DOI: https://doi.org/10.53555/nnmhs.v9i2.1561 Publication URL: https://nnpub.org/index.php/MHS/article/view/1561

EFFECT OF BLOOD PRESSURE – LOWERING DRUGS IN HEART FAILURE : A SYSTEMATIC REVIEW

Erick Persson Jeffry*

[*]Faculty of Medicine, Veteran National Development University of Jakarta

Corresponding Author:
erick.persson86@gmail.com

Abstract

It is probable that hypertension is the most major and influential risk factor that can be addressed to avoid the development of heart failure. The development of hypertensive heart disease is the end result of persistently elevated blood pressure, which causes remodeling of the heart's left ventricle. Heart failure is the inevitable manifestation of this condition. The early detection of cardiovascular illness and therapy that is adapted to the specific requirements of the patient are both critical components of an efficient preventative plan for cardiovascular disease. According to a study, certain types of antihypertensive medicine can reduce the progression of hypertension to heart failure (HF), but not all of these treatments are equally as efficient as one another in achieving this goal. Patients should try to avoid taking modest dosages of hydrochlorothiazide once per day, as this is the recommended course of treatment. When it comes to the prevention of heart failure, however, it would appear that long-acting thiazide-type diuretics like chlorthalidone and indapamide have an edge over other hypertension medications. This article presents good data to support the idea that individual patients can benefit from additional reductions in blood pressure even if they are already at or below a certain blood pressure guideline target. It is especially critical for those who are at the highest cardiovascular risk to achieve this decrease (eg, patients with diabetes who are smokers).

Keyword: *Antihypertension; Blood Pressure; Cardiovascular Disease; Heart Failure*

INTRODUCTION

Heart failure is a clinical syndrome characterized by a series of symptoms and signs of heart failure caused by structural and/or functional abnormalities of the heart resulting in reduced cardiac output and/or increased intracardiac pressure.[1] Heart failure is a condition in which the heart has difficulty pumping blood throughout the body. It can develop over a long period of time with symptoms of shortness of breath, problems exercising, fatigue, and swelling of the feet, ankles and abdomen.[2]

It is possible that hypertension is the most significant and influential risk factor that may be modified to prevent the development of heart failure. Persistent hypertension leads to cardiac remodeling within the left ventricle, which ultimately results in hypertensive heart disease. This disease eventually shows as heart failure. Detection at an early stage and treatment that is tailored to the individual's needs are both essential components of an effective cardiovascular disease prevention strategy.[3–5]

Most long-term hypertension eventually leads to heart failure (HF), unless the sequence of events is interrupted by another outcome; as a result, patients with HF frequently have a history of hypertension. During up to 20 years of follow-up in the Framingham Heart Study cohort of 5,143 subjects, hypertension preceded the development of HF in 91% of all newly diagnosed HF patients (mean 14.1 years). Controlling for age and HF risk variables, the probability of developing HF in hypertensive participants was roughly 2-fold in men and 3-fold in women in the Framingham Heart Study data.[6–8]

Multivariable analyses found that hypertension was a significant population-attributable risk factor for HF, accounting for 39% of male cases and 59% of female cases. Myocardial infarction, diabetes, LV hypertrophy, and valvular heart disease all indicated an elevated risk of HF in both sexes among hypertensive participants. Patients who suffer from comorbid hypertension and heart failure have a greater potential for improved clinical outcomes if they meet their blood pressure targets and make use of treatments that are supported by evidence.[9,10]

All antihypertensive medications reduce blood pressure. Nevertheless, a review of the literature demonstrates that not all antihypertensive medications have the same capacity to prevent HF. β-Blockers remain a cornerstone in the treatment of heart failure, and a recent evaluation indicated that patients with HFrEF in sinus rhythm should get beta-blockers to minimize the risk of mortality and hospitalization, regardless of age or gender.[5,11]

Study showed antihypertensive medication classes slow the progression from hypertension to heart failure (HF), although not all of these drugs are equally as effective as one another. It is recommended that patients avoid taking low doses of hydrochlorothiazide once day. However, long-acting thiazide-like diuretics such as chlorthalidone and indapamide appear to have an advantage over other antihypertensive medicines in the prevention of HF.[4,11]

It is well knowledge that patients who receive medication to control their blood pressure have a reduced risk of developing cardiovascular disease. This study wants to assess the effect of blood pressure – lowering drugs in heart failure.

