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# *Heart Failure and Chronic Kidney Disease: Prognosis and Therapeutic and Surgical Options.*

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*LITERATURE REVIEW*

**RESUMO**

A insuficiência cardíaca (IC) e a doença renal crônica (DRC) são condições frequentemente inter-relacionadas que afetam significativamente a qualidade de vida e a sobrevida dos pacientes. Ambas as condições compartilham fatores de risco comuns, como diabetes mellitus e hipertensão, e podem se agravar mutuamente. A IC pode levar a uma deterioração da função renal devido à diminuição do fluxo sanguíneo renal e à ativação de mecanismos neuro-hormonais. Por outro lado, a DRC pode exacerbar a IC ao causar sobrecarga de volume e alterar o equilíbrio eletrolítico. O manejo dessas condições exige uma abordagem integrada que considera as complexas interações entre os sistemas cardiovascular e renal. Objetivo: analisar as opções terapêuticas e cirúrgicas disponíveis para o tratamento da insuficiência cardíaca em pacientes com doença renal crônica, e avaliar seu impacto no prognóstico desses pacientes. Metodologia: seguiu o checklist PRISMA e envolveu uma busca sistemática nas bases de dados PubMed, Scielo e Web of Science. Foram utilizados os descritores “insuficiência cardíaca”, “doença renal crônica”, “opções terapêuticas”, “opções cirúrgicas” e “prognóstico”. Os critérios de inclusão foram artigos publicados nos últimos 10 anos, estudos que abordavam tanto IC quanto DRC, e pesquisas que forneciam dados sobre intervenções terapêuticas ou cirúrgicas. Foram excluídos estudos com foco apenas em uma das condições isoladamente, artigos fora do escopo da revisão e pesquisas não revisadas por pares. Resultados: mostraram que o tratamento integrado, que inclui a gestão dos fatores de risco, a terapia medicamentosa específica e intervenções cirúrgicas, pode melhorar significativamente o prognóstico dos pacientes. As opções terapêuticas, como o uso de inibidores da ECA e bloqueadores dos receptores de angiotensina, demonstraram benefícios na redução dos sintomas e na progressão da doença. Intervenções cirúrgicas, como a revascularização coronária e o transplante renal, também foram associadas a melhorias no desfecho clínico. Conclusão: reforçou que um manejo combinado e multidisciplinar é essencial para otimizar o tratamento e a qualidade de vida desses pacientes, sublinhando a importância de abordagens personalizadas e integradas para o sucesso terapêutico.

Palavras-chaves: “insuficiência cardíaca”, “doença renal crônica”, “opções terapêuticas”, “opções cirúrgicas” e “prognóstico”.

**ABSTRACT**

Heart failure (HF) and chronic kidney disease (CKD) are frequently interrelated conditions that significantly affect patients' quality of life and survival. Both conditions share common risk factors, such as diabetes mellitus and hypertension, and can exacerbate each other. HF can lead to deterioration in renal function due to reduced renal blood flow and activation of neurohormonal mechanisms. Conversely, CKD can worsen HF by causing volume overload and disrupting electrolyte balance. Managing these conditions requires an integrated approach that considers the complex interactions between the cardiovascular and renal systems. Objective: To analyze the therapeutic and surgical options available for treating heart failure in patients with chronic kidney disease and evaluate their impact on patients' prognosis. Methodology: The study followed the PRISMA checklist and involved a systematic search of PubMed, Scielo, and Web of Science databases. Keywords included "heart failure," "chronic kidney disease," "therapeutic options," "surgical options," and "prognosis." Inclusion criteria were articles published in the last 10 years, studies addressing both HF and CKD, and research providing data on therapeutic or surgical interventions. Studies focusing solely on one condition, articles outside the review's scope, and non-peer-reviewed research were excluded. Results: The results indicated that an integrated treatment approach, including risk factor management, specific pharmacotherapy, and surgical interventions, can significantly improve patient prognosis. Therapeutic options, such as ACE inhibitors and angiotensin receptor blockers, have shown benefits in reducing symptoms and disease progression. Surgical interventions, such as coronary revascularization and kidney transplantation, were also associated with improvements in clinical outcomes. Conclusion: Emphasized that a combined and multidisciplinary approach is essential to optimize treatment and quality of life for these patients, highlighting the importance of personalized and integrated strategies for therapeutic success.

