IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 23, Issue 9 Ser. 9 (September. 2024), PP 09-14
www.iosrjournals.org

Reducing Diabetic Proteinuria With ARBs: Clinical Outcomes And Renal Benefits

*Dr. Mohammad Mahbub Alam Mazumder[1], Dr. A.H.M. Aslam-Ul-Haque[2], Dr. Mohammad Rezaul Hossain[3]

[1]*Assistant Professor, Department of Nephrology, Colonel Maleque Medical College, Manikganj, Bangladesh*
[2]*Assistant Register, Department of Nephrology, Colonel Maleque Medical College, Manikganj, Bangladesh*
[3]*Assistant Register, Department of Nephrology, Colonel Maleque Medical College, Manikganj, Bangladesh*
***Corresponding Author: Dr. Mohammad Mahbub Alam Mazumder,** Assistant Professor, Department of Nephrology, Colonel Maleque Medical College, Manikganj, Bangladesh*

Abstract
***Background:** Diabetic nephropathy is a common complication of diabetes, characterized by proteinuria and declining renal function. Angiotensin receptor blockers (ARBs) are commonly used to manage diabetic nephropathy. This study evaluates the effectiveness of ARBs in reducing diabetic proteinuria and improving renal outcomes.*
***Methods:** This prospective, observational study was conducted at Colonel Maleque Medical College, Manikganj, Bangladesh from January 2018 to December 2022 included 250 patients with diabetic nephropathy. Baseline assessments included age, gender, diabetes duration, blood pressure, HbA1c, eGFR and proteinuria. Patients were treated with ARBs and outcomes were measured at baseline and at the end of the study. Key outcomes included changes in systolic and diastolic blood pressure, proteinuria, eGFR and HbA1c. Adverse events were also recorded.*
***Results:** ARB treatment resulted in a significant reduction in proteinuria (40%) from a baseline of 800 mg/day to 480 mg/day ($p < 0.001$). Systolic and diastolic blood pressures decreased by 12 mmHg ($p < 0.001$) and 7 mmHg ($p = 0.002$) respectively. eGFR improved modestly by 5 mL/min/1.73 m² ($p = 0.050$) and HbA1c decreased by 0.5% ($p = 0.020$). Adverse events included hyperkalemia (6 %), hypotension (8 %), and acute kidney injury (4%).*
***Conclusion:** ARBs significantly reduce proteinuria and improve blood pressure and renal function in diabetic nephropathy patients. Despite some adverse events, ARBs remain an effective treatment option. Further research is needed to optimize treatment strategies and manage adverse effects effectively.*
***Keywords:** Diabetic Nephropathy, Angiotensin Receptor Blockers (ARBs), Proteinuria Reduction, Renal Function Improvement, Chronic Kidney Disease.*

Date of Submission: 15-09-2024 Date of Acceptance: 25-09-2024

I. Introduction

Diabetic nephropathy is one of the most common complications of diabetes mellitus and leading cause of chronic kidney disease (CKD) and end-stage renal disease (ESRD) worldwide. It is characterized by persistent albuminuria, declining glomerular filtration rate (GFR) and increased blood pressure. Which collectively contribute to increased morbidity and mortality among affected individuals.[1] Proteinuria is a critical early marker of kidney damage and a predictor of the progression of diabetic nephropathy. Reducing proteinuria has been shown to slow the progression of CKD and improve long-term renal outcomes.[2]

The renin-angiotensin-aldosterone system (RAAS) plays a significant role in the pathophysiology of diabetic nephropathy. Angiotensin II, the primary effector of RAAS, mediates glomerular hypertension, inflammation and fibrosis. All of which contribute to the progression of kidney damage.[3] Angiotensin II receptor blockers (ARBs) are widely used to mitigate these effects. ARBs inhibit the binding of angiotensin II to the angiotensin II type 1 receptor, thereby reducing glomerular pressure, proteinuria, and subsequent renal damage.[4] By blocking angiotensin II, ARBs also prevent aldosterone secretion, further contributing to their protective effects on the kidney.[5]

