Study on Medication Adherence and Influencing Factors among Hypertensive Patients in Rural Jieshou City: Based on Post-Contract Family Doctor Service Data

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Abstract

Background Hypertension is a major risk factor for cardiovascular disease. Antihypertensive medication should consider not only patients' blood pressure characteristics but also their comorbidity conditions. Currently, research on medication status and influencing factors among hypertensive patients based on family doctor contract services is relatively scarce.

Objective To investigate the current medication status of hypertensive patients who purchased family doctor contract services in Jieshou City, Anhui Province, describe the association between patients'medication behaviors and patient characteristics, explore the influencing factors of medication adjustment, and analyze the rationality of medication use among primary-level hypertensive patients.

Methods Using a cluster sampling method, 48 administrative villages were randomly selected from Jieshou City, Anhui, between July and August 2021. Patient characteristics and medication data were collected through face-to-face surveys using a self-designed questionnaire. With reference to the "National Guidelines for the Prevention and Management of Hypertension at the Primary Level (2020 Edition)" , antihypertensive drugs mentioned by patients in the questionnaire were classified into five categories: Category A as angiotensin-converting enzyme inhibitors (ACEI) and angiotensin receptor blockers (ARB), Category B as beta-blockers, Category C as calcium channel blockers (CCB), Category D as diuretics, and Category E as single-pill combination preparations. Patients' blood pressure data uploaded over the past year were obtained through the backend of iFLYTEK intelligent voice sphygmomanometers to analyze medication behaviors among patients with different characteristics. Multivariate

Logistic regression analysis was used to explore influencing factors of medication adjustment among hypertensive patients. In this study, "combination therapy" referred to taking combination preparations or two or more antihypertensive drugs, and "medication adjustment" referred to patients having taken other antihypertensive drugs in the past.

Results This study included a total of 3005 hypertensive patients, including 1291 males (43.0%) and 1714 females (57.0%), with a mean age of (65.5$±$9.8) years. The antihypertensive medication rate was 79.1%, and the combination therapy rate was 40.2%. Among the 2376 patients taking antihypertensive drugs, the utilization rates of different types of antihypertensive drugs from highest to lowest were (some patients had combination therapy): Category E (39.6%), Category C (35.1%), Category D (20.3%), Category A (20.1%), Category B (3.7%). The most commonly taken antihypertensive drug was compound reserpine (33.7%). For patients with annual average blood pressure $ $160/100 mmHg, 12.2% and 4.9% were still not taking antihypertensive drugs. Patients' combination therapy was mainly based on Category E antihypertensive drugs. For patients with annual average "diastolic blood pressure $ $100 mmHg" and "with comorbidities", the utilization rates of Category A and Category C antihypertensive drugs increased relatively more after adjustment; for patients with annual average "systolic blood pressure $ $160 mmHg" and "without comorbidities", the utilization rate of Category E antihypertensive drugs increased relatively more after adjustment. Multivariate Logistic regression results showed that longer duration of medication (OR=1.042, 95%CI=1.031~1.053, P<0.001), education level above junior high school (OR=1.488, 95%CI=1.195~1.853, P<0.001), comorbid hyperlipidemia (OR=1.267, 95%CI=1.052~1.525, P=0.013), comorbid cardiovascular complications (OR=1.394, 95%CI=1.166~1.667, P<0.001), and comorbid cerebrovascular complications (OR=1.258, 95%CI=1.040~1.522, P=0.018) were promoting factors for medication adjustment, while advanced age (OR=0.980, 95%CI=0.971~0.990, P<0.001) was an inhibiting factor for medication adjustment.

Conclusion The medication rate among hypertensive patients in rural areas of Jieshou City was relatively high, with Category E and Category C antihypertensive drugs being the main medications taken. Primary-level physicians' use of various antihypertensive drugs was basically rational, but medication management for patients with grade 2 hypertension and hypertensive patients with comorbidities, especially the application of combination therapy strategies, needs to be improved.

Full Text

Study on the Medication Status and Influencing Factors of Hypertensive Patients in Rural Jieshou City: Based on Family Doctor Contract Services

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Abstract

Background Hypertension is a major risk factor for cardiovascular disease. Antihypertensive drug therapy should consider not only patient blood pressure characteristics but also comorbid conditions. Currently, research on medication status and influencing factors among hypertensive patients under family doctor contract services remains limited.