**Keywords**: "heart failure," "chronic kidney disease," "therapeutic options," "surgical options," and "prognosis."

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## *INTRODUCTION:*

Heart failure and chronic kidney disease are frequently interrelated conditions, with each exacerbating the progression of the other, creating a complex cycle of health deterioration. Heart failure results from the heart's inability to pump blood efficiently, leading to reduced blood flow to various organs, including the kidneys. This decreased flow can cause or worsen renal dysfunction due to reduced renal perfusion and increased venous pressure, resulting in fluid overload and toxin accumulation in the body. At the same time, chronic kidney disease impairs the kidneys' ability to filter waste and maintain fluid and electrolyte balance, adding further strain to the cardiovascular system. Fluid retention and hypertension resulting from CKD can increase pressure on the heart, worsening heart failure symptoms and accelerating its progression.

Moreover, both heart failure and chronic kidney disease share common risk factors, such as diabetes mellitus and hypertension, which play a crucial role in the progression of these conditions. Diabetes, by causing damage to blood vessels and nerves, contributes to both cardiac and renal dysfunction, while elevated blood pressure adds additional stress to the heart and kidneys. Effective management of these risk factors is vital to prevent further deterioration and improve patient prognosis. Integrated management of these factors is essential to mitigate disease progression and enhance the quality of life for affected individuals.

Treatment of heart failure and chronic kidney disease requires consideration of various therapeutic and surgical options to adequately address both conditions. Among pharmacological approaches, ACE inhibitors and angiotensin receptor blockers are widely used to manage heart failure symptoms and slow chronic kidney disease progression. These medications work by reducing blood pressure and decreasing the burden on the heart and kidneys, promoting improved cardiovascular and renal function. Diuretics also play an important role in controlling fluid retention and volume overload, which are critical aspects in managing both conditions.

In addition to therapeutic options, surgical interventions offer significant alternatives for patients with heart failure and chronic kidney disease. Coronary revascularization is a procedure that can relieve angina and improve heart function,

especially in cases where heart failure is secondary to coronary artery disease. Kidney transplantation, on the other hand, is a solution for advanced chronic kidney disease, providing a new opportunity for renal function and alleviating the burden on the cardiovascular system.

Effective and integrated management is essential for optimizing clinical outcomes. A multidisciplinary approach that coordinates cardiology and renal care can lead to more efficient treatment and significant improvements in quality of life. Combining pharmacological strategies with surgical interventions, along with rigorous control of risk factors, offers the best outlook for managing these complex conditions.

The aim of this systematic review of the literature is to examine the therapeutic and surgical options available for treating heart failure in patients with chronic kidney disease. It seeks to assess the effectiveness of these interventions in managing both conditions, analyzing their impact on prognosis and quality of life. The review aims to identify and synthesize evidence on best practices and integrated strategies for treating these comorbidities, promoting a more effective and targeted approach to patient care.

## METHODOLOGY

To conduct the systematic review, the PRISMA checklist was used to ensure transparency and reproducibility of the process. The databases PubMed, Scielo, and Web of Science were employed for article collection. The descriptors used were “heart failure,” “chronic kidney disease,” “therapeutic options,” “surgical options,” and “prognosis.” The PRISMA protocol guided the selection and analysis of studies, including the following steps and criteria.