METHODS

Protocol

The author complied with the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 guidelines to ensure that this research was conducted in compliance with the standards cited. This is done to assure the accuracy of the outcomes of this inquiry.

Criteria for Eligibility

This literature review aims to assess the impact of blood pressure-lowering medications on heart failure. by reviewing or analyzing previous studies on the subject. This article's theme is intended to emphasize the significance of the highlighted issues. Researchers who took part in studies satisfied the following criteria: 1) To be chosen for publication, the paper must be written in English and focus on the effect of blood pressure-lowering medications in heart failure. 2) This assessment covers papers published after 2017 but prior to the time period covered by this systematic review. Examples of banned research include editorials, submissions lacking a DOI, already published review articles, and entries that are substantially identical to previously published journal papers.

Search Strategy

We used "antihypertension" and "heart failure" as keywords.The search for studies to be included in the systematic review was carried out from February, 18th 2023 using the PubMed and SagePub databases by inputting the words: *("antihypertension"[All Fields] OR "antihypertensive agents"[Pharmacological Action] OR "antihypertensive agents"[MeSH Terms] OR ("antihypertensive"[All Fields] AND "agents"[All Fields]) OR "antihypertensive agents"[All Fields] OR "antihypertensive"[All Fields] OR "antihypertensives"[All Fields]) AND ("heart failure"[MeSH Terms] OR ("heart"[All Fields] AND "failure"[All Fields]) OR "heart failure"[All Fields])* used in searching the literature.