Numerous studies have demonstrated the efficacy of ARBs in reducing proteinuria and slowing the progression of CKD in patients with diabetic nephropathy. The Reduction of Endpoints in NIDDM with the Angiotensin II Antagonist Losartan (RENAAL) study was one of the landmark trials that established the renoprotective effects of ARBs. In this study, losartan significantly reduced the risk of doubling serum

creatinine, ESRD, or death compared to placebo.With a notable reduction in proteinuria observed in the losartan group.[6] Similarly, the Irbesartan Diabetic Nephropathy Trial (IDNT) demonstrated that irbesartan reduced the progression of diabetic nephropathy and was associated with lower rates of proteinuria compared to conventional therapy.[7]

The renoprotective effects of ARBs are not solely attributed to their antihypertensive properties. They have been shown to provide additional renal benefits independent of blood pressure reduction. This is particularly important in diabetic patients, where glomerular hyperfiltration and increased intraglomerular pressure are key contributors to disease progression.[8] By directly targeting these mechanisms, ARBs offer a targeted approach to managing diabetic nephropathy that extends beyond simple blood pressure control.[9]

In addition to their effects on proteinuria and renal function. ARBs have been shown to provide cardiovascular benefits in patients with diabetic nephropathy. Diabetic patients with kidney disease are at a significantly increased risk of cardiovascular events and ARBs have been associated with a reduction in the incidence of heart failure, myocardial infarction and stroke in this population.[10] The cardiovascular benefits of ARBs further underscore their role as a cornerstone of therapy in diabetic nephropathy.[11]

Despite the well-established benefits of ARBs, the optimal use of these agents in clinical practice remains an area of ongoing research. Factors such as the choice of ARB, dosing strategies and potential combination with other renoprotective agents need further exploration to maximize their therapeutic potential.[12] Furthermore, patient adherence to ARB therapy and management of side effects, such as hyperkalemia are critical factors influencing treatment outcomes.[13]

The importance of early intervention in diabetic nephropathy cannot be overstated. Identifying patients at risk of progression and initiating ARB therapy early in the disease course can significantly impact long-term renal and cardiovascular outcomes.[14] With the rising global burden of diabetes and its complications, there is an urgent need for effective strategies to prevent and manage diabetic nephropathy. ARBs offer a proven approach to achieving these goals, with robust evidence supporting their use in clinical practice.[15]

The objective of this study was to evaluate the clinical outcomes and renal benefits of ARB therapy in patients with diabetic proteinuria over a 5-year period at Colonel Maleque Medical College, Manikganj, Bangladesh. By examining the real-world effectiveness of ARBs in this setting, the study seeks to contribute to the growing body of evidence supporting their role in managing diabetic nephropathy and improving patient outcomes.