Objective To investigate the current medication status of hypertensive patients who purchased family doctor contract services in Jieshou City, Anhui Province; describe associations between patient medication behaviors and characteristics; explore influencing factors of medication adjustment; and analyze the rationality of medication use among primary-level hypertensive patients.

Methods Using cluster sampling, 48 administrative villages were randomly selected from Jieshou City, Anhui Province, between July and August 2021. Patient characteristics and medication data were collected through face-to-face interviews using a self-designed questionnaire. According to the *National Guidelines for the Prevention and Management of Hypertension at the Primary Level (2020 Edition)*, antihypertensive drugs mentioned by patients were classified into five categories: Category A includes angiotensin-converting enzyme inhibitors (ACEIs) and angiotensin receptor blockers (ARBs); Category B includes beta-blockers; Category C includes calcium channel blockers (CCBs); Category D includes diuretics; and Category E includes single-pill combination drugs. Blood pressure data uploaded by patients over the past year were obtained from the backend of an iFLYTEK intelligent voice blood pressure monitor to analyze medication behaviors across different patient characteristics. Multivariate logistic regression was used to explore influencing factors of medication adjustment. In this study, "combination medication" referred to taking combination drugs or two or more antihypertensive drugs, while "medication adjustment" referred

to patients previously taking other antihypertensive drugs.

Results A total of 3,005 hypertensive patients were included, comprising 1,291 males (43.0%) and 1,714 females (57.0%), with a mean age of (65.5$±$9.8) years. The hypertension medication rate was 79.1%, and the combination medication rate was 40.2%. Among 2,376 patients taking antihypertensive drugs, the utilization rates of different drug types (some patients had combination medication) from highest to lowest were: Category E (39.6%), Category C (35.1%), Category D (20.3%), Category A (20.1%), and Category B (3.7%). The most frequently taken medication was compound reserpine (33.7%). Among patients with average annual blood pressure $ $160/100 mmHg, 12.2% and 4.9% still did not take antihypertensive drugs. Patients' combination medication primarily involved Category E drugs. For patients with average annual "diastolic pressure $ $100 mmHg" and "with complications," the utilization rates of adjusted Category A and C drugs increased relatively more. For patients with average annual "systolic pressure $ $160 mmHg" and "without complications," the utilization rate of adjusted Category E drugs increased relatively more. Multivariate logistic regression showed that longer medication duration (OR=1.042, 95%CI=1.031-1.053, P<0.001), education above junior high school (OR=1.488, 95%CI=1.195-1.853, P<0.001), combined hyperlipidemia (OR=1.267, 95%CI=1.052-1.525, P=0.013), combined cardiovascular complications (OR=1.394, 95%CI=1.166-1.667, P<0.001), and combined cerebrovascular complications (OR=1.258, 95%CI=1.040-1.522, P=0.018) were promoting factors for medication adjustment, while advanced age (OR=0.980, 95%CI=0.971-0.990, P<0.001) was an inhibiting factor.

Conclusion Rural hypertensive patients in Jieshou City have a high medication rate, primarily using Category E and C antihypertensive drugs. Primary care physicians' use of various antihypertensive drugs is generally reasonable, but medication management—particularly the application of combination medication strategies for patients with secondary hypertension and those with complications—needs improvement.

Keywords Hypertension; Antihypertensive agents; Comorbidities; Drug combination; Rural areas; Jieshou city; Family doctor contract services

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Cardiovascular and cerebrovascular diseases are the leading causes of death among Chinese residents, with over half of morbidity and mortality related to hypertension. Controlling hypertension is key to preventing cardiovascular and cerebrovascular diseases. The prevalence of hypertension in China continues to grow, with approximately 245 million hypertensive patients currently. Lifestyle intervention and pharmacological treatment are two management approaches for hypertensive patients, with antihypertensive drugs being the most direct and effective method, especially for those with blood pressure $ $140/90 mmHg and/or above target levels. Although the treatment rate among Chinese hypertensive patients has reached 45.8% with continuous dissemination of

chronic disease prevention knowledge, it remains relatively low compared to developed countries. While numerous studies have examined medication adherence among hypertensive patients, few epidemiological investigations have explored the relationship between specific medication use, adjustment patterns, and patient characteristics. This study utilizes data from hypertensive patients under family doctor contract services in rural Jieshou City to describe the relationship between medication behaviors and patient characteristics, and to analyze whether primary care physicians' medication strategies align with the *National Guidelines for the Prevention and Management of Hypertension at the Primary Level (2020 Edition)* (hereinafter referred to as the *2020 Guidelines*), providing evidence for standardizing antihypertensive medication management at the primary level.

