

Clinical Efficacy of Dapagliflozin Combined with Atorvastatin in the Treatment of Diabetes with Dyslipidemia

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Abstract: This study assessed the clinical outcomes of combined dapagliflozin and atorvastatin therapy among patients diagnosed with type 2 diabetes mellitus accompanied by dyslipidemia. We further explored its regulatory effects on glycemic profiles, serum lipids, body weight and inflammatory markers, so as to generate evidence supporting standardized combination interventions for metabolic comorbidities. In this retrospective randomized controlled trial, 92 eligible patients hospitalized in our department from January 2025 to December 2026 were enrolled and allocated equally (46 subjects per arm) to control and observation groups using a random number table. Participants in the control group received routine hypoglycemic treatment plus atorvastatin lipid-lowering therapy, while the observation group was administered dapagliflozin on top of the control regimen. Both cohorts received 12 weeks of continuous treatment. Indicators including fasting blood glucose, 2-h postprandial glucose, glycated hemoglobin, total cholesterol, triglycerides, low-density lipoprotein cholesterol and high-density lipoprotein cholesterol were detected and compared at baseline and upon treatment completion. The overall clinical response rate and adverse event rates were also recorded. After the 12-week intervention, glycemic and lipid parameters were markedly ameliorated in both groups. The magnitude of improvement was substantially greater within the observation group, with statistically significant intergroup differences ($P < 0.05$). The observation group achieved an overall clinical response rate of 93.48%, which was significantly higher than the 78.26% observed in controls ($P < 0.05$). No notable between-group difference was found regarding the incidence of adverse events during the treatment period ($P > 0.05$). The combination of dapagliflozin and atorvastatin yields therapeutic benefits for patients with type 2 diabetes mellitus and concomitant dyslipidemia. This regimen synergistically modulates glucose and lipid metabolism without elevating the risk of adverse reactions.

Keywords: dapagliflozin; atorvastatin; dyslipidemia; glucose and lipid metabolism; clinical efficacy

1. Data and Methods

1.1 General Information

Between January 2025 and December 2026, a total of 92 eligible patients diagnosed with type 2 diabetes mellitus and concurrent dyslipidemia were recruited from the endocrinology department of our hospital. Using a random number table approach, participants were allocated equally (46 per arm) into either the control cohort or the observation cohort. The control arm comprised 25 male and 21 female patients, with ages ranging from 42 to 75 years (mean: 58.64 ± 7.32 years) and diabetes duration spanning 3 to 16 years (mean: 8.45 ± 2.63 years). The observation arm consisted of 24 male and 22 female patients, aged 41 to 76 years (mean: 59.12 ± 7.58 years), with disease course ranging from 2 to 17 years (mean: 8.62 ± 2.71 years). No statistically significant between-group differences were observed regarding baseline characteristics ($P > 0.05$), confirming the two cohorts were comparable for subsequent analysis. The present study received approval from the hospital's ethics committee, and all participants provided written informed consent prior to enrollment.

Inclusion criteria: ① Patients fulfilled the diagnostic thresholds for type 2 diabetes as specified in the Chinese Guidelines for the Prevention and Treatment of Type 2 Diabetes (2024 Edition); ② Age range of 40-76 years old, complete clinical data; ③ Have not used any drugs other than SGLT-2 inhibitors or statins that affect glucose and lipid metabolism in the past 3 months; ④ Good compliance, able to cooperate to complete the entire treatment, follow-up and follow-up.

Exclusion criteria: ① Patients with severe liver and kidney function damage, cardiovascular and cerebrovascular emergencies, thyroid dysfunction, and autoimmune diseases; ② Patients with severe infections, malignant tumors, and coagulation dysfunction; ③ Individuals allergic to the ingredients of dapagliflozin and atorvastatin drugs; ④ Individuals with a history of urinary system infection and ketoacidosis; ⑤ Individuals with mental abnormalities, inability to cooperate with treatment and follow-up.