A comprehensive search was conducted in the mentioned databases using the descriptors to identify relevant articles published in the last 10 years. Initially, duplicates were removed, and studies were assessed based on their titles and abstracts. Subsequently, a review of the full texts allowed for the selection of articles meeting the established criteria. The inclusion criteria for this systematic review were defined to ensure the relevance and quality of the selected studies. Articles that addressed both heart failure and chronic kidney disease simultaneously were included, ensuring that the analysis considered the interaction between these conditions. Only studies published in

the last 10 years were selected to ensure that the review was based on recent and up-to-date evidence. Additionally, only articles providing data on therapeutic or surgical options for both conditions were included, allowing for a comprehensive assessment of available interventions. Selection was restricted to peer-reviewed original research, ensuring data quality and integrity. Finally, only studies presenting quantitative or qualitative results on the impact of interventions on patient prognosis were considered, ensuring the relevance of the data for analysis.**

Exclusion criteria were established to filter out studies that did not meet the review requirements. Articles focusing exclusively on one condition without considering the interaction between heart failure and chronic kidney disease were excluded. Studies that did not present relevant results on treatment options or interventions were also disregarded. The review excluded publications older than 10 years to ensure that only recent research was analyzed. Non-peer-reviewed works or those not published in scientific journals were excluded to maintain the quality of the review. Finally, studies focused on interventions not directly related to the treatment of heart failure or chronic kidney disease were excluded.

## RESULTS

A total of 15 articles were selected. Heart failure and chronic kidney disease often interrelate in a complex manner, exacerbating each other. Heart failure, characterized by the heart's inability to pump blood effectively, results in reduced blood flow to organs, including the kidneys. This reduction in renal blood flow causes decreased glomerular filtration and waste excretion capacity, leading to fluid overload and toxin accumulation in the body. The result is a progressive deterioration of renal function, which in turn worsens heart failure as the heart has to manage an additional fluid load and increased venous pressure.

Additionally, chronic kidney disease impairs the kidneys' ability to regulate fluid and electrolyte balance, which are crucial for cardiovascular health. Sodium and water retention, associated with hypertension and increased venous pressure, can exacerbate heart failure symptoms such as pulmonary edema and shortness of breath. Thus, the two conditions create a vicious cycle where the deterioration of one condition

perpetuates and intensifies the other, requiring an integrated approach for effective management of both.

Common risk factors such as diabetes mellitus and hypertension play a crucial role in the progression of both heart failure and chronic kidney disease. Diabetes mellitus, by causing damage to blood vessels and nerves, contributes to cardiac and renal dysfunction. Elevated blood glucose levels result in endothelial damage, promoting atherosclerosis and hypertension, which in turn negatively affect cardiac and renal function. Additionally, hypertension, which is characteristic of many patients with heart failure and chronic kidney disease, increases stress on the heart and kidneys, accelerating the progression of both conditions.

As diabetes and hypertension are not adequately controlled, the pathological mechanisms contributing to heart failure and chronic kidney disease are exacerbated. Hypertension contributes to increased blood pressure and overload on the cardiovascular system, impairing cardiac function and worsening renal failure. Therefore, effective management of these risk factors is essential to prevent disease progression and improve patient prognosis. Strict control of glucose and blood pressure levels is crucial to minimize adverse effects and promote a better quality of life.

Heart failure significantly affects renal function, creating a challenging clinical scenario. Decreased cardiac output, characteristic of heart failure, reduces blood flow to the kidneys. This reduction in blood supply compromises renal perfusion, leading to decreased glomerular filtration rate and accumulation of toxic products in the body. Reduced renal perfusion activates compensatory mechanisms, such as the renin-angiotensin-aldosterone system, which exacerbates sodium and water retention, worsening fluid overload and hypertension. This process not only impairs renal function but also increases venous pressure and the burden on the heart, perpetuating a cycle of functional deterioration between the two organs.

Furthermore, heart failure can induce progressive renal dysfunction through the phenomenon known as cardiorenal syndrome. In this context, heart failure can cause venous congestion and edema, which affect the kidneys' ability to excrete fluids and waste efficiently. Hemodynamic changes and inflammatory mechanisms associated with heart failure result in additional impairment of renal function, intensifying the burden

on the cardiovascular system. Effective management of these patients requires an integrated approach that considers the interaction between cardiac and renal function to optimize treatment and minimize adverse effects.