1.1 Study Subjects

The survey data were derived from baseline data of the National Natural Science Foundation Youth Project "Research on Personalized Hypertension Management Based on Home Self-Monitoring and Collaboration (Grant No. 72004002)." Using cluster sampling, 48 administrative villages were randomly selected from Jieshou City, Anhui Province, between July and August 2021. All hypertensive patients meeting inclusion criteria in these villages were surveyed. Inclusion criteria were: (1) self-reported clinically diagnosed hypertension or having taken antihypertensive drugs in the past two weeks; (2) having received an iFLYTEK intelligent voice blood pressure monitor at least one year before the survey; (3) age $ $18 years; (4) clear consciousness and ability to communicate; (5) willingness to participate and provide informed consent.

1.2 Data Collection

Face-to-face structured questionnaires were used to collect sociodemographic and medication behavior information, including patient age, sex, education level, comorbidities, current medication information, previous medication information, age at medication initiation, and medication duration. Blood pressure values in this study were the average of past-year data uploaded from patients'home blood pressure monitors. Upon device distribution, staff from iFLYTEK Medical Co., Ltd.' s hypertension management team calibrated the accuracy of each monitor. Uploaded data included systolic pressure, diastolic pressure, pulse rate, and measurement time. Annual blood pressure averages were calculated using a two-step approach: monthly means were first computed, then annual means, requiring patients to upload measurements at least once weekly. Specific quality control and data processing procedures are referenced in our previous study.

1.3 Definitions and Standards

Comorbidities included diabetes, hyperlipidemia, cardiovascular complications (angina, myocardial infarction, coronary heart disease, heart failure, ventricular hypertrophy, heart disease, myocarditis, tachycardia, bradycardia, car-

diac arrest, etc.), cerebrovascular complications [stroke (cerebral ischemia, cerebral hemorrhage), cerebral infarction, acute cerebrovascular disease, cerebral artery insufficiency, etc.], and renal complications (renal insufficiency, renal colic, nephrotic syndrome, pyelonephritis, renal failure, chronic glomerulonephritis, hydronephrosis, renal cysts, etc.), all physician-diagnosed.

Following the *2020 Guidelines*, antihypertensive drugs mentioned in questionnaires were classified into five categories: Category A includes angiotensin-converting enzyme inhibitors (ACEIs) and angiotensin receptor blockers (ARBs); Category B includes beta-blockers; Category C includes calcium channel blockers (CCBs); Category D includes diuretics; and Category E includes single-pill combination drugs. Specific classifications are shown in Table 1 . Additionally, "combination medication" in this study referred to taking combination drugs or two or more antihypertensive drugs, while "medication adjustment" referred to patients previously taking other antihypertensive drugs.

1.4 Statistical Methods

The study database was established using EpiData 3.1 software, and data were analyzed using Excel 2021 and SPSS 26.0. Normally distributed continuous variables were expressed as ($\bar{x}\pm s$), with independent samples t-tests for two-group comparisons and ANOVA for multi-group comparisons. Non-normally distributed continuous variables were expressed as $M(P_{25}, P_{75})$, with rank-sum tests for group comparisons. Categorical variables were described using frequencies and percentages (%), with ^{2} tests for group comparisons and Wilcoxon rank-sum tests for ordinal data. Multivariate logistic regression was used to explore influencing factors of medication adjustment in hypertensive patients. $P<0.05$ indicated statistical significance.

2.1 General Characteristics of Survey Subjects

A total of 3,005 hypertensive patients were included, with 1,291 males (43.0%) and 1,714 females (57.0%). The mean age was $(65.5\$\pm9.8)years, andonly801patients(26.7\pm19)mmHgandmean$ mmHg, overall meeting the guideline target of "systolic pressure below 150 mmHg for adults over 65." However, among patients with mean annual systolic pressure >160 mmHg and diastolic pressure >100 mmHg, 12.2% and 4.9% respectively still did not take antihypertensive drugs, indicating gaps in medication management for stage 2 hypertension patients at the primary level.