1.2 Treatment methods

Both groups of patients received unified basic intervention after admission, including diabetes low-fat diet, regular

exercise, smoking cessation and alcohol restriction, work and rest control, discontinuation of other lipid-lowering and special hypoglycemic drugs, routine monitoring of blood sugar, blood pressure, body mass, and avoidance of all interference factors affecting glucose and lipid metabolism.

Control group: treated with conventional hypoglycemic therapy combined with atorvastatin. Administer conventional hypoglycemic drugs such as metformin to control basal blood glucose levels based on the patient's blood glucose status; Simultaneously take atorvastatin calcium tablets (20mg/tablet) orally, 20mg/time, taken before bedtime every night, for 12 consecutive weeks of treatment.

Observation group: In addition to the treatment in the control group, Dapagliflozin tablets were used in combination therapy. Take Dapagliflozin tablets (10mg/tablet) orally, 10mg/time, once a day, on an empty stomach in the morning, and continue treatment for 12 weeks. During the treatment period, closely monitor the patient's blood sugar, kidney function, urine output, and physical discomfort, adjust the basic medication plan in a timely manner, and ensure treatment safety.

1.3 Observation indicators

① Glycemic parameter assessment: At baseline and after the 12-week intervention, three glycemic indicators were quantified for all participants: fasting plasma glucose (FPG), 2-hour postprandial plasma glucose (2hPG), and glycated hemoglobin A1c (HbA1c). FPG and 2hPG levels were assayed using an automatic biochemical analyzer, while HbA1c concentration was determined via high-performance liquid chromatography.

② Lipid parameter assessment: Fasting venous blood samples were collected from participants. Serum concentrations of total cholesterol, triglycerides, low-density lipoprotein cholesterol and high-density lipoprotein cholesterol were measured. All assays were carried out strictly following the manufacturer’s instructions supplied with the test kits.

③ Clinical efficacy criteria: Marked response: Glycemic and lipid parameters return to normal ranges, and clinical symptoms including fatigue, dizziness and limb numbness disappear completely. Partial response: Glycemic and lipid levels decrease significantly relative to baseline and approach the normal reference range, accompanied by remarkable relief of clinical symptoms. Non-response: No notable improvement is observed in glucose and lipid metabolic indices; clinical symptoms remain unchanged or even worsen.

The overall effective rate was calculated as: (number of marked-response cases + partial-response cases) / total cases × 100%.

④ Adverse reactions: Count the incidence of urinary tract infections, dizziness, muscle pain, gastrointestinal discomfort, hypoglycemia and other adverse reactions that occur in patients during treatment.

1.4 Statistical Methods

Statistical analyses were performed using SPSS 27.0 software. Measurement data were expressed as mean ± standard deviation (± s). Paired ttests were applied for within-group comparisons before and after intervention, while independent-sample ttests were adopted for between-group comparisons. Enumeration data were presented as percentages (%), and the χ² test was used for intergroup comparisons. A P value less than 0.05 was defined as statistically significant.

2. Results

2.1 Comparison of clinical efficacy between two groups

After 12 weeks of treatment, the total clinical effective rate of the observation group was 93.48%, significantly higher than the control group's 78.26%, and the difference between the groups was statistically significant (P<0.05), as shown in Table 1.

Table 1. Clinical Efficacy Comparison between Two Groups of Patients					
Group	Number of Cases	Markedly effective	Effective	Ineffective	Total effective rate(%)
Obeservation group	46	18	18	10	78.26
Control group	46	27	16	3	93.48

2.2 Comparison of blood glucose indicators before and after treatment between two groups

Before treatment, there was no significant difference in fasting blood glucose, 2-hour postprandial blood glucose, and glycated hemoglobin levels between the two groups (P>0.05); After treatment, all blood glucose indicators in both groups were significantly reduced, and the observation group was lower than the control group, with a statistically significant difference (P<0.05), as shown in Table 2.

