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COMPARISON OF EMPAGLIFLOZIN AND DAPAGLIFLOZIN IN HEART FAILURE IN DIABETIC PATIENTS TAKING SODIUM-GLUCOSE COTRANSPORTER-2 AND ANGIOTENSIN RECEPTOR NEPRILYSIN INHIBITOR

Dr Fatima Maqsood[*1], Prof Dr Qazi Abdul Saboor[2], Dr Ammad Amjad[3]

[*1,3]*MBBS*
[2]*MBBS, FCPS*

[*1]fatimaqsood74@gmail.com

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Corresponding Author: *
Dr Fatima Maqsood

Abstract

Objective: *"To compare the outcome of Empagliflozin and Dapagliflozin in heart failure in diabetic patients taking Sodium-glucose cotransporter-2 and angiotensin receptor neprilysin inhibitor".*

Study design: *Randomized controlled trial*

Study place and duration: *Department of Cardiology, Shaikh Zayed Hospital, Lahore for 6 months i.e. 1-10-2024 to 31-3-2025.*

Methodology: *One hundred and eight patients were enrolled and randomly divided in two groups. In group A, patients were prescribed Dapagliflozin 10 mg daily. In group B, patients were prescribed Empagliflozin 10 mg daily. Standard SGLT2 and ARNI treatment was given as per standard protocol. All patients were followed-up in OPD after 12 weeks for assessment of ejection fraction. All this information was recorded on proforma and was analysed in SPSS v.25.*

Results: *In this study, patients randomized to Dapagliflozin group had mean age of 47.93 ± 5.93 years, while patients randomized to Empagliflozin group had mean age of 50.63 ± 6.42 years. In Dapagliflozin group, there were 38 (70.4%) meals and 16 (29.6%) females. In Empagliflozin group, there were 31 (57.4%) males and 23 (42.6%) females. The mean change in ejection fraction was noted as 3.15 ± 1.58% with dapagliflozin while 6.02 ± 2.18% with empagliflozin. The difference in both groups was significant for mean improvement in ejection fraction (p-value <0.0001). Kidney dysfunction was observed in 6 (11.1%) patients with dapagliflozin while in 2 (3.7%) patients with empagliflozin (p-value >0.05).*

Conclusion: *Thus, the effect of empagliflozin is better on cardiac functioning than Dapagliflozin in heart failure diabetic patients.*

INTRODUCTION

Heart failure is becoming more common worldwide and is a common chronic phase of many heart disorders. Previous large-scale cardiovascular outcomes trials of sodium–glucose co-transporter 2 (SGLT2) inhibitors in patients with type 2 diabetes have suggested that these agents may help to prevent primary and secondary hospitalisation due to heart failure and cardiovascular death in these patients.[1]

Prior research on type 2 diabetes mellitus showed that sodium-glucose co-transporter-2 inhibitors improved cardiovascular results; however, there were some differences in the class's cardiovascular outcomes. Furthermore, their efficacies in Asians, females, and those with low cardiovascular risks were under-represented.[2, 3]

Large cardiovascular outcome trials enrolling patients with type 2 diabetes showed that SGLT2i substantially decreased heart failure hospitalization, both in patients with or without history of heart failure.[4-6] This finding was hypothesis-generating for randomized controlled trials testing the SGLT2i dapagliflozin and empagliflozin in heart failure patients regardless of comorbid diabetes.[7] The effectiveness of dapagliflozin and empagliflozin, respectively, for lowering cardiovascular death and heart failure hospitalization in heart failure patients with reduced ejection fraction, irrespective of type 2 diabetes status, was shown by DAPA-HF (Dapagliflozin and Prevention of Adverse Outcomes in Heart Failure) and EMPEROR-Reduced (Empagliflozin Outcome Trial in Patients with Chronic Heart Failure with Reduced Ejection Fraction). [8, 9] The established cardiovascular advantages of dapagliflozin and empagliflozin distinguish them in the field of diabetes treatment. Their effectiveness in lowering cardiovascular risks in people with diabetes and heart failure with a decreased ejection fraction has been demonstrated in a number of research studies. Even cardiac failure patients with maintained ejection fraction can benefit from them. Current guidelines now recommend to use SGLT2 inhibitors for heart failure patients, irrespective of their ejection fraction status.[10]