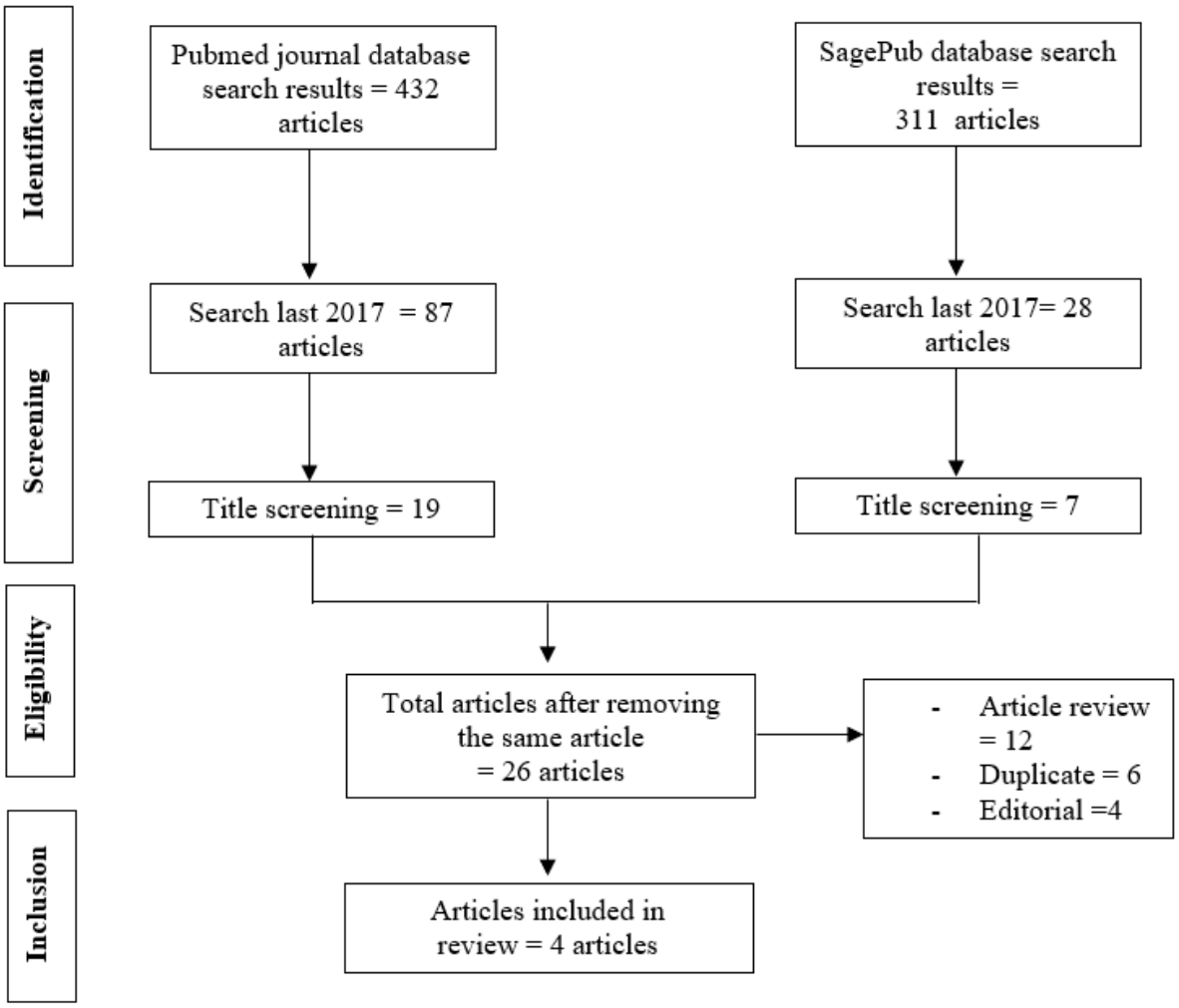

Figure 1. Article search flowchart

Data retrieval

The authors reviewed the studies to see if they met the inclusion criteria after reading the abstract and title of each study. The authors then choose a variety of previous studies to list as sources in this article. This result was reached after reviewing numerous studies that all followed the same pattern. All submissions must be written in English and must not have been previously published.

In the systematic review, only studies that met all inclusion criteria were examined. This restricts the search to to relevant results. We do not review any research findings that do not fit our set criteria. Following this phase comes a thorough analysis of the research. Throughout the course of this study's investigation, the following information was uncovered: names, authors, publication date, location, study activities, and parameters.

Quality Assessment and Data Synthesis

Prior to picking which papers to examine in greater detail, each author conducted their own independent study of the individual research listed in the publication's title and abstract. Thereafter, we'll evaluate all papers that fulfill the review's inclusion criteria and are therefore acceptable for inclusion. Then, we will determine which papers to include in the review depending on our findings. Using this criterion, manuscripts are selected for evaluation. To simplify as much as feasible the approach for choosing papers for review. Which prior studies were undertaken, and what aspects of those research qualify them for inclusion in the review?

RESULT

Zhang, et al (2019)[12] During one year of follow-up, the mean systolic blood pressure in the intensive-treatment group was 127.5 mm Hg compared to 135.3 mm Hg in the standard-treatment group. At a median follow-up time of 3.34 years, primary-outcome events occurred in 147 patients (3.5%) in the intensive-treatment group, as compared with 196 patients (4.6%) in the standard-treatment group (hazard ratio [HR] = 0.74; 95% confidence interval [CI] = 0.60-0.92; P = 0.007).