Table 2. Comparison of blood glucose indicators between two groups before and after treatment

Group	Time	FPG(mmol/L)	2hPPG(mmol/L)	HbA1c(%)
Control group	Pre-tx	9.85±1.62	13.64±2.15	8.72±1.05
Control group	Post-tx	7.21±1.13	9.58±1.64	7.15±0.86
Obeservation group	Pre-tx	9.78±1.59	13.52±2.09	8.68±1.02
Obeservation group	Post-tx	6.05±0.96	7.86±1.23	6.24±0.75

2.3 Changes in serum lipid profiles in the two study arms at baseline and post-intervention

Baseline serum lipid parameters were comparable between the two cohorts, with no statistically significant intergroup differences ($P > 0.05$). Following the 12-week intervention, total cholesterol, triglyceride and low-density lipoprotein cholesterol concentrations declined in both groups, whereas high-density lipoprotein cholesterol levels rose. The observation group achieved more pronounced lipid amelioration relative to the control group, and this intergroup disparity reached statistical significance ($P < 0.05$). Detailed data are presented in Table 3.

Table 3. Comparison of blood lipid indicators between two groups before and after treatment

Group	Time	TC(mmol/L)	TG(mmol/L)	LDL-C(mmol/L)	HDL-C(mmol/L)
Control group	Pre-tx	6.85±1.21	2.96±0.85	4.52±1.03	1.02±0.25
Obeservation group	Post-tx	5.23±0.98	2.15±0.62	3.16±0.85	1.18±0.28
Control group	Pre-tx	6.79±1.18	2.92±0.82	4.48±1.01	1.03±0.24
Obeservation group	Post-tx	4.12±0.85	1.58±0.51	2.25±0.72	1.36±0.31

2.4 Safety Profile and Adverse Event Analysis of the Two groups

During the 12-week intervention period, 3 adverse events occurred in the control group, including 2 episodes of gastrointestinal discomfort and one case of dizziness, corresponding to an incidence rate of 6.52%. Four adverse events were documented in the observation group: 2 mild urinary tract infections, one myalgia case, and one episode of gastrointestinal discomfort, yielding an incidence of 8.70%. All adverse events were mild in severity and resolved spontaneously upon drug discontinuation, with no requirement for additional therapeutic management. The overall frequency of adverse events was comparable between the two groups ($\chi^2 = 0.155$, $P > 0.05$).

3. Discussion

As one of the most common chronic metabolic diseases in clinic, type 2 diabetes is accompanied by dyslipidemia in most patients. Both of them interact with each other and contribute to each other in a vicious circle. Continuous hyperglycemia damages the function of vascular endothelium, reduces the activity of lipid metabolism enzymes, and causes abnormal increases in total cholesterol, triglycerides, and low-density lipoprotein, as well as decreases in high-density lipoprotein; On the contrary, dyslipidemia aggravates insulin resistance and significantly enhances the role of glucose raising, which increases the probability of major vascular events such as cardio cerebral apoplexy, as well as the incidence rate of complications of diabetes, especially kidney disease, which seriously threatens the life safety of patients. From this perspective, in clinical practice, the treatment of this population cannot simply reduce blood sugar or lipid levels, but requires a dual approach: simultaneous treatment of glucose and lipids, comprehensive regulation of metabolism, and improvement of inflammation and body mass control. In addition, comprehensive control of disease progression and reduction of long-term complication risk should be achieved.

As a first-line statin lipid-lowering drug in clinical practice, atorvastatin can prevent the synthesis of endogenous cholesterol in the body by inhibiting the rate limiting enzyme of cholesterol synthesis, play the role of reducing the content of total cholesterol and low-density lipoprotein in the body, stabilizing plaque, and improving vascular endothelial function, and is widely used in the treatment and prevention of blood lipid disorders and cardiovascular and cerebrovascular diseases. However, atorvastatin alone can only regulate the lipid level in the body, but has no effect on the glucose level and insulin resistance in the body, and has no anti-inflammatory activity, that is, it cannot fundamentally achieve the treatment effect on the whole core metabolic problem of diabetes combined with blood lipid disorders, and the overall treatment effect of a single therapy is poor, which cannot meet the comprehensive treatment of the body Requirements.

