed to confirm this trend.

3.6 Overall Response Rate

A total of six randomized controlled trials used the overall clinical response rate as the primary efficacy endpoint. The meta-analysis results showed that the overall response rate in the rosuvastatin group was significantly higher than that in the atorvastatin group (OR = 3.08, 95% CI: 2.03–4.69, $P < 0.00001$), with a statistically significant difference. Heterogeneity analysis indicated low heterogeneity among the included studies ($Chi^2 = 6.66$, $df = 5$, $P = 0.25$; $I^2 = 25\%$). Therefore, a fixed-effects model was applied for pooled analysis. The results of individual studies consistently suggested a higher response rate in the rosuvastatin group, further supporting the robustness of this conclusion.

Figure 7: Forest plot of overall response rate



4. Discussion

This study systematically retrieved and rigorously screened relevant literature and ultimately included 12 randomized controlled trials to comprehensively evaluate the efficacy and safety of rosuvastatin versus atorvastatin in the treatment of ischemic stroke. The results showed that the rosuvastatin group was significantly superior to the atorvastatin group in terms of overall clinical response rate, with a pooled odds ratio of 3.08 (95% CI: 2.03–4.69, $P < 0.00001$). Regarding lipid regulation, rosuvastatin demonstrated a stronger lipid-lowering effect, showing significantly greater reductions in low-density lipoprotein cholesterol (LDL-C) (MD = 0.34, 95% CI: 0.27–0.40, $P < 0.00001$) and total cholesterol (TC) (MD = 0.51, 95% CI: 0.45–0.57, $P < 0.00001$) compared with atorvastatin, as well as a more pronounced increase in high-density lipoprotein cholesterol (HDL-C) (MD = 0.31, 95% CI: 0.28–0.35, $P < 0.00001$). In terms of neurological

function recovery, the difference in the National Institutes of Health Stroke Scale (NIHSS) score between the two groups did not reach statistical significance (MD = –0.50, 95% CI: –1.02 to 0.02, P = 0.06); however, the overall trend still favored rosuvastatin. These findings suggest that rosuvastatin may have certain advantages in improving lipid profiles, delaying the progression of atherosclerosis, and promoting neurological recovery in patients with ischemic stroke, while maintaining a favorable safety profile, and may provide reliable evidence-based support for optimal statin selection in clinical practice.

Statins have been established as cornerstone agents in the secondary prevention of ischemic stroke. They not only effectively inhibit hydroxymethylglutaryl-coenzyme A reductase, thereby reducing cholesterol synthesis, decreasing the deposition of low-density lipoprotein in the vascular wall, and slowing or even reversing the progression of atherosclerosis, but also stabilize vulnerable plaques and reduce both primary and recurrent stroke risk. More importantly, statins exert multiple pleiotropic effects beyond lipid lowering, including anti-inflammatory, antioxidant, antiplatelet, neuroprotective, and endothelial function–improving properties [2,13]. These mechanisms act synergistically throughout the pathophysiological process of stroke, from initial injury and inflammatory cascade to neural repair, thereby contributing to improved prognosis and quality of life.

With the advancement of evidence-based medicine, the clinical value of statins in stroke management has been increasingly recognized. Early studies established the role of statins in secondary prevention, supporting long-term or even lifelong use to reduce recurrence risk, which has been validated by numerous high-quality randomized controlled trials. Subsequent clinical studies further demonstrated their benefits in the acute and hyperacute phases of ischemic stroke, suggesting that early initiation of statin therapy not only achieves rapid lipid control but also provides immediate vascular and neuroprotective effects, thereby improving short-term outcomes. In recent years, the therapeutic concept of “early initiation, intensive lipid lowering, long-term maintenance, and lifelong management” has been gradually adopted in clinical guidelines, emphasizing individualized statin therapy based on etiological subtypes and patient-specific risk factors [19].

Rosuvastatin and atorvastatin are both widely used high-intensity statins in clinical practice, with comparable effects in lipid lowering, plaque stabilization, and vascular protection, making them suitable for both acute intervention and long-term secondary prevention of ischemic stroke. However, differences exist in their pharmacokinetic properties and safety profiles. Atorvastatin is primarily metabolized by the hepatic cytochrome P450 enzyme system (particularly CYP3A4), which increases the risk of drug–drug interactions and requires careful monitoring and dose adjustment in patients with hepatic or renal impairment [7]. In contrast, rosuvastatin undergoes minimal hepatic metabolism and is predominantly eliminated via the kidneys, resulting in better tolerability in patients with hepatic dysfunction or those receiving multiple concomitant medications. Furthermore, at equivalent doses, rosuvastatin demonstrates greater reductions in LDL-C and TC levels and more pronounced increases in HDL-C. Some studies have also suggested that rosuvastatin may have stronger neuroprotective potential, possibly related to its more potent inhibition of HMG-CoA reductase and broader anti-inflammatory and endothelial repair effects [13]. These characteristics may help explain the superior clinical efficacy and safety observed for rosuvastatin in this study.

The results of this meta-analysis further support the potential superiority of rosuvastatin in the treatment of ischemic stroke. It showed overall advantages in improving clinical response rates, optimizing lipid profiles, and reducing neurological deficit scores, indicating a higher likelihood of clinical benefit. However, moderate to high heterogeneity was observed in the pooled analysis of lipid parameters, which may be attributed to differences in sample size, treatment regimens, duration of therapy, and follow-up periods among the included studies. Therefore, future large-scale, multicenter, and well-designed randomized controlled trials are warranted to validate these findings. Although the improvement in NIHSS scores did not reach statistical significance, the observed trend remains clinically informative and warrants further investigation using additional neurological outcome measures.

Overall, this study provides more targeted evidence-based support for the use of rosuvastatin in ischemic stroke. Compared with atorvastatin, rosuvastatin demonstrated advantages in lipid-lowering efficacy, overall clinical outcomes, and safety. Based on the current evidence, rosuvastatin may be considered a preferable option for individualized lipid-lowering therapy in patients with ischemic stroke, particularly in high-risk populations requiring long-term secondary prevention or those with poor tolerance to conventional statins. Further prospective data are needed to refine precision treatment strategies across different etiological subtypes.

4.1 Limitations

This study has several limitations. First, the number of included studies was relatively small, and the sample sizes were limited, which may affect the stability and reliability of the results. Second, variations in treatment regimens and outcome measures across studies may have influenced the pooled analysis. In addition, some studies were of relatively low methodological quality or had small sample sizes, which may have introduced bias. Therefore, further high-quality randomized controlled trials are required to validate the comparative effects and mechanisms of rosuvastatin versus atorvastatin in stroke recovery.

4.2 Future Perspectives

Future studies may focus on the upstream and downstream molecular targets regulated by different statins. In addition, conducting large-scale, multicenter, randomized controlled trials to verify the efficacy and safety of non-invasive brain stimulation techniques is of great significance. Exploring the combined effects of statins with other treatment modalities may also provide more clinically applicable evidence.

5. Conclusion

This systematic review and meta-analysis of 12 randomized controlled trials demonstrated that rosuvastatin was superior to atorvastatin in improving overall clinical response rate, lipid profiles, and carotid atherosclerosis in patients with ischemic stroke. It also showed advantages in efficacy and safety and may provide better improvement in neurological deficits. These findings provide evidence-based support for clinical medication selection. However, further large-scale, multicenter, high-quality studies are still required to confirm the long-term efficacy.

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