Later, the EMPEROR-Preserved (Empagliflozin Outcome Trial in Patients with Chronic Heart Failure with Preserved Ejection Fraction) trial showed that empagliflozin decreased the risk of cardiovascular death/HF hospitalization also in patients with EF above 40%, either with or without diabetes.[11] This study's rationale is to examine the effects of dapagliflozin and empagliflozin on heart failure in patients receiving ARNI and SGLT2. Research revealed that the two medications' results are identical. Although the cardiac functioning improved better with empagliflozin. But limited data has been available in this regard, while no local trial conducted before. Thus, in routine SGLT2 and ARNI are given to control glycemic level and maintain cardiac functioning. However, addition of Empagliflozin and Dapagliflozin can be more beneficial in improving cardiac functioning and reducing reis of adverse events. Therefore, we planned to conduct this study to get evidence in local population. This will help us to improve our practice as well as we will obtain evidence for local data.

METHODOLOGY

This Randomized controlled trial was conducted at Department of Cardiology, Shaikh Zayed Hospital, Lahore for 6 months i.e. *1-10-2024 to 31-3-2025* with approval of ethical review committee (ID: TERC/SC/INT/2024/261). Trial was registered with ClinicalTrials.gov (ID NCT06915870, Unique Protocol ID 271). By using openepi.com, sample size of 108 patients; 54 in each group is calculated with 95% confidence level, 80% power of test and mean ejection fraction i.e. 34.5±9.8 % with dapagliflozin and 38.6±4.3 % with empagliflozin.[12] Patients who fulfilled following selection standards were enrolled by applying Non-probability, consecutive sampling technique.

Inclusion of patients: Patients aged 40-60 years of either gender diagnosed with heart failure were enrolled in the study. Heart failure was defined as presence of ejection fraction <50% on echocardiography, with pedal edema, water in lungs, paroxysmal nocturnal dyspnea or exertional limitation due to failure of ventricular fillings. Diabetic patients, with HBA1c>6.5% for >1 year already taking SGLT-2 and ARNI inhibitor were enrolled in the study.

Exclusion of patients: Patients already had valvular device, mitral or aortic valve regurgitation or stenosis detected on echocardiography, heart transplantation, chronic renal failure or dialysis patients, cardiomyopathy, liver failure or malignancy were excluded from the study. Patients already taking trial drugs or other anti-glycemic or cardiac medication were also excluded.

Total of 108 patients fulfilling the selection criteria were enrolled from OPD. Informed consent and

demographic data of all the patients were obtained. Then patients were randomly divided in two groups by using lottery method. In group A, patients were prescribed Dapagliflozin 10 mg daily for 12 weeks. In group B, patients were prescribed Empagliflozin 10 mg daily for 12 weeks. Standard SGLT2 and ARNI treatment was given as per standard protocol. All patients were followed-up in OPD after 12 weeks for assessment of ejection fraction by using echocardiography. During follow-up, patients were also examined for deterioration of kidney functions, if serum creatinine >0.3 mg/dl within 72 hours of treatment as compared to before therapy. All this information was recorded on proforma.

