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The Role of Medication Use in Reducing the Hospital Length of Stay in Circulatory System Diseases

Dolaşım Sistemi Hastalıklarında Hastanede Kalış Süresinin Azaltılmasında İlaç Kullanımının Rolü

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Abstract

Objective: Optimizing medication use is critical to minimize the hospital length of stay in circulatory system diseases. In this respect, the aim of this study was to examine the role of medication use in reducing the hospital average length of stay in circulatory system diseases.

Methods: In line with the aim of the study, the independent variables were the uses (in daily doses) of cardiac glycoside, anti-arrhythmic, anti-hypertensive, diuretic, and beta-blocking medications, while the dependent variable was the hospital average length of stay (in days) due to circulatory system diseases. The population of the study consisted of 38 Organisation for Economic Co-operation and Development (OECD) countries. Data from the years 2018-2021 were obtained from the OECD database. A panel least squares regression analysis was performed.

Results: According to the analysis results, the regression model was found to be statistically significant ($p<0.01$). Additionally, anti-hypertensive ($t=-2.740$, $p=0.006$), diuretic ($t=-2.073$, $p=0.040$), and beta-blocker ($t=-2.019$, $p=0.044$) medication consumption made significant contributions to the model. As the use of anti-hypertensive, diuretic, and beta-blocking medications increased, the average hospital length of stay decreased.

Conclusion: The use of anti-hypertensive diuretic, and beta-blocking medications plays an important role in reducing the average hospital length of stay of patients with circulatory system diseases. This emphasizes the importance of these medicines in the effective management of circulatory conditions, which may lead to faster patient recovery and more efficient use of health resources.

Keywords: Circulatory system diseases, rational use of medicine, hospital average length of stay, Organisation for Economic Co-operation and Development

Öz

Amaç: Dolaşım sistemi hastalıklarında hastanede kalış süresini en aza indirmek için ilaç kullanımının optimize edilmesi büyük önem taşımaktadır. Bu doğrultuda, bu çalışmanın amacı, dolaşım sistemi hastalıklarına bağlı hastanede ortalama kalış süresini azaltmada ilaç kullanımının rolünü incelemektir.

Yöntem: Araştırmanın amacı doğrultusunda bağımsız değişkenler; kardiyak glikozid, anti-aritmik, anti-hipertansif, diüretikler ve beta bloker ilaçların günlük doz bazında kullanımı olarak belirlenmiştir. Bağımlı değişken ise dolaşım sistemi hastalıklarına bağlı olarak hesaplanan hastane ortalama kalış süresi (gün) olarak tanımlanmıştır. Araştırmanın evrenini 38 Ekonomik İşbirliği ve Kalkınma Örgütü (OECD) ülkesi oluşturmuş, 2018-2021 yıllarına ait veriler OECD veri tabanından temin edilmiştir. Veriler panel en küçük kareler regresyon analizi ile değerlendirilmiştir.

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Öz

Bulgular: Analiz sonuçlarına göre, oluşturulan regresyon modeli istatistiksel olarak anlamlı bulunmuştur (p<0,01). Ayrıca anti-hipertansif (t=-2,740, p=0,006), diüretik (t=-2,073, p=0,040) ve beta bloker (t=-2,019, p=0,044) ilaç kullanımının modele anlamlı katkı sağladığı görülmüştür. Bu üç ilaç grubunun kullanımındaki artış, hastane ortalama kalış süresinde azalma ile ilişkilendirilmiştir.

Sonuç: Anti-hipertansif, diüretik ve beta bloker ilaçların kullanımı, dolaşım sistemi hastalıklarına sahip bireylerin hastanede kalış süresini azaltmada önemli bir rol oynamaktadır. Bu bulgular, söz konusu ilaç gruplarının dolaşım sistemi hastalıklarının etkin yönetiminde kritik öneme sahip olduğunu ve bu sayede daha hızlı hasta iyileşmesi ile sağlık kaynaklarının daha verimli kullanılabileceğini ortaya koymaktadır.

Anahtar Kelimeler: Dolaşım sistemi hastalıkları, akılcı ilaç kullanımı, hastanede ortalama kalış süresi, Ekonomik İşbirliği ve Kalkınma Örgütü

Introduction

Circulatory system diseases, also known as cardiovascular diseases, are among the leading causes of morbidity and mortality worldwide. They are a significant contributor to the global burden of disease, causing many deaths long-term disability, affecting the quality of life of millions of individuals. The costs associated with treating these diseases and managing their complications are high, and the economic burden is considerable. In addition, the loss of productivity due to illness and premature death further increases the economic pressure on health systems globally[1,2].