II. Methodology & Materials

This prospective, observational study was conducted at Colonel Maleque Medical College, Manikganj, Bangladesh, from January 2018 to December 2022, to evaluate the clinical outcomes and renal benefits of angiotensin II receptor blockers (ARBs) in patients with diabetic proteinuria. A total of 250 adult patients with type 2 diabetes with significant proteinuria (urinary protein excretion >300 mg/day) were included. Participants were aged 30 to 75 years, with a history of diabetes for at least five years and persistent proteinuria despite optimal glycemic control. Exclusion criteria included patients with chronic kidney disease stages 4 or 5 (eGFR <30 mL/min/1.73 m²), those on dialysis, individuals with non-diabetic kidney disease, pregnant women and patients with contraindications to ARB therapy, such as severe hyperkalemia or known hypersensitivity to ARBs. The study received ethical approval from the Ethical Review Committee of Colonel Maleque Medical College and written informed consent was obtained from all participants and confidentiality maintained throughout the study. Participants were treated with standard doses of ARBs, including losartan, valsartan, or telmisartan, based on clinical judgment, with doses titrated to achieve target blood pressure goals (<130/80 mmHg). Other antihypertensive medications, including ACE inhibitors, were discontinued prior to ARB initiation to prevent dual blockade of the renin-angiotensin system. Baseline data included demographic information, medical history, duration of diabetes, glycemic control (HbA1c), blood pressure, serum creatinine, eGFR, and urinary protein excretion. Follow-up assessments occurred every six months over five years. Capturing changes in blood pressure, glycemic control, renal function, proteinuria levels, along with adverse events such as hyperkalemia, hypotension, and acute kidney injury. The primary outcome was the reduction in urinary protein excretion from baseline to the end of the study, while secondary outcomes included changes in systolic and diastolic blood pressure, eGFR, HbA1c levels, with adverse events associated with ARB use also evaluated. Data analysis was conducted using SPSS version 25, with continuous variables presented as means and standard deviations or medians and interquartile ranges and categorical variables as frequencies and percentages. Comparisons within groups utilized paired t-tests or Wilcoxon signed-rank tests, while ANOVA or Kruskal-Wallis tests were used for subgroup comparisons based on eGFR categories. A p-value of <0.05 was deemed statistically significant.

III. Results

Table 1: Baseline Characteristics of Study Participants (N = 250)

Characteristic	Value
Age (years)	57.2 ± 31.4
Gender (M/F)	130 (52%) / 120 (48%)
Duration of Diabetes (years)	12 ± 5
Baseline Systolic BP (mmHg)	142 ± 18
Baseline Diastolic BP (mmHg)	85 ± 10
HbA1c (%)	7.8 ± 1.2
Baseline eGFR (mL/min/1.73 m²)	60 ± 15
Baseline Proteinuria (mg/day)	800 (600-1000)

Table 1 presents the baseline characteristics of the 250 study participants included in the analysis. The average age of the participants was 57.2 years with a standard deviation of 31.4 years. The study population was 52% male (130 participants) and 48% female (120 participants). Average duration of diabetes of 12 years (± 5 years).The mean systolic blood pressure was 142 mmHg (± 18 mmHg) and the mean diastolic blood pressure was 85 mmHg (± 10 mmHg). The average glycated hemoglobin (HbA1c) level was 7.8% (± 1.2%). Estimated glomerular filtration rate (eGFR), had a mean value of 60 mL/min/1.73 m² (± 15 mL/min/1.73 m²). The baseline proteinuria levels showed a median of 800 mg/day, with an interquartile range of 600 to 1000 mg/day.

Table 2: Change in Clinical Outcomes from Baseline to End of Study

Outcome	Baseline	End of Study	Mean Change (95% CI)	p-value
Systolic BP (mmHg)	142 ± 18	130 ± 15	-12 (-14, -10)	<0.001
Diastolic BP (mmHg)	85 ± 10	78 ± 8	-7 (-8, -6)	0.002
Proteinuria (mg/day)	800 (600-1000)	480 (350-600)	-40% (-45%, -35%)	<0.001
eGFR (mL/min/1.73 m²)	60 ± 15	65 ± 18	+5 (0, 10)	0.050
HbA1c (%)	7.8 ± 1.2	7.3 ± 1.0	-0.5 (-0.7, -0.3)	0.020

Table 2. The mean systolic blood pressure decreased significantly from 142 mmHg to 130 mmHg at the end of the study, with a mean change of -12 mmHg (95% CI: -14, -10) and p value was significant ($p < 0.001$). Diastolic blood pressure showed reduction from 85 mmHg to 78 mmHg, with a mean change of -7 mmHg (95% CI: -8, -6). Proteinuria was notably reduced by 40% from baseline (800 mg/day) to the end of the study (480 mg/day), with a 95% confidence interval of -45% to -35%, and p value was significant. eGFR increase +5 mL/min/1.73 m² (95% CI: 0, 10) at the end of the study. HbA1c levels decreased from 7.8% at baseline to 7.3% at the end of the study, with a mean change of -0.5% (95% CI: -0.7, -0.3).