Table 1. The litelature include in this study

Author	Origin	Method	Sample Size	Follow Up Duration	Agent Therapy	Result
Zhang, 2021[12]	China	Multicenter, randomized, controlled trial	8,511 patients	1 year	Systolic blood-pressure goal below 120 mm Hg (intensive treatment) or below 140 mm Hg (standard treatment)	In older hypertensive patients, intensive therapy with a systolic blood pressure target of 110 to less than 130 mm Hg was associated with a reduced incidence of cardiovascular events than conventional treatment with a systolic blood pressure target of 130 to less than 150 mm Hg.
Hermida, 2020[13]	Spain	Multicentre, controlled, prospective endpoint trial	19,084 hypertensive patients	6.3 years	Daily dose of ≥1 prescribed BP-lowering medications of the major therapeutic classes (ARB, ACEI, CCB, β-blocker, and/or diuretic)	Ingestion of 1 prescribed BP-lowering medications at bedtime, as opposed to upon waking, by hypertensive patients results in improved ABP control (significantly enhanced decrease in asleep BP and increased sleep-time relative BP decline, i.e. BP dipping) and, most importantly, significantly reduced incidence of major cardiovascular disease (CVD) events.
The SPRINT Research Group[14]	China	Prospective cohort study	9,361 participants	3.33 years	Olmesartan (an angiotensin-receptor blocker), amlodipine (a calcium-channel blocker), and hydrochlorothiazide (a diuretic)	In patients at increased cardiovascular risk, targeting a systolic blood pressure of less than 120 mm Hg was associated with lower rates of major adverse cardiovascular events and lower all-cause mortality compared to targeting a systolic blood pressure of less than 140 mm Hg, both during and after the trial. Several adverse events were more prevalent in the intensive therapy group.
Juraschek, 2018[15]	USA	Randomized, controlled trial	52,864 patients	4 years	No describe	The outcomes of they investigation should help alleviate further worries about the potential for OH to be caused by an aggressive BP aim. Replication of they work in other groups, such as older people, people who are not African-American, people who have diabetes, and people who do not have chronic kidney disease (CKD), is necessary.

The results for the majority of individual components of the primary outcome also favored intensive treatment: the HR for stroke was 0.67 (95% CI = 0.47-0.97), acute coronary syndrome 0.67 (95% CI = 0.47-0.94), acute decompensated heart failure 0.27 (95% CI = 0.08-0.98), coronary revascularization 0.69 (95% CI = 0.40-1.18), atrial fibrillation 0.96 (95% CI = 0.55-1). In terms of safety and renal outcomes, there were no significant differences between the two groups, with the exception of the incidence of hypotension, which was greater in the intensive-treatment group.[12]

Hermida et al. (2020)[13] shown that 48 hours of ambulatory blood pressure (ABP) monitoring was performed both at the time of inclusion and at each planned clinic visit (at least once yearly) over the subsequent period of follow-up. 1752 people experienced the primary cardiovascular disease endpoint throughout the course of the study's median patient follow-up duration of 6.3 years (CVD death, myocardial infarction, coronary revascularization, heart failure, or stroke). Adjusted for significant influential characteristics of age, sex, type 2 diabetes, chronic kidney disease, smoking, HDL cholesterol, asleep systolic BP mean, sleep-time relative BP decline, and previous CVD event, patients of the bedtime treatment-time regimen had a significantly lower hazard ratio for the primary CVD outcome [0.55 (95% CI = 0.50-0.61), P <0.001] and each of its single components (P <0.001 in all cases), i.e. CVD death [0.44 (0.34-0.56)], myocardial infarction [0.66 (0.52-0.84)], coronary revascularization [0.60 (0.47-0.75)], heart failure [0.58 (0.49-0.70)], and stroke [0.51 (0.41-0.63)].[13]

Other study conducted with median follow-up is 3.33 years, the rate of the primary outcome and all-cause mortality during the trial were significantly lower in the intensive-treatment group than in the standard-treatment group (rate of the primary outcome, 1.77% per year vs. 2.40% per year; hazard ratio, 0.73; 95% CI = 0.63-0.86; all-cause mortality, 1.06% per year vs. 1.41% per year; HR = 0.75; 95% CI = 0.61-0.92.[14]