Major risk factors for circulatory system diseases include lack of physical activity, unhealthy diet, tobacco use, and excessive alcohol consumption. These can lead to plaque buildup in the arteries, high blood pressure and other complications[3].

Circulatory system diseases are among the leading causes of death globally, accounting for an estimated 17.9 million deaths each year. Over 80% of deaths linked to circulatory system diseases result from heart attacks and strokes, with approximately one in three occurring prematurely in individuals younger than 70 years[4,5]. Early detection, lifestyle changes and appropriate medical interventions (surgery, appropriate doses of medication, etc.) are critical in managing and preventing these diseases, which have a significant impact on both individual health and the global health burden[6].

The hospital's average-length-of-stay (ALOS) for circulatory system diseases is an important indicator of healthcare efficiency and patient outcomes. This measurement represents the average number of days patients with cardiovascular conditions, such as heart attacks, heart failure, or strokes, spend in the hospital. Several factors influence this duration, including the severity of the illness, the availability of advanced medical treatments, and the efficiency of the care provided. Longer stays may indicate more severe cases or complications, while shorter stays can reflect effective treatment protocols and early discharge practices. Managing the length of stay is crucial for hospitals, as it impacts not only patient recovery and satisfaction but also hospital resources and overall healthcare costs. Reducing the length of stay without compromising patient care is a significant challenge and requires a balance between delivering rapid, effective treatment and ensuring that patients are stable enough to be discharged safely[7,8].

Pharmacological treatment is considered another factor in reducing the ALOS for circulatory system diseases, directly influencing health outcomes and healthcare efficiency. Effective pharmacological treatmentcan stabilize patients more quickly, manage symptoms, and prevent complications that could otherwise prolong hospital stays. For instance, the timely administration of anti-coagulants, anti-hypertensives, or heart failure medications can prevent the progression of conditions such as strokes or heart attacks, facilitating earlier discharge. Furthermore, evidence-based medication plans tailored to individual patient needs can promote faster recovery, reducing the need for prolonged inpatient care. By optimizing the use of appropriate medications, healthcare providers not only improve patient health but also alleviate the pressure on hospital resources, ultimately lowering healthcare costs and enhancing the overall quality of care[9]. In this context, the aim of this study was to examine the effect of medication use on the ALOS in circulatory system diseases.

Materials and Methods

Importance of the Study

Investigating the impact of pharmacological treatment on the length of stay in these conditions is crucial for optimizing patient outcomes and healthcare efficiency. Effective medication therapy can lead to faster recovery, reducing the time patients need to remain in the hospital, which in turn lowers healthcare costs and frees up resources for other

patients. Additionally, shortening the hospital stay decreases the risk of complications such as hospital-acquired infections and improves overall patient satisfaction. The findings from this research can inform clinical guidelines, ensuring best practices are followed and ultimately enhancing the quality of care provided to patients with circulatory system diseases.

Population and Sample

The population of this study consists of 38 Organisation for Economic Co-operation and Development (OECD) countries. No sample selection was made, and data from 31 OECD countries with complete data were used. Accordingly, Colombia, Ireland, Japan, Mexico, Poland, Switzerland, and the United States were excluded from the analysis.

Variables and Data Collection

The study utilizes five independent variables (cardiac glycosides, anti-arrythmics, anti-hypertensives, diuretics, and beta-blocking agents) and one dependent variable (hospital average lenght of stay). The choice of the five independent variables—cardiac glycosides, anti-arrhythmics, anti-hypertensives, diuretics, and beta-blocking agents,—is based on their fundamental role in treating cardiovascular conditions, which are a major driver of hospital admissions globally. These medications are routinely used in managing diseases such as heart failure, arrhythmias, and hypertension-conditions that often require prolonged hospital care. Investigating how these drug classes influence the hospital average length of stay is crucial, as timely and effective pharmacotherapy can accelerate clinical stabilization and facilitate earlier discharge. By analyzing the relationship between these treatments and hospital average length of stay, healthcare providers can refine therapeutic strategies, enhance patient outcomes, and use hospital resources more efficiently. Information regarding these variables is presented in Table 1. The data, accessed through the OECD database, pertain to the years 2018-2021. This timeframe was chosen because complete data were only available for the specified years.

Research Model

The structural model of the research is presented in Figure 1.