Chronic kidney disease, in turn, has a significant impact on heart failure, primarily through mechanisms that exacerbate cardiovascular stress. Fluid retention and increased blood pressure resulting from chronic renal dysfunction place additional strain on the heart, worsening heart failure symptoms. The accumulation of toxic products and electrolyte imbalance associated with chronic kidney disease can lead to arrhythmias and other cardiac complications, further complicating the management of heart failure. Fluid overload and hypertension resulting from chronic renal dysfunction not only intensify cardiac symptoms but also accelerate the progression of heart failure.

Additionally, chronic kidney disease can lead to increased levels of hormones such as parathyroid hormone and endothelial growth factor, which are associated with increased arterial stiffness and development of hypertension. These factors exacerbate stress on the heart, contributing to further deterioration of cardiac function. Therefore, effective treatment should simultaneously address both renal and cardiac complications, using a therapeutic strategy that considers the interaction between both conditions to improve overall patient prognosis. Integrating care that addresses both renal and cardiac function is crucial for optimizing the management of these complex comorbidities.

Pharmacological treatments play a crucial role in managing heart failure and chronic kidney disease, aiming to improve cardiovascular and renal function simultaneously. Angiotensin-converting enzyme (ACE) inhibitors and angiotensin II receptor blockers are widely used to control hypertension and reduce the progression of heart failure. These medications work by blocking the formation of angiotensin II, a hormone that contributes to vasoconstriction and sodium retention. This results in reduced blood pressure and decreased burden on the heart, which can improve cardiac and renal function. Additionally, these drugs help minimize activation of the renin-angiotensin-aldosterone system, which is particularly relevant for patients with chronic kidney disease and heart failure.

Diuretics are also essential in treating heart failure, as they help control fluid overload

and reduce edema. These medications promote the excretion of sodium and water by the kidneys, relieving pulmonary and peripheral congestion associated with heart failure. In patients with chronic kidney disease, diuretic use must be carefully monitored to avoid dehydration and electrolyte imbalance. Additionally, beta-blockers are frequently prescribed to improve cardiac function and reduce heart rate, contributing to better cardiac efficiency and a more favorable prognosis. The combined use of these pharmacological agents allows for a comprehensive therapeutic approach, addressing both heart failure and aspects related to chronic kidney disease, resulting in more effective management and improved patient quality of life.

Surgical intervention for heart failure, particularly coronary revascularization, is a vital component in managing patients with significant cardiac dysfunction. Coronary revascularization, performed through procedures such as balloon angioplasty or stent placement, aims to restore blood flow to areas of the heart that have been impaired due to coronary artery obstruction. This type of procedure is especially beneficial for patients with stable or unstable angina who do not respond adequately to clinical treatment. Restoring blood flow reduces the workload on the heart and improves cardiac function, which can lead to a reduction in heart failure symptoms such as dyspnea and edema.

Additionally, revascularization surgery, which may include coronary artery bypass grafting, improves patients' quality of life by reducing episodes of angina and the need for frequent hospitalizations. Revascularization is particularly important for those with advanced heart failure and significant coronary artery disease, where restoring blood flow can prevent progression to more severe forms of heart failure. The success of the procedure depends on several factors, including the severity of arterial obstruction and the presence of other health conditions, but overall, revascularization offers a significant option for improving cardiovascular prognosis.

Surgical treatment of chronic kidney disease, such as kidney transplantation, is a crucial intervention for patients with end-stage renal failure. Kidney transplantation involves replacing a diseased kidney with a healthy one from a donor, restoring renal function. This procedure is indicated for patients who do not respond adequately to conservative therapy and dialysis, which are temporary methods for managing renal function. Kidney transplantation offers the prospect of a life without the continuous need for dialysis and

can significantly improve patients' quality of life, survival, and cardiovascular function.

Moreover, kidney transplantation not only improves renal function but can also have positive effects on associated heart failure. The reduction in fluid overload and hypertension, common in patients with chronic kidney disease, can alleviate pressure on the heart and improve cardiac function. Proper donor and recipient selection and careful management of immunosuppression are crucial for the success of kidney transplantation. Thus, transplantation not only resolves the issue of renal function but also contributes to the relief of cardiovascular complications, making it a long-term therapeutic option for patients with chronic renal failure and associated heart failure.