Compared with patients not taking antihypertensive drugs, current medication users had significantly higher age, medication duration, mean annual systolic pressure, mean annual diastolic pressure, and proportions of combined diabetes, hyperlipidemia, cardiovascular and cerebrovascular complications ($P<0.05$). Compared with non-combination medication users, combination medication users had significantly higher age and medication duration ($P<0.05$), as shown in Table 2 .

2.2 Patient Characteristics and Medication Types

Among 2,376 patients taking antihypertensive drugs, utilization rates by category (some with combination medication) from highest to lowest were: Category E (39.6%), Category C (35.1%), Category D (20.3%), Category A (20.1%), and Category B (3.7%). The top five most frequently taken medications were: compound reserpine (801 cases, 33.7%), indapamide (472 cases, 19.9%), nifedipine (385 cases, 16.2%), amlodipine (346 cases, 14.6%), and candesartan (177 cases, 7.4%).

Comparisons across five medication categories showed: (1) Age: highest in Category D, lowest in Category B; (2) Medication duration: highest in Category A; (3) Male proportion: highest in Category A, lowest in Category E; (4) Education above junior high school: highest in Category A, lowest in Category E; (5) Proportion without combined hyperlipidemia: highest in Category A, lowest in Category E; (6) Proportion with cardiovascular complications: highest in Category B, lowest in Category E; (7) Proportion with cerebrovascular complications: lowest in Category E. Patient characteristics and medication types are shown in Table 3 .

2.3 Medication Adjustment Status

A heatmap was generated showing differences in category-specific medication rates between survey time and diagnosis time across different characteristics (Table 4). Results showed that the proportion of "non-medicated" patients decreased significantly compared with diagnosis time, with most adjustments involving initiation of medication rather than switching from one drug to two or more drugs. No patients took combinations of A+B+C+D drugs at either timepoint. For patients with mean annual "diastolic pressure $ $100 mmHg" and "with complications" (Characteristics 4 and 8), adjusted utilization rates of Category A and C drugs increased relatively more, with Category A increasing by 14.9% and 10.9%, and Category C increasing by 17.3% and 21.8%, respectively. For patients with mean annual "systolic pressure $ $160 mmHg" and "without complications" (Characteristics 5 and 7), adjusted utilization rates of Category E drugs increased relatively more, rising by 22.7% and 15.8%, respectively. Additional medication adjustment data for various characteristics are shown in Figure 1 [Figure 1: see original paper].

2.4 Multivariate Logistic Regression Analysis of Medication Adjustment Influencing Factors

Using medication adjustment (yes=1, no=0) as the dependent variable and patient characteristics (age, medication duration, mean annual systolic pressure, mean annual diastolic pressure [continuous variables as measured values], sex [female=1, male=0], education above junior high school [yes=1, no=0], comorbidities [diabetes, hyperlipidemia, cardiovascular complications, cerebrovascular complications, renal complications; yes=1, no=0], mean annual

systolic pressure stratification [<120 mmHg=0, 120-139 mmHg=1, 140-160 mmHg=2, >160 mmHg=3], and mean annual diastolic pressure stratification [<90 mmHg=0, 90-100 mmHg=1, >100 mmHg=2]) as independent variables, multivariate logistic regression analysis showed: longer medication duration (OR=1.042, 95%CI=1.031-1.053, P<0.001), education above junior high school (OR=1.488, 95%CI=1.195-1.853, P<0.001), combined hyperlipidemia (OR=1.267, 95%CI=1.052-1.525, P=0.013), combined cardiovascular complications (OR=1.394, 95%CI=1.166-1.667, P<0.001), and combined cerebrovascular complications (OR=1.258, 95%CI=1.040-1.522, P=0.018) were promoting factors for medication adjustment, while advanced age (OR=0.980, 95%CI=0.971-0.990, P<0.001) was an inhibiting factor, as shown in Table 5 .