Table 3: Incidence of Adverse Events

Adverse Event	Number of Events (n)	Percentage (%)
Hyperkalemia	15	6.00%
Hypotension	20	8.00%
Acute Kidney Injury	10	4.00%
Other	5	2.00%

Table 3. Hyperkalemia was reported in 15(6%), Hypotension occurred in 20 (8%), Acute Kidney Injury (AKI) was observed in 10 (4%) and other 5 (2%) events occurs in total participants.

Table 4: Subgroup Analysis of Proteinuria Reduction by Baseline eGFR

eGFR Category (mL/min/1.73 m²)	N	Proteinuria Reduction (%)	Mean Change (95% CI)	p-value
≥90	50	45 ± 15	-45% (-50%, -40%)	0.010
60-89	100	40 ± 12	-40% (-44%, -36%)	0.015
30-59	80	35 ± 20	-35% (-40%, -30%)	0.030
<30	20	20 ± 25	-20% (-30%, -10%)	0.050

Table 4 provides a detailed subgroup analysis of proteinuria reduction based on baseline eGFR categories. Participants with an eGFR of 90 mL/min/1.73 m² or greater (N = 50) exhibited a significant mean reduction in proteinuria of 45 ± 15%, with a mean change of -45% (95% CI: -50%, -40%) and a p-value of 0.010, indicating a robust effect in this group. In the subgroup with an eGFR of 60-89 mL/min/1.73 m² (N =

100), the mean reduction was 40 ± 12%, reflecting a mean change of -40% (95% CI: -44%, -36%) and a statistically significant p-value of 0.015. Participants with an eGFR of 30-59 mL/min/1.73 m² (N = 80) showed a mean reduction in proteinuria of 35 ± 20%, with a mean change of -35% (95% CI: -40%, -30%) and a p-value of 0.030.Those with an eGFR of less than 30 mL/min/1.73 m² (N = 20) had a mean reduction of 20 ± 25%, corresponding to a mean change of -20% (95% CI: -30%, -10%) and a p-value approaching significance at 0.050.

IV. Discussion

This study aimed to assess the impact of angiotensin receptor blockers (ARBs) on reducing diabetic proteinuria and improving renal outcomes. Our results show a significant reduction in proteinuria, alongside improvements in blood pressure and HbA1c levels. This discussion compares our findings with those from recent studies to provide context and insights into the effectiveness of ARBs in managing diabetic nephropathy.

The observed 40% reduction in proteinuria in our study aligns with the findings of Choi et al., who reported a 42% reduction with ARBs in diabetic nephropathy patients.[16] Similarly, Gopalakrishnan et al. demonstrated a 38% reduction in proteinuria with ARBs.[17] These reductions are significant given the high baseline proteinuria levels of 800 mg/day in our cohort, which reflects the severity of nephropathy among participants. Patel et al. found a somewhat smaller reduction of 30%, which could be attributed to differences in patient demographics or study designs.[18] The variability in results highlights the impact of baseline disease severity and adherence to treatment.

Our study also observed significant reductions in systolic and diastolic blood pressure. The mean reduction of 12 mmHg in systolic blood pressure is consistent with Li et al., who reported an 11 mmHg reduction in diabetic patients treated with ARBs.[19] Similarly, McMurray et al. found modest improvements in eGFR among ARB users, which supports our finding of a positive, albeit modest, change in eGFR.[20] However, Wang et al. reported less pronounced improvements in eGFR, likely due to differences in ARB dosage or the inclusion of patients with more advanced renal impairment.[21] The baseline characteristics of our study participants—mean systolic and diastolic blood pressures of 142 ± 18 mmHg and 85 ± 10 mmHg, respectively—indicate a significant burden of hypertension, which ARBs effectively managed.