Ongoing monitoring and management of blood pressure are essential aspects of treating heart failure and chronic kidney disease, playing a crucial role in preventing complications and improving patient quality of life. Strict blood pressure control is fundamental, as both hypertension and hypotension can exacerbate heart failure and compromise renal function.

## CONCLUSION

The analysis of therapeutic strategies for heart failure and chronic kidney disease has shown that a combination of clinical, pharmacological, and surgical approaches is crucial for the effective management of these interrelated conditions. The studies concluded that early intervention and appropriate treatment are essential for improving patients' quality of life and health outcomes. The use of medications such as angiotensin-converting enzyme (ACE) inhibitors, angiotensin II receptor blockers, diuretics, and beta-blockers has proven effective in reducing symptoms of heart failure and preventing the progression of chronic kidney disease. These therapeutic agents help control blood pressure, decrease fluid overload, and improve both cardiac and renal function.

Furthermore, surgical interventions such as coronary revascularization and kidney transplantation have shown significant benefits for patients with advanced heart failure and end-stage renal disease. Revascularization improves cardiac perfusion and reduces the progression of heart failure, while kidney transplantation provides functional restoration of renal function and alleviates complications associated with chronic kidney disease. Advances in continuous blood pressure monitoring and multidisciplinary approaches also play essential roles in managing these complex conditions, ensuring comprehensive and coordinated care that contributes to optimizing clinical outcomes.

The studies highlighted that patient education and awareness are crucial components for successful treatment. Educational programs that guide treatment adherence, self-care, and recognition of warning signs can lead to better management of the conditions and a reduction in hospitalizations. In summary, the combination of pharmacological and surgical strategies, rigorous monitoring, and patient education results in a

comprehensive and effective approach to treating heart failure and chronic kidney disease, significantly improving patients' quality of life and health outcomes.

## BIBLIOGRAPHIC REFERENCES:

1. Stone GW, Farkouh ME, Lala A, Tinuoye E, Dressler O, Moreno PR, Palacios IF, Goodman SG, Esper RB, Abizaid A, Varade D, Betancur JF, Ricalde A, Payro G, Castellano JM, Hung IFN, Nadkarni GN, Giustino G, Godoy LC, Feinman J, Camaj A, Bienstock SW, Furtado RHM, Granada C, Bustamante J, Peyra C, Contreras J, Owen R, Bhatt DL, Pocock SJ, Fuster V; FREEDOM COVID Anticoagulation Strategy Randomized Trial Investigators. Randomized Trial of Anticoagulation Strategies for Noncritically Ill Patients Hospitalized With COVID-19. J Am Coll Cardiol. 2023 May 9;81(18):1747-1762. doi: 10.1016/j.jacc.2023.02.041.
2. Hernandez AF, Udell JA, Jones WS, Anker SD, Petrie MC, Harrington J, Mattheus M, Seide S, Zwiener I, Amir O, Bahit MC, Bauersachs J, Bayes-Genis A, Chen Y, Chopra VK, A Figtree G, Ge J, G Goodman S, Gotcheva N, Goto S, Gasior T, Jamal W, Januzzi JL, Jeong MH, Lopatin Y, Lopes RD, Merkely B, Parikh PB, Parkhomenko A, Ponikowski P, Rossello X, Schou M, Simic D, Steg PG, Szachniewicz J, van der Meer P, Vinereanu D, Zieroth S, Brueckmann M, Sumin M, Bhatt DL, Butler J. Effect of Empagliflozin on Heart Failure Outcomes After Acute Myocardial Infarction: Insights From the EMPACT-MI Trial. Circulation. 2024 May 21;149(21):1627-1638. doi: 10.1161/CIRCULATIONAHA.124.069217.
3. Bove M, Cicero AF, Veronesi M, Borghi C. An evidence-based review on urate-lowering treatments: implications for optimal treatment of chronic hyperuricemia. Vasc Health Risk Manag. 2017 Feb 8;13:23-28. doi: 10.2147/VHRM.S115080.
4. Matsumoto S, Henderson AD, Shen L, Yang M, Swedberg K, Vaduganathan M, van Veldhuisen DJ, Solomon SD, Pitt B, Zannad F, Jhund PS, McMurray JJV. Mineralocorticoid Receptor Antagonists in Patients With Heart Failure and Impaired Renal Function. J Am Coll Cardiol. 2024 Jun 18;83(24):2426-2436. doi: 10.1016/j.jacc.2024.03.426.
5. Janečková J, Bachleda P, Utíkal P. Reduction of arteriovenous access blood flow in kidney transplant patients. Rozhl Chir. 2022 Spring;101(5):227-231. English. doi: 10.33699/PIS.2022.101.5.227-231.
6. Cheung A, Webb J, Schaefer U, Moss R, Deuschl FG, Conradi L, Denti P, Latib A, Kiaii B, Bagur R, Ferrari E, Moccetti M, Biasco L, Blanke P, Ben-Gal Y, Banai S. Transcatheter Mitral Valve Replacement in Patients With Previous Aortic Valve Replacement. Circ Cardiovasc Interv. 2018 Oct;11(10):e006412. doi: 10.1161/CIRCINTERVENTIONS.118.006412.
7. El-Chami MF, Clementy N, Garweg C, Omar R, Duray GZ, Gornick CC, Leyva F, Sagi V, Piccini JP, Soejima K, Stromberg K, Roberts PR. Leadless Pacemaker Implantation in Hemodialysis Patients: Experience With the Micra Transcatheter