Statistical Analysis

In this study, a panel data ordinary least squares regression analysis was performed. Before performing the analysis, a literature review was carried out to select the variables. Since the OECD database was used, the variables were limited to those available in the database. Data on other types of medications were not included in the study due to incomplete and irregular records regarding medication usage.

To meet the necessary conditions for panel data analysis, a logarithmic transformation was first applied to the data to ensure normality. Second, the data were confirmed to be stationary at the level. Third, the presence of cross-sectional dependence was assessed. Finally, the choice between a fixed effects model and a random effects model was determined. Since secondary data was used in this study, ethical committee approval was not required.

Results

Descriptive statistics for the variables are shown in Table 2. Accordingly, the highest average medication use was observed for beta-blockers, with approximately 44 (±18.45), while the lowest average was observed for cardiac glycosides, with 1.64 (±0.69).

The results of the regression analysis are presented in Table 3. During the analysis, the stationarity of the data was tested using the Augmented Dickey-Fuller Fisher X^2 test, and all variables were found to be stationary at level ($p<0.05$). The cross-sectional dependence between countries across the years was tested using the adjusted Lagrange multiplier test, and no dependence was found ($p>0.05$). The Hausman test was applied to the variables. Based on this test, variables were analyzed according to either fixed or random effects models. It is recommended to use the random effects model when $p>0.05$, and the fixed effects model when $p<0.05$[10].

Table 1. Variables

		Explanations	Data from
Independents	Cardiac glycosides	Daily doses per 1 000 inhabitants per day (Doses)	OECD Health Statistics (https://www.oecd.org/en/data/datasets/oecd-health-statistics.html)
	Anti-arrhythmics		
	Anti-hypertensives		
	Diuretics		
	Beta-blocking agents		
Dependent	Hospital average lenght of stay	Hospital average lenght of stay (day)	

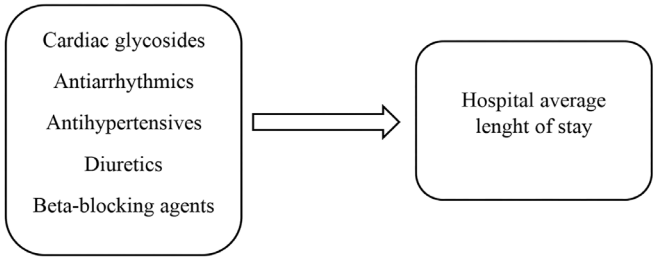

Figure 1. Structural Model of the Study

In this study, the Hausman test result was p>0.05, (p=0.065), so the analysis was conducted using the random effects model, which led to more consistent statistical estimates.

The Breusch-Pagan-Godfrey test was performed for heteroscedasticity, the Hsiao test for heterogeneity, while other panel unit root tests (Akaike Information Criterion, Schwarz Criterion, Hannan-Quinn Criterion) were carried out, with the results presented in Table 3.

According to Table 3, the established regression model was found to be statistically significant (p<0.001). Anti-hypertensive drugs (t=-2.740, p=0.006), diuretic drugs (t=-2.073, p=0.040), and beta-blockers (t=-2.019, p=0.044) made significant contributions to the model. Accordingly, as the use of anti-hypertensives, diuretics, and beta-blocker drugs, increases, the average length of hospital stay decreases.

Discussion

Rational drug use is considered highly important for minimizing the ALOS in patients with circulatory system diseases, and improving overall patient outcomes in the management of these conditions. This study, conducted to examine the effect of medication use on the ALOS for circulatory system diseases, used data from the OECD database. It was determined that the use of anti-hypertensive, diuretic, and beta-blocker, drugs (measured in daily doses) significantly reduced the average length of hospital stay.

A review of the literature reveals studies with similar findings. In a study by Dragomir et al.[11], it was found that the use of anti-hypertensive medications was effective in reducing the average hospital length of stay for patients with hypertension and related cardiovascular conditions. These medications help manage blood pressure effectively, preventing complications such as stroke, heart attack, and other cardiovascular diseases, which often require prolonged hospitalization. Another study by Hamrahian et al.[12] found that the timely and rational use of anti-hypertensive drugs could prevent chronic hypertension from progressing to more severe conditions, typically requiring longer hospital stays. Patients adhering to anti-hypertensive medication regimens are less likely to experience hypertensive crises or develop associated conditions like congestive heart failure, which require long-term care. Anti-hypertensive medications stabilize patients' blood pressure, reducing the

Table 2. Descriptives [n=124 (31x4)]