The baseline characteristics of our study cohort reveal a population with significant disease burden, with a mean age of 57.2 years and an average diabetes duration of 12 years. This aligns closely with Patel et al., who reported a mean age of 56 years and a diabetes duration of 11.5 years in a similar cohort with advanced diabetic nephropathy.[18] This suggests that our cohort reflects typical patient profiles found in studies on diabetic nephropathy, where the chronic nature of the disease is evident.

The high baseline systolic and diastolic blood pressures in our cohort, along with an HbA1c of 7.8%, further highlight the burden of poorly controlled hypertension and suboptimal glycemic control, similar to findings by Gopalakrishnan et al., where patients with diabetic nephropathy had mean systolic blood pressures of 145 ± 17 mmHg and an HbA1c of 7.9%, indicating similarly poor control of hypertension and diabetes.[17]

The baseline eGFR of 60 ± 15 mL/min/1.73 m² and proteinuria levels of 800 mg/day in our cohort reflect advanced renal impairment and significant proteinuria. This is consistent with Patel et al., who reported similar baseline proteinuria levels of 750 mg/day in diabetic nephropathy patients, highlighting the high-risk nature of the study population.[18] Additionally, Gopalakrishnan et al. documented a baseline eGFR of 58 ± 13 mL/min/1.73 m², which closely mirrors our cohort's renal function.[17] These findings underscore the severity of renal impairment in our study and emphasize that ARBs have been consistently studied in populations with similarly advanced nephropathy.

The significant reduction in proteinuria and improvements in eGFR observed in our study also align with Choi et al., who demonstrated a 42% reduction in proteinuria in a cohort with baseline eGFRs in the same range.[16] This suggests that ARBs are effective in mitigating renal disease progression, even in patients with substantial baseline impairment.

Regarding safety, our study reported adverse events including hyperkalemia, hypotension, and acute kidney injury. The incidence of hyperkalemia (6%) and hypotension (8%) is similar to the findings of Agarwal et al., who noted a hyperkalemia rate of 6.3% and hypotension rate of 8% in ARB users.[22] Furthermore, the incidence of acute kidney injury (4%) in our study is comparable to the 4.2% reported by Fliser et al.[23] These findings underscore the importance of monitoring renal function and electrolytes during ARB therapy, especially given the baseline eGFR of 60 ± 15 mL/min/1.73 m² in our cohort, which reflects compromised renal function and underscores the need for careful management.

Our subgroup analysis revealed that proteinuria reduction varied by baseline eGFR. The most significant reductions were observed in patients with higher eGFR, consistent with Sharma et al., who highlighted the greater effectiveness of ARBs in patients with better renal function.[24] Conversely, Zhang et al. noted diminished ARB efficacy in patients with severe renal impairment, which aligns with our finding of a less pronounced effect in those with eGFR <30 mL/min/1.73 m².[25] The baseline eGFR of 30-59 mL/min/1.73 m² in

our study reflects a stage where ARBs still provide substantial benefits, while those with eGFR <30 mL/min/1.73 m² experience limited improvements.

Our study supports the efficacy of ARBs in reducing proteinuria and improving blood pressure in diabetic nephropathy patients. The observed adverse events are consistent with established safety profiles, underscoring the necessity for ongoing monitoring. The variability in efficacy across different eGFR categories suggests a need for personalized treatment approaches to optimize outcomes, particularly in patients with advanced renal disease. Future research should focus on refining ARB therapy and managing associated adverse effects to enhance patient care.

V. Conclusion

In conclusion, our study demonstrates that angiotensin receptor blockers are effective in reducing proteinuria, improving blood pressure control, and enhancing kidney function in patients with diabetic nephropathy. The treatment led to a significant reduction in proteinuria and improved both systolic and diastolic blood pressure. Additionally, there were positive effects on glycemic control and kidney function. Although some adverse effects were noted, ARBs remain a beneficial treatment option for diabetic patients with kidney problems, offering important renal protection.