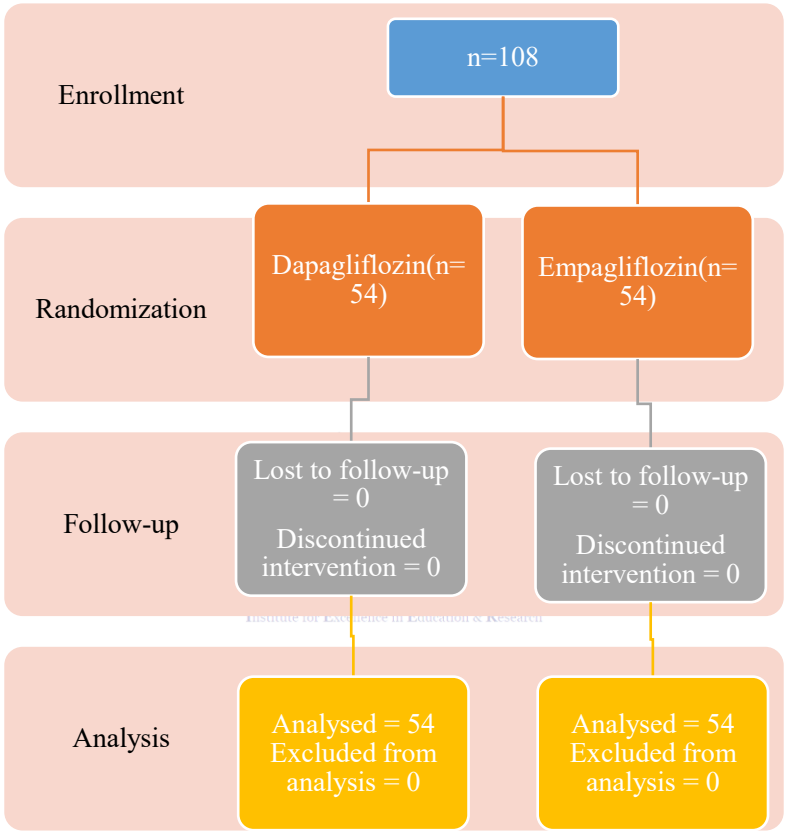

Figure-1: Patient Flow Diagram (n= 108)

The collected data was analysed statistically by using SPSS version 25. Independent samples t-test was applied to compare both groups for mean ejection fraction and by using Chi-square test was applied to compare both groups for kidney dysfunctions. P-value ≤0.05 was kept as significant.

RESULTS

In this study, patients randomized to Dapagliflozin group had mean age of 47.93 ± 5.93 years, while patients randomized to Empagliflozin group had mean age of 50.63 ± 6.42 years. In Dapagliflozin group, there were 38 (70.4%) meals and 16 (29.6%) females. In Empagliflozin group, there were 31 (57.4%) males and 23 (42.6%) females. In dapagliflozin group, there were 30 (55.6%) and 22 (40.7%) morbidly obese patients. In empagliflozin group, there were 22 (40.7%) and 27 (50%) morbidly obese patients. In dapagliflozin group, there were 20 (37.0%) smokers, 27 (50%) had dyslipidemia and 24 (44.4%) had anemia. In empagliflozin group, there were 21 (38.9%) smokers, 30 (55.6%) had dyslipidemia and 20 (37.0%) had anemia. Table I

In dapagliflozin group, the mean ejection fraction improved from 37.80 ± 4.53% to 40.94 ± 4.84% after 12 weeks of treatment. The mean change in

ejection fraction was noted as 3.15 ± 1.58% with dapagliflozin. In empagliflozin group, the mean ejection fraction improved from 37.33 ± 4.82% to 43.35 ± 5.39% after 12 weeks of treatment. The mean change in ejection fraction was noted as 6.02 ± 2.18% with empagliflozin. The difference in both groups was significant for mean improvement in ejection fraction (p-value <0.0001). In dapagliflozin group, the mean serum creatinine level increased from 0.67 ± 0.15 mg/dl to 0.77 ± 0.22 mg/dl after 12 weeks of treatment. The mean change in serum creatinine level was noted as 0.11 ± 0.15 mg/dl with dapagliflozin. In empagliflozin group, the mean serum creatinine level increased from 0.67 ± 0.18 mg/dl to 0.70 ± 0.22 mg/dl after 12 weeks of treatment. The mean change in serum creatinine level was noted as 0.03 ± 0.08 mg/dl with empagliflozin. The difference in both groups was significant for mean increase in serum creatinine level (p-value <0.05). In dapagliflozin group, there were 6 (11.1%) patients who developed kidney dysfunction while in empagliflozin group, only 2 (3.7%) patients developed kidney dysfunction. Although the risk of developing kidney dysfunction is insignificant in both groups but risk is slightly higher with dapagliflozin (p-value >0.05). Table II