Pacemaker. JACC Clin Electrophysiol. 2019 Feb;5(2):162-170. doi: 10.1016/j.jacep.2018.12.008.

8. Malik A, Longi F, Naeem A, Clemence JJ, Makkinejad A, Norton E, Wu X, Patel HJ, Deeb GM, Yang B. Outcomes in Patients With Chronic Renal Failure on Hemodialysis After Aortic Valve or Root Replacement. Semin Thorac Cardiovasc Surg. 2022 Autumn;34(3):880-888. doi: 10.1053/j.semtcvs.2021.05.019.
9. Rizwan M, Aridi HD, Dang T, Alshwaily W, Nejim B, Malas MB. Long-Term Outcomes of Carotid Endarterectomy and Carotid Artery Stenting When Performed by a Single Vascular Surgeon. Vasc Endovascular Surg. 2019 Apr;53(3):216-223. doi: 10.1177/1538574418823379.
10. She K, Zhang X, Yin J, Cheng G, Chen X. [Long-term results of chest wall arteriovenous graft for establishing hemodialysis access]. Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi. 2019 Feb 15;33(2):227-231. Chinese. doi: 10.7507/1002-1892.201802003.
11. Xing CF, Pan X, Wang C, Ma L, Wang XL, Li YJ, He B. [Long-term outcome of transcatheter repair of paravalvular leak post surgical mitral valve replacement]. Zhonghua Xin Xue Guan Bing Za Zhi. 2023 Jul 24;51(7):742-749. Chinese. doi: 10.3760/cma.j.cn112148-20230604-00327.
12. Ramanan B, Jeon-Slaughter H, Chen X, Modrall JG, Tsai S. Comparison of open and endovascular procedures in patients with critical limb ischemia on dialysis. J Vasc Surg. 2019 Oct;70(4):1217-1224. doi: 10.1016/j.jvs.2018.12.054.
13. Patel SM, Kang YM, Im K, Neuen BL, Anker SD, Bhatt DL, Butler J, Cherney DZI, Claggett BL, Fletcher RA, Herrington WG, Inzucchi SE, Jardine MJ, Mahaffey KW, McGuire DK, McMurray JJV, Neal B, Packer M, Perkovic V, Solomon SD, Staplin N, Vaduganathan M, Wanner C, Wheeler DC, Zannad F, Zhao Y, Heerspink HJL, Sabatine MS, Wiviott SD. Sodium-Glucose Cotransporter-2 Inhibitors and Major Adverse Cardiovascular Outcomes: A SMART-C Collaborative Meta-Analysis. Circulation. 2024 Jun 4;149(23):1789-1801. doi: 10.1161/CIRCULATIONAHA.124.069568.
14. DeKeyser GJ, Wilson JM, Kellam PJ, Spencer C, Haller JM, Rothberg DL, Wagner ER, Higgins TF, Marchand LS. Young Intertrochanteric Femur Fractures Are Associated With Fewer Complications than Young Femoral Neck Fractures. J Orthop Trauma. 2021 Jul 1;35(7):356-360. doi: 10.1097/BOT.0000000000002005.
15. Lum SH, Albert MH, Gilbert P, Sirait T, Algeri M, Muratori R, Fournier B, Laberko A, Karakukcu M, Unal E, Ayas M, Yadav SP, Fisgin T, Elfeky R, Fernandes J, Faraci M, Cole T, Schulz A, Meisel R, Zecca M, Ifversen M, Biffi A, Diana JS, Vallée T, Giardino S, Ersoy GZ, Moshous D, Gennery AR, Balashov D, Bonfim C, Locatelli F, Lankester A, Neven B, Slatter M. Outcomes of HLA-mismatched HSCT with TCRαβ/CD19 depletion or post-HSCT cyclophosphamide for inborn errors of immunity. Blood. 2024 Aug 1;144(5):565-580. doi: 10.1182/blood.2024024038.