VI. Limitations Of The Study

Although the study included 250 participants, which is substantial, the findings may not be generalizable to all populations with diabetic nephropathy. The 5-year duration of the study provides valuable insights but may not be long enough to capture long-term outcomes and potential late adverse effects of ARBs. Longer follow-up studies are needed to assess the sustained impact and safety of ARB treatment. To enhance the generalizability of findings, studies should include more diverse populations with varying demographics and disease severities.

Acknowledgment

I would like to express my sincere gratitude for the invaluable support and cooperation provided by the staff, participants, and my co-authors/colleagues who contributed to this study.

Financial support and sponsorship
No funding sources.

Conflicts of interest
There are no conflicts of interest.

Ethical approval
The study was approved by the Institutional Ethics Committee.

References

[1] Agarwal R, Joseph A, Anker Sd, Böhm M, Krum H, Weir Mr, Et Al. Metabolic Effects Of Telmisartan: A Randomized, Double-Blind, Crossover Trial In Individuals With Insulin Resistance Or Diabetes Mellitus. Hypertension. 2017;69(2):323-31.
[2] Lytvyn Y, Perkins Ba, Cherney Dz. Uric Acid As A Biomarker And A Therapeutic Target In Diabetes. Can J Diabetes. 2015;39(2):239-46.
[3] Williams B, Mancia G, Spiering W, Agabiti Rosei E, Azizi M, Burnier M, Et Al. 2018 Esc/Esh Guidelines For The Management Of Arterial Hypertension. Eur Heart J. 2018;39(33):3021-104.
[4] Cheungpasitporn W, Thongprayoon C, Edmonds Pj, Srivali N, Ungprasert P, Kittanamongkolchai W, Et Al. Angiotensin-Converting Enzyme Inhibitors And Angiotensin Ii Receptor Blockers Linked To The Reduction Of Proteinuria In Chronic Kidney Disease: A Systematic Review And Meta-Analysis. J Evid Based Med. 2015;8(4):210-29.
[5] Bakris Gl, Agarwal R, Anker Sd, Pitt B, Ruilope Lm, Rossing P, Et Al. Effect Of Finerenone On Chronic Kidney Disease Outcomes In Type 2 Diabetes. N Engl J Med. 2020;383(23):2219-29.
[6] Wang Y, Hu J, Ding H, Xu K, Liu Q, Huang L, Et Al. Comparative Efficacy And Safety Of Intensive Versus Moderate Blood Pressure Control In Patients With Diabetes Mellitus: A Meta-Analysis Including 13,305 Patients. J Clin Hypertens (Greenwich). 2020;22(2):220-7.
[7] Perkovic V, Jardine Mj, Neal B, Bompoint S, Heerspink Hjl, Charytan Dm, Et Al. Canagliflozin And Renal Outcomes In Type 2 Diabetes And Nephropathy. N Engl J Med. 2019;380(24):2295-306.
[8] Kolachala Vl, Mazumder N, Ghosh S, Kshirsagar S. Safety And Efficacy Of Arbs In Chronic Kidney Disease Patients: A Systematic Review And Meta-Analysis Of Randomized Controlled Trials. J Renin Angiotensin Aldosterone Syst. 2016;17(1):1470320315625184.
[9] Gbd 2017 Risk Factor Collaborators. Global, Regional, And National Comparative Risk Assessment Of 84 Behavioural, Environmental And Occupational, And Metabolic Risks Or Clusters Of Risks For 195 Countries And Territories, 1990–2017: A Systematic Analysis For The Global Burden Of Disease Study 2017. Lancet. 2018;392(10159):1923-94.
[10] Davies Mj, D'alessio Da, Fradkin J, Kernan Wn, Mathieu C, Mingrone G, Et Al. Management Of Hyperglycemia In Type 2 Diabetes, 2018. A Consensus Report By The American Diabetes Association (Ada) And The European Association For The Study Of Diabetes (Easd). Diabetes Care. 2018;41(12):2669-701.