Data was stratified for age, gender and different effect modifiers and it has been observed that improvement in ejection fraction was significantly higher with empagliflozin in all strata as compared to dapagliflozin (p<0.05), except for patients with normal BMI (p>0.05). Table III

Kidney dysfunction was more common in age group 40-50 years with dapagliflozin, males, and obese patients (p<0.05). Details of other effect modifiers is given in table below. Table IV

Table I: Demographics details of patients (n = 108)

	Dapagliflozin	Empagliflozin
n	54	54
Age (years)	47.93 ± 5.93	50.63 ± 6.42
Gender		
Male	38 (70.4%)	31 (57.4%)
Female	16 (29.6%)	23 (42.6%)
BMI (kg/m^2)	29.19 ± 3.33	29.93 ± 3.67
Normal	2 (3.7%)	5 (9.3%)
Obese	30 (55.6%)	22 (40.7%)
Morbidly Obese	22 (40.7%)	27 (50%)
Duration of heart failure symptoms	6.89 ± 3.10	6.31 ± 2.98
History of		
Smoking	20 (37.0%)	21 (38.9%)
Dyslipidemia	27 (50%)	30 (55.6%)
Anemia	24 (44.4%)	20 (37.0%)

Table II: Comparison of ejection fraction at presentation and after 12 weeks in both groups (n = 108)

	Dapagliflozin	Empagliflozin	p-value
n	54	54	
Ejection fraction at baseline (%)	37.80 ± 4.53	37.33 ± 4.82	0.608
Ejection fraction at 12th week (%)	40.94 ± 4.84	43.35 ± 5.39	0.016
Change in ejection fraction (%)	3.15 ± 1.58	6.02 ± 2.18	0.000
Serum creatinine at baseline	0.67 ± 0.15	0.67 ± 0.18	0.88
Serum creatinine at 12th week	0.77 ± 0.22	0.70 ± 0.22	0.118
Change in serum creatinine	0.11 ± 0.15	0.03 ± 0.08	0.002
Kidney dysfunction	6 (11.1%)	2 (3.7%)	0.142

Table III: Comparison of mean change in ejection fraction in both groups when analyzed for different effect modifiers

	Dapagliflozin	Empagliflozin	p-value
Age 40-50 years	3.14±1.50	6.31±2.05	0.000
Age 51-60 years	3.17±1.79	5.75±2.30	0.000
Male	3.05±1.61	5.81±2.27	0.000
Female	3.38±1.54	6.30±2.08	0.000
BMI			
Normal	3.50±0.71	4.80±2.39	0.504
Obese	3.23±1.59	5.95±2.30	0.000
Morbidly obese	3.00±1.66	6.30±2.05	0.000
Smokers	2.95±1.76	5.90±2.30	0.000
Non-smoker	3.26±1.50	6.09±2.14	0.000
Dyslipidemia	3.59±1.67	6.03±2.14	0.000
Normal lipid profile	2.70±1.38	6.00±2.28	0.000
Anemic	3.29±1.46	5.40±2.35	0.001
Non-anemia	3.03±1.69	6.38±2.03	0.000
Duration of symptoms 1-6 weeks	2.82±1.47	5.90±2.35	0.000
Duration of symptoms 7-12 weeks	3.38±1.64	6.17±1.99	0.000

Table IV: comparison of kidney dysfunction in both groups when analyzed for different effect modifiers