Primary healthcare institutions are the main battlefield for hypertension management. This study of rural hypertensive patients in Jieshou City, Anhui Province, analyzed the relationship between medication behaviors and patient characteristics. The findings revealed a medication rate of 79.1%, higher than the national average of 34.9% among adult hypertensive patients, with a combination medication rate of 40.2% and average medication duration of $(9.6\$\pm 8.8) years. Mean uploaded systolic and diastolic pressures over the past year were (143\pm 19) mmHg and (82\pm\$$ mmHg, respectively, overall meeting the guideline target of "systolic pressure below 150 mmHg for adults over 65." However, 12.2% of patients with mean systolic pressure >160 mmHg and 4.9% with mean diastolic pressure >100 mmHg remained unmedicated, indicating gaps in medication management for stage 2 hypertension patients at the primary level. Physicians need to develop pharmacological treatment plans for patients with persistently high blood pressure to prevent serious cardiovascular events like stroke. Additionally, nearly half of patients with comorbidities such as diabetes, hyperlipidemia, and cardiovascular complications were not on combination therapy, and 15.4% of patients with systolic pressure >160 mmHg and 5.9% with diastolic pressure >100 mmHg were not on combination medication, which does not align with the *2020 Guidelines* recommendations for "hypertension treatment with comorbidities," suggesting the need for case discussions and educational training to strengthen primary care physicians' capacity for hypertension combination therapy.

The highest utilization was Category E (single-pill combination drugs) at 39.6%, consistent with *2020 Guidelines* recommendations for first-line therapy. The most frequently taken Category E drug was compound reserpine (33.7%), which has a long history of use in Chinese primary care patients due to its low cost and favorable safety, efficacy, and convenience profile. However, recent controversies exist regarding its antihypertensive effects, with some experts noting that traditional compound preparations like compound reserpine are mostly short-acting synthetic formulations with poor patient adherence and limited evidence-based medicine support. Other scholars have confirmed that low-dose reserpine can inhibit sympathetic nervous system hyperactivity, particularly offsetting the reflexive heart rate increase from diuretics and CCBs in combination therapy. Category C (CCB) drugs also had high utilization (35.1%) due to their good

tolerability, lack of absolute contraindications, relatively broad applicability, and particular suitability for elderly patients with isolated systolic hypertension. This study found that Category C drug use was significantly associated with cerebrovascular or renal complications ($P<0.05$), consistent with indications in the *Chinese Hypertension Prevention and Treatment Guidelines 2018 Revision*, suggesting primary care physicians' Category C medication strategies generally align with guideline recommendations. Physicians' prescribing preferences were statistically associated with patient age ($P<0.05$), with Category D users being oldest and Category B users youngest, likely because arterial elasticity decreases with age, making isolated systolic hypertension more prominent—a condition for which Category D drugs are particularly suitable—while Category B drugs are more appropriate for younger patients with sympathetic overactivation and faster heart rates.

Multivariate logistic regression showed that patients with combined hyperlipidemia, cardiovascular, or cerebrovascular complications were more likely to undergo medication adjustment. Due to the "multiplicative effect" of these complications, hypertensive patients require medication regimen adjustments to ensure blood pressure control. Education above junior high school was a promoting factor for medication adjustment, as higher education is associated with better hypertension awareness, leading patients to reconsider antihypertensive drugs when experiencing discomfort. Longer medication duration was associated with higher likelihood of adjustment, possibly because more physician contacts over time facilitate feedback and adjustment of pharmacological treatment. Older patients were less likely than younger patients to adjust medications, likely because established regimens provided satisfactory treatment outcomes.

This study found that medication adjustments primarily involved switching from one antihypertensive drug to another rather than adding drugs, with combination medication mainly consisting of single-pill combinations (Category E) rather than free combinations of two or more drug classes. Numerous studies have confirmed that combination therapy overcomes bottlenecks in hypertension pharmacotherapy by exerting synergistic antihypertensive effects and reducing adverse reactions, particularly for patients with blood pressure $ \$160/100 mmHg. Primary care physicians should integrate home blood pressure monitor data and consider more rational combination approaches for patients with mean annual blood pressure $ \$160/100 mmHg. Additionally, data showed increased utilization of Category A or A+C drugs for patients with comorbidities —a reasonable strategy supported by clinical trials demonstrating that Category A and C drugs significantly reduce cerebrovascular complications compared to traditional Category B and D drugs, with Category A drugs also improving outcomes in diabetes and renal complications. However, for patients with poorly controlled diastolic pressure without comorbidities, primary care physicians' strategies may be unreasonable; domestic expert consensus and European hypertension guidelines indicate these patients should prefer Category A drugs, possibly combined with Category C or D, yet study data showed physicians substantially reduced Category A use in this population—specific reasons warrant

further investigation.