Serious adverse events of hypotension, electrolyte abnormalities, acute kidney injury or failure, and syncope were significantly more frequent in the intensive-treatment group. When trial and post-trial follow-up data were combined (3.88 years in total), similar patterns were found for treatment benefit and adverse events; however, rates of heart failure no longer differed between the groups.[14]

Juraschek, et al (2018)[15] showed CHF, stroke, nonfatal cardiovascular disease (CVD), fatal CVD, any CVD (combined of previous events), and all-cause mortality were the outcomes. There were 1094 individuals (mean age 54.5 ± 10.7 years; 38.8% were female; and OH was measured at 52,864 visits). The mean sitting systolic blood pressure, diastolic blood pressure, and heart rate were 150.3 ± 23.9 mm Hg, 95.5 ± 14.2 mm Hg, and 72.0 ± 12.6 bpm, respectively.

A higher BP target had no effect on standing BP distributions and was not linked with OH, while metoprolol was associated with systolic OH compared to ramipril (odds ratio [OR] = 1.68; 95% CI = 1.15-2.46) and amlodipine (OR = 1.94; 95% CI = 1.09-3.44). Despite the fact that consensus OH was linked to stroke (HR = 5.01; 95% CI = 1.80-13.92), nonfatal CVD (HR = 2.28; 95% CI = 1.21-4.30), and any CVD event (HR = 2.12; 95% CI = 1.12-3.98), neither BP aim

nor medication changed this risk. Fears of inducing OH or its CVD effects should not dissuade persons with chronic renal disease caused by hypertension from lowering their blood pressure.[15]

DISCUSSION

Heart failure is a clinical syndrome characterized by a series of symptoms (dyspnoea, orthopnea, swelling of the lower limbs) and signs of heart failure (increased jugular venous pressure, pulmonary congestion) resulting from structural and/or functional abnormalities of the heart resulting in reduced cardiac output and or increased intracardiac pressure.[1] Chronic heart failure is a condition in which the heart has difficulty pumping blood throughout the body. It can develop over a long period of time with symptoms of shortness of breath, problems exercising, fatigue, and swelling of the feet, ankles and abdomen.[2]

Various cardiovascular conditions ranging from arrhythmias to valvular heart disease can lead to heart failure. Advanced age is the most powerful risk factor, although it is not modifiable. Hypertension increases the risk of heart failure 2-3 times. Analysis of the Framingham heart study revealed that the median blood pressure of patients who eventually developed heart failure was 150/90 mm Hg emphasizing that the risk is increased in suboptimally treated hypertension even at modest levels of severity. Multiple studies across multiple agents unequivocally show that treatment of blood pressure leads to a marked reduction in heart failure.[16]

The proportional reduction in major cardiovascular disease events that resulted from lowering blood pressure did not differ significantly from either the presence or absence of previous cardiovascular disease events, coronary heart disease, or cerebrovascular disease at the time of trial inclusion. This was the case even though these conditions were present. Because the relative effects are so constant, they anticipate that the absolute benefits of decreasing blood pressure will be greatest for persons who have the highest absolute risk of cardiovascular events. This is because these individuals have the largest absolute risk.[17]

Systolic Blood Pressure Intervention Trial (SPRINT)[14] found that intensive blood pressure control (systolic blood pressure [SBP] target of 120 mm Hg) was better for the heart than standard blood pressure control (target of 140 mm Hg). A meta-analysis showed that a target systolic blood pressure <130 mm Hg was linked to a lower risk of cardiovascular events and death, especially in people who were already at high risk. Recent large-scale observational studies, on the other hand, have shown that older patients should be careful when their systolic blood pressure is lowered to less than 130 mm Hg.[18,19]