	Dapagliflozin	Empagliflozin	p-value
Age 40-50 years	6 (16.7%)	1 (3.8%)	0.115
Age 51-60 years	0 (0%)	1 (3.6%)	0.418
Male	6 (15.8%)	2 (6.5%)	0.228
Female	0 (0%)	0 (0%)	NA
BMI			
Normal	0 (0%)	0 (0%)	NA
Obese	3 (10%)	0 (0%)	0.127
Morbidly obese	3 (13.6%)	2 (7.4%)	0.474
Smokers	1 (5.0%)	1 (4.8%)	0.972
Non-smoker	5 (14.7%)	1 (3.0%)	0.094
Dyslipidemia	3 (11.1%)	1 (3.3%)	0.251
Normal lipid profile	3 (11.1%)	1 (4.2%)	0.357
Anemic	1 (4.2%)	0 (0%)	0.356
Non-anemia	5 (16.7%)	2 (5.9%)	0.168
Duration of symptoms 1-6 weeks	3 (13.6%)	1 (3.3%)	0.168
Duration of symptoms 7-12 weeks	3 (9.4%)	1 (4.2%)	0.454

DISCUSSION

Following 12 weeks of therapy, we found that dapagliflozin increased the mean ejection fraction by 3.15 ± 1.58%, from 37.80 ± 4.53% to 40.94 ± 4.84%. After 12 weeks of therapy with empagliflozin, the mean ejection fraction increased from 37.33 ± 4.82% to 43.35 ± 5.39%, with a mean change of 6.02 ± 2.18%. The mean change in ejection fraction was significantly better with empagliflozin as compared to dapagliflozin.

Hao et al., conducted a similar trial and observed that that mean ejection fraction was improved from

30.1±3.2 to 34.5±9.8% with dapagliflozin (change = 4.4±6.6) and from 30.6±3.4 to 38.6±4.3% with empagliflozin (change = 8±0.9), (p<0.001). But renal impairment was noted in 1% vs. 0% cases, respectively (p=0.451).[12] These findings were almost similar as we observed in our trial. But Park et al., conducted a similar trial and observed found that Dapagliflozin and Empagliflozin showed a similar incidence of patient-oriented composite endpoint (5.7% vs. 5.7%, p=0.201). And two groups also showed no significant difference in admission for heart failure (0.7% vs. 1.0%, p=0.285).[13]

Wiviot et al., conducted placebo-controlled trial with dapagliflozin and observed that dapagliflozin did not result in a lower rate of MACE (8.8% dapagliflozin vs. 9.4% placebo; P-value = 0.17), but lead to lower rate of cardiovascular death or hospitalization for heart failure (4.9% vs. 5.8%; P-value = 0.005). Death from any cause occurred in 6.2% and 6.6% of the dapagliflozin and placebo groups, respectively (hazard ratio, 0.76; 95% CI, 0.67 to 0.87) and in 4.3% and 5.6% of the groups, respectively (hazard ratio, 0.93; 95% CI, 0.82 to 1.04). Diabetic ketoacidosis was more common with dapagliflozin than with placebo (0.3% vs. 0.1%, P=0.02), as was the rate of genital infections that led to discontinuation of the regimen or that were considered to be serious adverse events (0.9% vs. 0.1%, P<0.001).[4]

Modezelewski et al., did a study and found that out of 744,914 heart failure patients who had never used SGLT2 inhibitor medication, 15,976 (56.9%) were given empagliflozin and 12,099 (43.1%) were given dapagliflozin. Empagliflozin-treated patients were less likely to experience the primary composite outcome of all-cause mortality or hospitalization compared with those treated with dapagliflozin, 3,545 [32.2%] vs. 3,828 [34.8%] events (HR, 0.90; 95% CI, 0.86-0.94) within 1 year of SGLT2 inhibitor initiation. They concluded that patients with heart failure and no prior SGLT2 inhibitor use treated with empagliflozin were less likely to experience all-cause mortality or hospitalization compared with patients treated with dapagliflozin during the first year of use.[14]

Clear patterns of impact are supported by the DECLARE–TIMI 58 experiment when compared to other cardiovascular outcomes trials using empagliflozin and canagliflozin. First, compared to atherosclerotic cardiovascular events, SGLT2 inhibitors have a stronger and more reliable impact in preventing heart failure and renal outcomes. These observations fit with the mechanism of action of SGLT2 inhibitors on the kidney and the well-documented downstream effects, including natriuresis, blood-pressure reduction, improved tubular glomerular feedback, vascular compliance, and endothelial function.[15-17] Second, although treatment with SGLT2 inhibitors appears to result in a moderate reduction in the risk of MACE in patients with atherosclerotic cardiovascular disease, no effect has been observed in patients with multiple risk factors for atherosclerotic cardiovascular disease.[15]