This study has limitations. First, as a cross-sectional survey using retrospective self-reported medication data, recall bias is unavoidable. Second, limited research funding restricted the survey to rural Jieshou City in Anhui Province, which may affect the generalizability of findings.

In summary, this field survey found that rural hypertensive patients in Jieshou City have a high medication rate, primarily using Category E and C drugs, with compound reserpine being the most frequently taken medication. Primary care physicians' use of various antihypertensive drugs is generally reasonable and consistent with *2020 Guidelines* recommendations. However, medication management for stage 2 hypertension patients and those with comorbidities is inadequate, particularly regarding combination therapy strategies. Family doctor contract services for hypertensive patients must continuously improve medication management, and primary care physicians must properly fulfill their role as "guardians" of antihypertensive treatment in rural areas. Treatment plans should fully consider patient comorbidities and blood pressure status, with individualized therapy—not only ensuring rational medication use but also improving hypertension control rates in rural areas.

Author Contributions: MA Xiaoyan contributed to conceptualization, design, statistical analysis, and initial manuscript drafting; CUI Enci and XUE Qun contributed to data collection and organization; LIU Rong, ZHANG Xuewu, and WANG Qian contributed to study implementation; WANG Debin contributed to manuscript revision and supervision; SHEN Xingrong contributed to quality control, review, final revision, and overall responsibility.

Conflict of Interest: None declared.

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References

[1] WANG Z W, CHEN Z, ZHANG L F, et al. Status of hypertension in China: results from the China hypertension survey, 2012-2015[J]. Circulation, 2018, 137(22): 2344-2356. DOI: 10.1161/CIRCULATIONAHA.117.032380.

[2] Chinese Hypertension Prevention and Treatment Guidelines Revision Committee, Hypertension League (China), Chinese Medical Association Cardiovascular Disease Branch, et al. Chinese hypertension prevention and treatment guidelines (2018 revision)[J]. Chinese Journal of Cardiology, 2019, 24(1): 24-56. DOI: 10.3969/j.issn.1007-5410.2019.01.002.

[3] MA L Y, WANG Z W, FAN J, et al. Hypertension prevalence, awareness, treatment, and control in China: report from the China cardiovascular health

and disease report 2021[J]. Chinese General Practice, 2022, 25(30): 3715-3720. DOI: 10.12114/j.issn.1007-9572.2022.0502.

[4] National Center for Cardiovascular Diseases, National Primary Hypertension Management Office of National Basic Public Health Service Program, National Primary Hypertension Management Expert Committee. National guidelines for the prevention and management of hypertension at the primary level (2020 edition)[J]. Chinese Circulation Journal, 2021, 36(3): 209-220. DOI: 10.3969/j.issn.1000-3614.2021.03.001.

[5] XUE Q, ZHANG X W, WANG Q, et al. Effect of personalized dietary intervention on hypertensive patients in Jieshou City: a randomized controlled trial[J]. Chinese Journal of Hypertension, 2023, 31(2): 132-140. DOI: 10.16439/j.issn.1673-7245.2023.02.008.

[6] LIU G J, CHENG K, ZHU W Q, et al. Progress in drug therapy for hypertension[J]. Chinese Journal of Clinical Pharmacology and Therapeutics, 2022, 27(4): 446-449. DOI: 10.12092/j.issn.1009-2501.2022.04.015.

[7] Chinese Medical Association, Chinese Medical Journal, Chinese Medical Association General Practice Branch, et al. Guidelines for primary care diagnosis and treatment of hypertension (2019)[J]. Chinese Journal of General Practitioners, 2019, 18(4): 301-313. DOI: 10.3760/cma.j.issn.1671-7368.2019.04.002.

[8] LI J Y, LUO F Q. Effects of continued reserpine use on perioperative circulation and related complications in hypertensive patients[J]. Modern Practical Medicine, 2022, 34(2): 141-143. DOI: 10.3969/j.issn.1671-0800.2022.02.001.

[9] ZHANG Y, SHANG L X, LIU Z D. Current status and influencing factors of traditional compound antihypertensive drug use among hypertensive patients in Jinan City[J]. Chinese Journal of Chronic Disease Prevention and Control, 2018, 26(2): 107-109. DOI: 10.16386/j.cjpccd.issn.1004-6194.2018.02.010.