	Cardiac glycosides	Anti-arrhytmics	Anti-hypertensives	Diuretics	Beta-blocking agents	Hospital average lenght of stay
Mean	1.64	4.10	8.62	40.40	43.59	8.65
Sd.	0.69	2.76	7.37	17.59	18.45	4.84
Obs.	124	124	124	124	124	124

Table 3. Panel regression analysis

	Std. Beta	t	p	VIF
Ln_cardiac_glycosides	0.205	0.619	0.537	1.534
Ln_Anti-arrhythmics	0.060	0.430	0.667	1.956
Ln_Anti-hypertensives	-0.085	-2.794	0.006	1.561
Ln_Diuretics	-0.050	-2.073	0.040	1.238
Ln_Beta-blocking agents	-0.060	-2.019	0.044	2.686
C	12.427	5.144	0.000	-

p (F statistic=0.000); Normality: 0.407; Hausman test: 0.065; Durbin-Watson: 2.179; Adjusted Lagrange Multiplier: 0.452; Augmented Dickey-Fuller-Fisher x2: 0.015; Breusch-Pagan-Godfrey: 0.412; Breusch-Godfrey serial correlation LM test: 0.059; Spesification test of Hsiao: 1.4E256 (1.4.10-256); Akaike Info Criterion: 9.447 Schwarz Criterion: 8.325; Hannan-Quinn Criterion: 8.100.

VIF: Variance inflation factor

severity of acute attacks, thus leading to quicker stabilization and discharge from the hospital. This not only improves patient outcomes but also ensures more efficient use of hospital resources, reduces healthcare costs, and eases the burden on healthcare systems[13].

Diuretic medications are crucial in the management of conditions such as heart failure, hypertension, and edema, and they significantly contribute to reducing the average hospital length of stay. By promoting the removal of excess fluid from the body, diuretics help alleviate symptoms like swelling and shortness of breath, enabling patients to stabilize more quickly. For instance, in cases of acute heart failure, the timely use of diuretics can rapidly reduce fluid overload, improve cardiac function, and facilitate earlier discharge from the hospital[14]. In a study by Siddique et al.[15], it was found that reducing hospital stay not only minimizes the time patients spend in the hospital but also optimizes healthcare resources by freeing up beds and lowering overall treatment costs. Another study by Oh and Han[16] noted that while diuretics are generally effective in restoring fluid balance and improving symptoms, their use must be carefully monitored to avoid complications that could prolong hospital stays. For example, excessive use of diuretics can lead to dehydration or kidney dysfunction, potentially requiring additional treatment and extending the hospital stay. Therefore, although diuretics are a powerful tool in reducing hospital stay, their administration must be part of a well-coordinated treatment plan to ensure optimal patient outcomes.

Beta-blockers are a type of medication that works by blocking the effects of the hormone adrenaline on beta receptors in the heart and blood vessels, thereby reducing the heart's workload. Beta-blockers are crucial in managing cardiovascular diseases such as hypertension, arrhythmias, and heart failure, and they significantly contribute to reducing the hospital average length of stay[17]. A study by Chatterjee et al.[18] found that the prompt use of beta-blocking agents can prevent the progression of these conditions, thereby reducing the need for prolonged hospitalizations. For example, in the treatment of heart failure, beta-blockers have been shown to improve cardiac function over time, leading to faster recovery and earlier discharge. This not only benefits patients but also helps optimize bed availability and reduce healthcare costs. Another study by Guay and Ochroch[19] determined that beta-blockers could reduce the incidence of certain cardiovascular issues during surgery and, depending on factors such as dosage, timing of administration, and patient-specific characteristics, could also reduce discharge times.

The absence of a significant impact of cardiac glycosides on ALOS can be explained by their pharmacological profile and clinical use. These drugs, such as digoxin, are predominantly utilized in chronic management of heart failure and to control heart rate in patients with atrial fibrillation. Their therapeutic effect is gradual and more supportive, aimed at symptom relief rather than acute correction of cardiovascular instability. In acute care settings, where swift stabilization is key to discharge readiness, faster-acting agents are generally preferred. Furthermore, due to their narrow therapeutic index and risk of toxicity, cardiac glycosides are often used with caution during hospitalization, which may limit their immediate utility and thus diminish any measurable effect on shortening hospital stays[20].