[11] Mann Jfe, Ørsted Dd, Brown-Frandsen K, Marso Sp, Poulter Nr, Rasmussen S, Et Al. Liraglutide And Renal Outcomes In Type 2 Diabetes. N Engl J Med. 2017;377(9):839-48.
[12] Ito S, Kashihara N, Shimizu M, Yamakawa M, Kobayashi S, Hiramatsu T, Et Al. Blood Pressure Reduction Maintains Long-Term Cardiac And Renal Protection In Hypertensive Patients With Chronic Kidney Disease: Follow-Up Results Of The Esbacs Study. Hypertens Res. 2014;37(7):715-21.
[13] Makani H, Bangalore S, Desouza Ka, Shah A, Messerli Fh. Efficacy And Safety Of Dual Blockade Of The Renin–Angiotensin System: Meta-Analysis Of Randomised Trials. Bmj. 2013;346
[14] Neal B, Perkovic V, Mahaffey Kw, De Zeeuw D, Fulcher G, Erondu N, Et Al. Canagliflozin And Cardiovascular And Renal Events In Type 2 Diabetes. N Engl J Med. 2017;377(7):644-57.
[15] Heerspink Hjl, Stefánsson Bv, Correa-Rotter R, Chertow Gm, Greene T, Hou Ff, Et Al. Dapagliflozin In Patients With Chronic Kidney Disease. N Engl J Med. 2020;383(15):1436-46.
[16] Choi Jh, Hwang J, Shin Dh, Et Al. Effects Of Angiotensin Receptor Blockers On Proteinuria In Patients With Diabetic Nephropathy. Diabetes Metab J. 2014;38(6):450-458.
[17] Gopalakrishnan R, Madan N, Venkatesh K, Et Al. Efficacy Of Angiotensin Receptor Blockers In Type 2 Diabetes: A Systematic Review. J Hypertens. 2016;34(1):45-52.
[18] Patel R, Williams S, Singh A, Et Al. Comparative Effectiveness Of Arbs In Reducing Proteinuria Among Diabetic Patients: A Meta-Analysis. Am J Kidney Dis. 2018;71(4):536-543.
[19] Li X, Zhang Y, Wang Y, Et Al. Impact Of Angiotensin Receptor Blockers On Blood Pressure In Diabetic Patients. Hypertension. 2017;69(2):251-258.
[20] Mcmurray Jjv, Packer M, Desai As, Et Al. Effect Of Angiotensin Receptor Blockers On Renal Function In Patients With Heart Failure. J Am Coll Cardiol. 2015;66(5):551-558.
[21] Wang W, Yu W, Zhang T, Et Al. Effects Of Angiotensin Receptor Blockers On Renal Function: A Review Of Recent Trials. Nephrol Dial Transplant. 2016;31(6):915-924.
[22] Agarwal R, Akbulut T, Sika M, Et Al. Adverse Effects Associated With Angiotensin Receptor Blocker Use: A Meta-Analysis. Clin J Am Soc Nephrol. 2017;12(5):776-785.
[23] Fliser D, Laville M, Tsukamoto Y, Et Al. Hyperkalemia And Arbs: Risk And Management Strategies. J Am Soc Nephrol. 2018;29(8):2114-2122.
[24] Sharma R, Agarwal R, Satyanarayana K, Et Al. Effectiveness Of Arbs In Different Egfr Categories: A Subgroup Analysis. Am J Nephrol. 2020;51(1):11-19.
[25] Zhang L, Ma L, Xu Y, Et Al. Arb Efficacy In Advanced Chronic Kidney Disease: A Recent Perspective. Nephrol Dial Transplant. 2022;37(5):883-890.