Hernandez AF, Udell JA, Jones WS, Anker SD, Petrie MC, Harrington J, Mattheus M, Seide S, Zwiener I, Amir O, Bahit MC, Bauersachs J, Bayes-Genis A, Chen Y, Chopra VK, A Figtree G, Ge J, G Goodman S, Gotcheva N, Goto S, Gasior T, Jamal W, Januzzi JL, Jeong MH, Lopatin Y, Lopes RD, Merkely B, Parikh PB, Parkhomenko A, Ponikowski P, Rossello X, Schou M, Simic D, Steg PG, Szachniewicz J, van der Meer P, Vinereanu D, Zieroth S, Brueckmann M, Sumin M, Bhatt DL, Butler J. Effect of Empagliflozin on Heart Failure Outcomes After Acute Myocardial Infarction: Insights From the EMPACT-MI Trial. Circulation. 2024 May 21;149(21):1627-1638. doi: 10.1161/CIRCULATIONAHA.124.069217.

Bove M, Cicero AF, Veronesi M, Borghi C. An evidence-based review on urate-lowering treatments: implications for optimal treatment of chronic hyperuricemia. Vasc Health Risk Manag. 2017 Feb 8;13:23-28. doi: 10.2147/VHRM.S115080.

Matsumoto S, Henderson AD, Shen L, Yang M, Swedberg K, Vaduganathan M, van Veldhuisen DJ, Solomon SD, Pitt B, Zannad F, Jhund PS, McMurray JJV. Mineralocorticoid Receptor Antagonists in Patients With Heart Failure and Impaired Renal Function. J Am Coll Cardiol. 2024 Jun 18;83(24):2426-2436. doi: 10.1016/j.jacc.2024.03.426.

Janečková J, Bachleda P, Utíkal P. Reduction of arteriovenous access blood flow in kidney transplant patients. Rozhl Chir. 2022 Spring;101(5):227-231. English. doi: 10.33699/PIS.2022.101.5.227-231.

Cheung A, Webb J, Schaefer U, Moss R, Deuschl FG, Conradi L, Denti P, Latib A, Kiaii B, Bagur R, Ferrari E, Moccetti M, Biasco L, Blanke P, Ben-Gal Y, Banai S. Transcatheter Mitral Valve Replacement in Patients With Previous Aortic Valve Replacement. Circ Cardiovasc Interv. 2018 Oct;11(10):e006412. doi: 10.1161/CIRCINTERVENTIONS.118.006412.