In this trial, we also observed that kidney dysfunction occurred in 6 (11.1%) patients who were using dapagliflozin as serum creatinine level increased from 0.67 ± 0.15 mg/dl to 0.77 ± 0.22 mg/dl after 12 weeks of treatment, showing mean change of 0.11 ± 0.15 mg/dl. While with empagliflozin, only 2 (3.7%) patients developed kidney dysfunction and their serum creatinine level increased from 0.67 ± 0.18 mg/dl to 0.70 ± 0.22 mg/dl with mean change of 0.03 ± 0.08 mg/dl.

6,609 individuals in EMPA-KIDNEY were randomly assigned to receive either empagliflozin or a placebo. The main outcome of renal or cardiovascular disease progression was 13.1% with empagliflozin and 16.9% with a placebo. These outcomes were consistent regardless of diabetic status or prior cardiovascular disease.[18] DAPA-CKD included 4,304 patients, where the primary outcome (a composite of a sustained decline in the eGFR of at least 50%, end-stage kidney disease, or death from renal/cardiovascular causes) occurred in 9.2% in the dapagliflozin group and 14.5% in the placebo group.[19] Therefore, dapagliflozin has a superior value for those without diabetes, whereas empagliflozin has a better financial value for avoiding composite renal and cardiovascular problems in diabetic patients. Dapagliflozin provides a better monetary value for the prevention of cardiovascular disease, whereas empagliflozin has a better value for the prevention of kidney disease progression.[20]

CONCLUSION

Thus, the effect of empagliflozin is better on cardiac functioning than Dapagliflozin in heart failure diabetic patients. Now in future, for prevention of cardiovascular diseases and improvement in cardiac functioning, we will rely on empagliflozin among diabetic patients.

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CONFLICT OF INTEREST

None

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AUTHORS CONTRIBUTION

FM: Conception and design, acquisition of data, article writing, statistical analysis, proofreading
QAS: Conception and design, acquisition of data, article writing, statistical analysis, proofreading
AA: Conception and design, acquisition of data, article writing, statistical analysis, proofreading

REFERENCES

1. Rosano G, Quek D, Martínez F. Sodium–Glucose Co-transporter 2 Inhibitors in Heart Failure: Recent Data and Implications for Practice. Card Fail Rev. 2020;6:e31. doi: 10.15420/cfr.2020.23.
2. Lim J, Choi Y-J, Kim BS, Rhee T-M, Lee H-J, Han K-D, et al. Comparative cardiovascular outcomes in type 2 diabetes patients taking dapagliflozin versus empagliflozin: a nationwide population-based cohort study. Cardiovasc Diabetol. 2023;22(1):188. doi: 10.1186/s12933-023-01911-7.
3. Memon RA, Akbariromani H, Vohra RR, Kundi H, Saleem RF, Ghaffari MA, et al. Comparison of Cardiovascular Outcomes Between Dapagliflozin and Empagliflozin in Patients With Type 2 Diabetes: A Meta-Analysis. Cureus. 2022;14(7):e27277. doi: 10.7759/cureus.
4. Wiviott SD, Raz I, Bonaca MP, Mosenzon O, Kato ET, Cahn A, et al. Dapagliflozin and Cardiovascular Outcomes in Type 2 Diabetes. The New England journal of medicine. 2019;380(4):347-57. doi: 10.1056/NEJMoa1812389.
5. Kato ET, Silverman MG, Mosenzon O, Zelniker TA, Cahn A, Furtado RHM, et al. Effect of Dapagliflozin on Heart Failure and Mortality in Type 2 Diabetes Mellitus. Circulation. 2019;139(22):2528-36. doi: 10.1161/circulationaha.119.040130.
6. Cannon CP, Pratley R, Dagogo-Jack S, Mancuso J, Huyck S, Masiukiewicz U, et al. Cardiovascular Outcomes with Ertugliflozin in Type 2 Diabetes. The New England journal of medicine. 2020;383(15):1425-35. doi: 10.056/NEJMoa2004967.
7. Cosentino F, Cannon CP, Cherney DZI, Masiukiewicz U, Pratley R, Dagogo-Jack S, et al. Efficacy of Ertugliflozin on Heart Failure-Related Events in Patients With Type 2 Diabetes Mellitus and Established Atherosclerotic Cardiovascular Disease: Results of the VERTIS CV Trial. Circulation. 2020;142(23):2205-15. doi: 10.1161/circulationaha.120.050255.
8. McMurray JJV, Solomon SD, Inzucchi SE, Køber L, Kosiborod MN, Martinez FA, et al. Dapagliflozin in Patients with Heart Failure and Reduced Ejection Fraction. The New England journal of medicine. 2019;381(21):1995-2008. doi: 10.1056/NEJMoa1911303.
9. Packer M, Anker SD, Butler J, Filippatos G, Pocock SJ, Carson P, et al. Cardiovascular and Renal Outcomes with Empagliflozin in Heart Failure. The New England journal of medicine. 2020;383(15):1413-24. doi: 10.056/NEJMoa2022190.