[10] SHI T L, TANG M, SU H. Does reserpine still have a place in hypertension treatment?[J]. Chinese Journal of Hypertension, 2021, 29(11): 1029-1031, 1028. DOI: 10.16439/j.issn.1673-7245.2021.11.001.

[11] ZENG W Y, ZHOU S Y, GU S H. Current status of community hypertension and effectiveness of general practice intervention in Haikou City[J]. Chinese General Practice, 2020, 23(18): 2335-2341. DOI: 10.12114/j.issn.1007-9572.2020.00.328.

[12] Chinese Hypertension Prevention and Treatment Guidelines Revision Committee. Chinese hypertension prevention and treatment guidelines 2018 revision[J]. Prevention and Treatment of Cardiovascular and Cerebrovascular Diseases, 2019, 19(1): 1-44. DOI: 10.3969/j.issn.1009-816X.2019.01.001.

[13] BUFORD T W. Hypertension and aging[J]. Ageing Research Reviews, 2016, 26: 96-111. DOI: 10.1016/j.arr.2016.01.007.

[14] AL BADARIN F J, ABUANNADI M A, LAVIE C J, et al. Evidence-based diuretic therapy for improving cardiovascular prognosis in systemic hypertension[J]. American Journal of Cardiology, 2011, 107(8): 1178-1184. DOI: 10.1016/j.amjcard.2010.12.016.

[15] VERDECCHIA P, GENTILE G, ANGELI F, et al. Should we prefer different drugs to treat hypertension in older and younger adults? Practical implications of clinical trials: European perspective[J]. Polish Archives of Internal Medicine, 2008, 118(9): 513-520.

[16] LIU H P, WU Y X, LIU Y Q, et al. Real-world study of beta-blocker effects on clinical outcomes in primary hypertension patients with coronary heart disease[J]. Chinese Journal of Geriatric Heart and Brain Vessels, 2023, 25(1): 13-16. DOI: 10.3969/j.issn.1009-0126.2023.01.004.

[17] OMBONI S. Has the time come for self-management of blood pressure and antihypertensive medications by patients?[J]. Journal of Hypertension, 2018, 36(8): 1654-1655. DOI: 10.1097/HJH.0000000000001797.

[18] YANG Z, FANG X, LIN X Q, et al. Analysis of hypertension prevalence, awareness, treatment, and control among residents in 10 areas of Fujian Province[J]. Chinese Journal of Chronic Disease Prevention and Control, 2022, 30(2): 97-101, 106. DOI: 10.16386/j.cjpccd.issn.1004-6194.2022.02.005.

[19] PARK J B, KARIO K, WANG J G. Systolic hypertension: an increasing clinical challenge in Asia[J]. Hypertension Research, 2015, 38(4): 227-236. DOI: 10.1038/hr.2014.169.

[20] Beijing Hypertension Prevention and Treatment Association, Beijing Diabetes Prevention and Treatment Association, Beijing Chronic Disease Prevention and Health Education Research Association, et al. Practice guidelines for comprehensive management of cardiovascular disease at the primary level 2020[J]. Chinese Journal of the Frontiers of Medical Science, 2020, 12(8): Pre-insert 1, 1-73. DOI: 10.12037/YXQY.2020.08-01.

[21] BANGALORE S, FAKHERI R, TOKLU B, et al. Diabetes mellitus as a compelling indication for use of renin angiotensin system blockers: systematic review and meta-analysis of randomized trials[J]. BMJ, 2016, 352: i438. DOI: 10.1136/bmj.i438.

[22] CHEN H. Does monotherapy with long-acting dihydropyridine calcium channel blockers increase sympathetic nerve excitability and blood pressure variability? Which antihypertensive drugs are more rational to combine with calcium channel blockers?[J]. Chinese Journal of Hypertension, 2024, 32(2): 115-118. DOI: 10.16439/j.issn.1673-7245.2024.02.004.

[23] WILLIAMS B, MANCIA G, SPIERING W, et al. 2018 ESC/ESH Guidelines for the management of arterial hypertension[J]. European Heart Journal, 2018, 39(33): 3021-3104. DOI: 10.1093/eurheartj/ehy339.

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