In a similar vein, anti-arrhythmic medications tend not to influence ALOS significantly, as their role is typically confined to controlling specific arrhythmias and maintaining sinus rhythm over the long term. These drugs are often not first-line treatments for the acute issues that prolong hospitalization, and their initiation frequently occurs in outpatient settings or once a patient is clinically stable. Additionally, anti-arrhythmics can carry a risk of adverse effects, including proarrhythmia, necessitating extended monitoring periods, which may extend hospital stays in some cases. Because they are used selectively and under careful supervision, their influence on broader hospitalization outcomes like hospital average length of stay is often limited, especially when compared to other interventions that more directly address the underlying causes of acute cardiovascular events[21].

The effect of the specified medications on the ALOS is influenced by various factors, including patient adherence to the medication, the presence of comorbidities, and the timing of treatment initiation. Poor adherence to treatment plans or delayed treatments can lead to an extended hospital stay due to complications. Additionally, patients with multiple health issues may require more complex and prolonged treatment, even with medication use[22].

Policy Implications

The findings of the regression model, which was statistically significant ($p<0.001$), have important policy implications for hospital management and clinical practice. The significant negative associations between the use of anti-hypertensive drugs, diuretics, and beta-blockers and the average length of

hospital stay suggest that optimized and early administration of these medications can contribute to more efficient patient recovery and earlier discharge. Policymakers and healthcare administrators should consider developing or updating clinical guidelines that prioritize the timely use of these drug classes in the management of cardiovascular patients. Moreover, integrating these findings into hospital protocols may not only improve patient outcomes but also enhance resource utilization and reduce healthcare costs by minimizing unnecessary hospital days. Encouraging adherence to evidence-based pharmacological strategies through training, monitoring, and supportive health policies could play a key role in improving the efficiency of inpatient care.

Study Limitations

While this study offers valuable insights into the relationship between pharmacological treatment and ALOS for circulatory system diseases, several limitations should be acknowledged. First, the analysis was constrained by the availability and completeness of data within the OECD database, limiting the scope of medications studied to only five drug classes. This restriction may omit other potentially influential medications or therapeutic strategies that could affect hospital average length of stay. Second, although the study included 31 OECD countries, the exclusion of 7 countries due to incomplete data may affect the generalizability of the findings across all OECD nations. Third, the use of aggregated country-level data may mask individual-level variations in drug use, patient severity, comorbidities, or healthcare system differences that can influence hospital stay duration. Finally, the time frame (2018-2021) may reflect unique healthcare challenges and responses, particularly related to the coronavirus disease-2019 pandemic, which could have impacted hospitalization patterns independently of medication use. Future research using patient-level data and more granular variables could help validate and extend these findings.

Conclusion

The rational use of medications, including anti-hypertensives, diuretics, and beta-blockers, plays a critical role in the management of circulatory system diseases and in minimizing the average hospital length of stay. The findings, supported by existing literature, highlight the significant impact of these medications on improving patient outcomes and reducing the burden on healthcare systems. By effectively controlling blood pressure, managing fluid balance, and stabilizing cardiac function, these medications not only prevent complications that require prolonged hospitalization but also facilitate faster recovery and earlier discharge for patients.

The presented evidence supports the idea that timely and appropriate use of anti-hypertensive medications can prevent serious cardiovascular events, which are often associated with prolonged hospitalizations. Similarly, it has been demonstrated that the judicious use of diuretics and beta-blockers facilitates faster stabilization of acute conditions such as heart failure and arrhythmias, thereby reducing hospital stay duration. However, the administration of these medications requires careful monitoring to avoid potential side effects that could negate their benefits and lead to extended hospital stays.

Overall, the strategic and rational use of these medications not only improves patient care by reducing the risk of long-term complications but also contributes to more efficient use of healthcare resources. Healthcare institutions can optimize bed availability, reduce healthcare costs, and improve overall health outcomes by reducing the average hospital length of stay. These findings underscore the importance of incorporating evidence-based drug protocols into the management of circulatory system diseases to achieve optimal patient outcomes and alleviate the economic burden on healthcare systems.

While medications play a crucial role in reducing hospital stay durations for circulatory system diseases, it is important to remember that drugs alone are insufficient to fully address these conditions. Proper management of disease goes beyond medical treatment and involves a holistic strategy, incorporating lifestyle modifications such as balanced nutrition, consistent exercise, and quitting smoking-key steps in lowering major risk factors such as high blood pressure, excess weight, and elevated cholesterol levels. Furthermore, patient education and adherence to treatment plans are essential for the rational use of medications. Regular monitoring and adjustments of treatment effectiveness are necessary. Addressing psychosocial factors, such as providing support for stress management and mental health, plays a vital role in holistic care. Therefore, a multidisciplinary approach that integrates medical, behavioral, and lifestyle interventions is more appropriate for optimizing outcomes in patients with circulatory system diseases.