10. Kim JH, Yoon YC, Kim YH, Park JI, Choi KU, Nam JH, et al. Cardiovascular outcomes between dapagliflozin versus empagliflozin in patients with diabetes mellitus. Clinical cardiology. 2024;47(3):e24248. doi: 10.1002/clc.
11. Anker SD, Butler J, Filippatos G, Ferreira JP, Bocchi E, Böhm M, et al. Empagliflozin in Heart Failure with a Preserved Ejection Fraction. The New England journal of medicine. 2021;385(16):1451-61. doi: 10.056/NEJMoa2107038.
12. Hao Z, Zhang Y. Dapagliflozin and Empagliflozin in Heart Failure with Reduced Ejection Fraction: A Retrospective Study. International journal of general medicine. 2022;15:5915-8. doi: 10.2147/ijgm.s366943.
13. Park Jong I, Kim U, Park J-S. Comparison of clinical outcomes between dapagliflozin versus empagliflozin in patients with diabetes mellitus. J Am Coll Cardiol. 2022;79(9_Supplement):677. doi: 10.1016/S0735-1097(22)01668-0.
14. Modzelewski KL, Pipilas A, Bosch NA. Comparative outcomes of empagliflozin to dapagliflozin in patients with heart failure. JAMA Network Open. 2024;7(5):e249305. doi: 10.1001/jamanetworkopen.2024.9305.
15. 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. The New England journal of medicine. 2017;377(7):644-57. doi: 10.1056/NEJMoa1611925.
16. Heerspink HJ, Kosiborod M, Inzucchi SE, Cherney DZ. Renoprotective effects of sodium-glucose cotransporter-2 inhibitors. Kidney Int. 2018;94(1):26-39. doi: 10.1016/j.kint.2017.12.027.
17. Sattar N, McGuire DK. Pathways to cardiorenal complications in type 2 diabetes mellitus: a need to rethink. Circulation. 2018;138(1):7-9. doi: 10.1161/CIRCULATIONAHA.118.035083
18. The EMPA-KIDNEY Collaborative Group. Empagliflozin in Patients with Chronic Kidney Disease. The New England journal of medicine. 2023;388(2):117-27. doi: 10.1056/NEJMoa2204233.
19. Heerspink HJL, Stefánsson BV, Correa-Rotter R, Chertow GM, Greene T, Hou F-F, et al. Dapagliflozin in Patients with Chronic Kidney Disease. New England Journal of Medicine. 2020;383(15):1436-46. doi: 10.056/NEJMoa2024816.
20. Alnsasra H, Tsaban G, Solomon A, Khalil F, Aboalhasan E, Azab AN, et al. Dapagliflozin versus empagliflozin in patients with chronic kidney disease. Fronti Pharmacol. 2023;14:1227199. doi: https://doi.org/10.3389/fphar.2023.

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