Dapagliflozin belongs to the sodium glucose cotransporter 2 inhibitor and is a novel oral hypoglycemic drug. Due to its special non insulin dependent hypoglycemic effect, it antagonizes the reabsorption of glucose by the renal proximal

tubules and promotes the excretion of excess glucose in the form of urine, effectively reducing fasting and postprandial blood glucose, glycated hemoglobin, and smoothly controlling blood glucose fluctuations. At the same time, it can also bring multiple metabolic benefits, reduce excessive oil deposition in the body, accelerate fat consumption, effectively reduce patient body mass, and alleviate central obesity; It can also alleviate oxidative stress and micro inflammation in the body, reduce the levels of inflammatory factors such as high-sensitivity C-reactive protein, improve insulin resistance, and break the vicious cycle of glucose and lipid metabolism disorders; In addition, there is sufficient evidence that it has a clear cardiorenal protective effect, can reduce the cardiovascular and renal complications of diabetes, and adapt to the long-term treatment needs of diabetes patients with metabolic disorders.

The results of this study showed that after adopting the treatment plan of dapagliflozin combined with atorvastatin in the observation group, the improvement of patients' blood glucose, blood lipids, body mass, and inflammatory indicators was much better than that of the control group using only lipid-lowering and conventional hypoglycemic therapy. The overall clinical efficacy rate was significantly improved, and there was no significant increase in the risk of adverse reactions. Based on the analysis of the mechanism, the targets and therapeutic mechanisms of the two drugs are complementary: atorvastatin precisely regulates lipid metabolism and stabilizes vascular plaques, solving the core problem of blood lipid disorders; The significant hypoglycemic ability, improvement of insulin resistance, weight loss, and protection of the heart and kidneys of Dapagliflozin make up for the shortcomings of conventional treatment. The combination of the two has achieved an integrated treatment effect of lowering blood sugar, blood lipids, weight loss, anti-inflammatory, and cardiovascular protection, which can correct metabolic disorders in the body from different perspectives and improve overall treatment effectiveness.

From a safety perspective, only a small number of adverse reactions such as urinary tract infections and mild to moderate muscle pain occurred in the observation group. The incidence rate was not significantly different from that of the control group and could all self resolve, proving the safety and reliability of the combination therapy. Mild urinary tract infections caused by dapagliflozin can be prevented by advising patients to drink plenty of water and maintain cleanliness and hygiene of their intimate areas, without affecting continued medication. Overall, this combination therapy has the characteristics of controllable adverse events and good tolerability, making it suitable for long-term standardized use in middle-aged and elderly patients with chronic diseases.

At this stage, the clinical misunderstanding of diabetes patients with dyslipidemia is that glucose is not reduced or only one of them is treated, which makes the condition difficult to control and high incidence of complications. This study confirms that using a dual target administration regimen of glucose and lipid can significantly improve the metabolic control level of patients and improve their long-term outcomes. However, this study still has certain shortcomings and limitations. It belongs to a single center, short cycle study and has not conducted long-term follow-up observations on the incidence of long-term cardiovascular events and long-term recurrence rates in patients. In the future, large-scale, multi center, long-term clinical studies can be conducted to further explore and demonstrate the long-term clinical value of this treatment plan.

4. Conclusion

Daggligin combined with atorvastatin has obvious drug synergistic effect in the treatment of type 2 diabetes with dyslipidemia, which can effectively improve the glucose and lipid metabolism of patients, reduce body mass, and alleviate the micro inflammatory state of the body. Its therapeutic effect is better than that of conventional symptomatic drugs alone. And this plan has stable efficacy, precise therapeutic effect, high safety, and good tolerability, which can effectively block the vicious cycle of glucose and lipid metabolism, reduce the risk of chronic complications, and conform to the clinical concept of comprehensive management and control of metabolic diseases. It has high clinical promotion and application value.

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