Ethics

Ethics Committee Approval: Since secondary data were used in this study, it does not require ethics committee approval.

Informed Consent: The data, accessed through the OECD database.

Footnotes

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References

1. Nabel EG. Cardiovascular disease. N Engl J Med. 2003;349:60-72.
2. Roth GA, Mensah GA, Johnson CO, et al. Global burden of cardiovascular diseases and risk factors, 1990-2019: update from the GBD 2019 study. J Am Coll Cardiol. 2020;76:2982-3021.
3. Dahlöf B. Cardiovascular disease risk factors: epidemiology and risk assessment. Am J Cardiol. 2010;105:3A-9A.
4. World Health Organization. Cardiovascular diseases (CVDs): key facts. [Internet]. Geneva: WHO. Available from: https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds)
5. World Health Organization. Cardiovascular diseases. [Internet]. Geneva: WHO; 2024. Available from: https://www.who.int/health-topics/cardiovascular-diseases#tab=tab_1
6. AbdulRaheem Y. Unveiling the significance and challenges of integrating prevention levels in healthcare practice. J Prim Care Community Health. 2023;14:21501319231186500.
7. Namvar M, Fakhrolmobasheri M, Mazaheri-Tehrani S, Heidarpour M, Emamimeybodi M, Shafie D. Association between the length of hospital stay and 30-day outcomes in patients admitted with acute decompensated heart failure. Emerg Med Int. 2023;2023:6338597.
8. Stone K, Zwiggelaar R, Jones P, Mac Parthaláin N. A systematic review of the prediction of hospital length of stay: towards a unified framework. PLOS Digit Health. 2022;1:e0000017.
9. Omboni S, Caserini M. Effectiveness of pharmacist's intervention in the management of cardiovascular diseases. Open Heart. 2018;5:e000687.
10. Hausman, JA. Specification tests in econometrics. Econometrica. 1978;46:1251-71.
11. Dragomir A, Côté R, Roy L, et al. Impact of adherence to antihypertensive agents on clinical outcomes and hospitalization costs. Med Care. 2010;48:418-25.
12. Hamrahian SM, Maarouf OH, Fülöp T. A critical review of medication adherence in hypertension: barriers and facilitators clinicians should consider. Patient Prefer Adherence. 2022;16:2749-57.
13. Mohandas R, Chamarthi G, Bozorgmehri S, et al. Pro re nata antihypertensive medications and adverse outcomes in hospitalized patients: a propensity-matched cohort study. Hypertension. 2021;78:516-24.
14. Pandey M, Singh A, Agnihotri N, et al. Clinical pharmacology & therapeutic uses of diuretic agents: a review. J Res Appl Sci Biotechnol. 2022;1:11-20.
15. Siddique SM, Tipton K, Leas B, et al. Interventions to reduce hospital length of stay in high-risk populations: a systematic review. JAMA Netw Open. 2021;4:e2125846.
16. Oh SW, Han SY. Loop diuretics in clinical practice. Electrolyte Blood Press. 2015;13:17-21.
17. Wiysonge CS, Bradley HA, Volmink J, Mayosi BM, Opie LH. Beta-blockers for hypertension. Cochrane Database Syst Rev. 2017;1:CD002003.
18. Chatterjee S, Biondi-Zoccai G, Abbate A, et al. Benefits of β blockers in patients with heart failure and reduced ejection fraction: network meta-analysis. BMJ. 2013;346:f55.
19. Guay J, Ochroch EA. Beta-blocking agents for surgery: influence on mortality and major outcomes. A meta-analysis. J Cardiothorac Vasc Anesth. 2013;27:834-44.
20. Chang KY, Giorgio K, Schmitz K, et al. Effect of chronic digoxin use on mortality and heart failure hospitalization in pulmonary arterial hypertension. J Am Heart Assoc. 2023;12:e027559.
21. Yarlagadda C, Abutineh MA, Datir RR, et al. Navigating the incidence of postoperative arrhythmia and hospitalization length: The role of amiodarone and other anti-antiarrhythmics in prophylaxis. Cureus. 2024;16:e57963.
22. Mebrahtu G, Moleki MM, Achila OO, Seyoum Y, Adnoy ET, Ovberedjo M. Antihypertensive medication adherence and associated factors: a cross-sectional analysis of patients attending a National Referral Hospital in Asmara, Eritrea. Patient Prefer Adherence. 2021;15:2619-32.