Lower SBP goals should also be thought about in terms of how likely people are to stick with their treatment and the bad things that could happen as a result.[18,19] Uncertainty exists about the efficacy of mineralocorticoid antagonists (MRAs), β-adrenoceptor blockers (β-blockers), and angiotensin-converting enzyme inhibitors / angiotensin receptor blockers (ACEIs/ARBs) in HFpEF.[20] Similar patterns in treatment efficacy were identified for spironolactone on surrogate outcomes, however eplerenone exhibited a tendency of higher efficacy in reducing hospitalizations compared to all other drugs.[21,22]

No medication therapy exhibited statistically significant improvement in clinical and surrogate outcomes in HFpEF patients diagnosed in accordance with the 2016 ESC guideline. Compared to alternative pharmacological therapies, spirolactone and eplerenone demonstrated clinically significant reductions in mortality and hospitalization, respectively. To establish treatment results in HFpEF, more MRA clinical studies are required.[21,22]

Additional studies by medication class revealed that RAAS inhibitors reduced SBP the most, whilst beta-blockers had no discernible effect on SBP. Nevertheless, there were only four beta-blocker studies, and they sensitivity analysis revealed that the total SBP change across beta-blocker trials was biased by the MERIT-HF trial, in which the SBP rose in the metoprolol arm relative to the placebo arm. Taking away this outlier study, they findings are consistent with research in the general population, where beta-blockers appear to be less successful in decreasing blood pressure on average.[20–22]

A 5 mm Hg drop in systolic blood pressure lowered the incidence of major cardiovascular events by roughly 10% in this large-scale study of randomised trials, regardless of previous diagnoses of cardiovascular disease and even at normal or high-normal blood pressure readings. These findings imply that a set degree of pharmacological blood pressure reduction is equally beneficial for both primary and secondary prevention of severe cardiovascular disease, even at blood pressure values that are not currently regarded for treatment. Doctors who communicate the justification for blood pressure lowering medication to their patients should emphasize the relevance of lowering cardiovascular risk rather than just lowering blood pressure.[23]

CONCLUSION

In spite of the fact that the reader's blood pressure may be at or below the goal range established by the guidelines, this article presents convincing evidence that all readers would benefit from additional reductions in their blood pressure. This protection is especially valuable for those with the highest cardiovascular risk (eg, patients with diabetes who are smokers).