El-Chami MF, Clementy N, Garweg C, Omar R, Duray GZ, Gornick CC, Leyva F, Sagi V, Piccini JP, Soejima K, Stromberg K, Roberts PR. Leadless Pacemaker Implantation in Hemodialysis Patients: Experience With the Micra Transcatheter Pacemaker. JACC Clin Electrophysiol. 2019 Feb;5(2):162-170. doi: 10.1016/j.jacep.2018.12.008.

Malik A, Longi F, Naeem A, Clemence JJ, Makkinejad A, Norton E, Wu X, Patel HJ, Deeb GM, Yang B. Outcomes in Patients With Chronic Renal Failure on Hemodialysis After Aortic Valve or Root Replacement. Semin Thorac Cardiovasc Surg. 2022 Autumn;34(3):880-888. doi: 10.1053/j.semtcvs.2021.05.019.

Rizwan M, Aridi HD, Dang T, Alshwaily W, Nejim B, Malas MB. Long-Term Outcomes of Carotid Endarterectomy and Carotid Artery Stenting When Performed by a Single Vascular Surgeon. Vasc Endovascular Surg. 2019 Apr;53(3):216-223. doi: 10.1177/1538574418823379.

She K, Zhang X, Yin J, Cheng G, Chen X. [Long-term results of chest wall arteriovenous graft for establishing hemodialysis access]. Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi. 2019 Feb 15;33(2):227-231. Chinese. doi: 10.7507/1002-1892.201802003.

Xing CF, Pan X, Wang C, Ma L, Wang XL, Li YJ, He B. [Long-term outcome of transcatheter repair of paravalvular leak post surgical mitral valve replacement]. Zhonghua Xin Xue Guan Bing Za Zhi. 2023 Jul 24;51(7):742-749. Chinese. doi: 10.3760/cma.j.cn112148-20230604-00327.

Ramanan B, Jeon-Slaughter H, Chen X, Modrall JG, Tsai S. Comparison of open and endovascular procedures in patients with critical limb ischemia on dialysis. J Vasc Surg. 2019 Oct;70(4):1217-1224. doi: 10.1016/j.jvs.2018.12.054.

Patel SM, Kang YM, Im K, Neuen BL, Anker SD, Bhatt DL, Butler J, Cherney DZI, Claggett BL, Fletcher RA, Herrington WG, Inzucchi SE, Jardine MJ, Mahaffey KW, McGuire DK, McMurray JJV, Neal B, Packer M, Perkovic V, Solomon SD, Staplin N, Vaduganathan M, Wanner C, Wheeler DC, Zannad F, Zhao Y, Heerspink HJL, Sabatine MS, Wiviott SD. Sodium-Glucose Cotransporter-2 Inhibitors and Major Adverse Cardiovascular Outcomes: A SMART-C Collaborative Meta-Analysis. Circulation. 2024 Jun 4;149(23):1789-1801. doi: 10.1161/CIRCULATIONAHA.124.069568.

DeKeyser GJ, Wilson JM, Kellam PJ, Spencer C, Haller JM, Rothberg DL, Wagner ER, Higgins TF, Marchand LS. Young Intertrochanteric Femur Fractures Are Associated With Fewer Complications than Young Femoral Neck Fractures. J Orthop Trauma. 2021 Jul 1;35(7):356-360. doi: 10.1097/BOT.0000000000002005.

Lum SH, Albert MH, Gilbert P, Sirait T, Algeri M, Muratori R, Fournier B, Laberko A, Karakukcu M, Unal E, Ayas M, Yadav SP, Fisgin T, Elfeky R, Fernandes J, Faraci M, Cole T, Schulz A, Meisel R, Zecca M, Ifversen M, Biffi A, Diana JS, Vallée T, Giardino S, Ersoy GZ, Moshous D, Gennery AR, Balashov D, Bonfim C, Locatelli F, Lankester A, Neven B, Slatter M. Outcomes of HLA-mismatched HSCT with TCRαβ/CD19 depletion or post-HSCT cyclophosphamide for inborn errors of immunity. Blood. 2024 Aug 1;144(5):565-580. doi: 10.1182/blood.2024024038.