REFERENCE

[1]. Loscalzo J. Harrison's Cardiovascular Medicine. Philadelphia: McGraw-Hill Education; 2012.
[2]. National Cancer Institute. NCI Dictionary of Cancer Terms [Internet]. NCI Dictionary. Available from: https://www.cancer.gov/publications/dictionaries/cancer-terms/def/chronic-heart-failure
[3]. Di Palo KE, Barone NJ. Hypertension and Heart Failure: Prevention, Targets, and Treatment. Heart Fail Clin. 2020 Jan;16(1):99–106.
[4]. Pfeffer MA. Heart Failure and Hypertension: Importance of Prevention. Med Clin North Am. 2017 Jan;101(1):19–28.
[5]. Laurent S, Boutouyrie P. Blood pressure lowering trials: wrapping up the topic? Lancet [Internet]. 2016;387(10022):923–4. Available from: https://www.sciencedirect.com/science/article/pii/S0140673615013446
[6]. Bavishi C, Messerli FH, Kadosh B, Ruilope LM, Kario K. Role of neprilysin inhibitor combinations in hypertension: insights from hypertension and heart failure trials. Eur Heart J. 2015;36(30):1967–73.
[7]. Cleland JGF, Swedberg K, Follath F, Komajda M, Cohen-Solal A, Aguilar JC, et al. The EuroHeart Failure survey programme-- a survey on the quality of care among patients with heart failure in Europe. Part 1: patient characteristics and diagnosis. Eur Heart J. 2003 Mar;24(5):442–63.
[8]. Truby LK, Rogers JG. Advanced Heart Failure: Epidemiology, Diagnosis, and Therapeutic Approaches. JACC Heart Fail. 2020 Jul;8(7):523–36.
[9]. Messerli FH, Rimoldi SF, Bangalore S. The Transition From Hypertension to Heart Failure: Contemporary Update. JACC Hear Fail [Internet]. 2017;5(8):543–51. Available from: https://www.sciencedirect.com/science/article/pii/S2213177917303177
[10]. Nagueh SF. Heart failure with preserved ejection fraction: insights into diagnosis and pathophysiology. Cardiovasc Res. 2021 Mar;117(4):999–1014.
[11]. Kotecha D, Manzano L, Krum H, Rosano G, Holmes J, Altman DG, et al. Effect of age and sex on efficacy and tolerability of β blockers in patients with heart failure with reduced ejection fraction: individual patient data meta-analysis. bmj. 2016;353.
[12]. Zhang W, Zhang S, Deng Y, Wu S, Ren J, Sun G, et al. Trial of Intensive Blood-Pressure Control in Older Patients with Hypertension. N Engl J Med. 2021 Sep;385(14):1268–79.
[13]. Hermida RC, Crespo JJ, Domínguez-Sardiña M, Otero A, Moyá A, Ríos MT, et al. Bedtime hypertension treatment improves cardiovascular risk reduction: the Hygia Chronotherapy Trial. Eur Heart J. 2020 Dec;41(48):4565–76.
[14]. Group SR. Final report of a trial of intensive versus standard blood-pressure control. N Engl J Med. 2021;384(20):1921–30.
[15]. Juraschek SP, Appel LJ, Miller ER 3rd, Mukamal KJ, Lipsitz LA. Hypertension Treatment Effects on Orthostatic Hypotension and Its Relationship With Cardiovascular Disease. Hypertens (Dallas, Tex 1979). 2018 Oct;72(4):986–93.
[16]. Gautam V; Ramani MD; Patricia AU; et al. Chronic Heart Failure: Contemporary Diagnosis and Management. Mayo Clin Proc. 2010;85(2):180–95.
[17]. Ettehad D, Emdin CA, Kiran A, Anderson SG, Callender T, Emberson J, et al. Blood pressure lowering for prevention of cardiovascular disease and death: a systematic review and meta-analysis. Lancet. 2016;387(10022):957–67.
[18]. Krousel-Wood M, Joyce C, Holt E, Muntner P, Webber LS, Morisky DE, et al. Predictors of decline in medication adherence: results from the cohort study of medication adherence among older adults. Hypertension. 2011;58(5):804–10.
[19]. Williamson JD, Supiano MA, Applegate WB, Berlowitz DR, Campbell RC, Chertow GM, et al. Intensive vs standard blood pressure control and cardiovascular disease outcomes in adults aged≥ 75 years: a randomized clinical trial. Jama. 2016;315(24):2673–82.
[20]. Bonsu KO, Arunmanakul P, Chaiyakunapruk N. Pharmacological treatments for heart failure with preserved ejection fraction—a systematic review and indirect comparison. Heart Fail Rev. 2018;23:147–56.
[21]. Bruntol L, Dandan R, Knollmann B. Goodman & Gilman's: The Pharmacological Basis of Therapeutics. Philadelphia: Mc Graw Hill Education; 2018.
[22]. Zipes D, Libby P, Bonow R. Braunwald's Heart Disease. 8th ed. Philadelphia: Elsevier; 2019.
[23]. Rahimi K, Bidel Z, Nazarzadeh M, Copland E, Canoy D, Ramakrishnan R, et al. Pharmacological blood pressure lowering for primary and secondary prevention of cardiovascular disease across different levels of blood pressure: an individual participant-level data meta-analysis. Lancet [Internet]. 2021 May 1;397(10285):1625–36. Available from: https://doi.org/10.1016/S0140-6736(21)00590-0