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Original Article

Risk factors for comorbid hypertension in elderly patients with type 2 diabetes

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Abstract: Objective: To identify risk factors for hypertension (HT) in elderly patients with diabetes, using retrospective data analysis. Methods: A total of 139 elderly patients with diabetes were recruited, including 61 in the HT group and 78 to the non-HT group. Demographic characteristics, lifestyle factors, and serum biochemical marker were compared between the two groups. Binary logistic regression was performed to identify independent risk factors for HT, and their predictive utility was later examined using receiver operating characteristic (ROC) analysis. Cardio-cerebrovascular events were recorded during a two-year follow-up period, along with scores from the 36-item Short-Form Health Survey Questionnaire (SF-36). Results: Compared with the non-HT group, patients with HT were significantly older and had longer disease duration, higher low-density lipoprotein cholesterol (LDL-C), and a higher incidence of cardio-cerebrovascular events. Besides, patients with HT were more likely to smoke, consume excessive alcohol, exercise less, and had lower high-density lipoprotein cholesterol (HDL-C) levels and SF-36 scores. According to binary logistic regression-based analysis, disease duration, alcohol consumption, exercise frequency, HDL-C, LDL-C, UA, and microalbuminuria were significant contributors to HT in elderly people suffering from diabetes. Individually, these factors yielded area under the curve (AUC) values ranging from 0.580 to 0.740, while their combined model achieved an AUC of 0.910. Conclusions: Prolonged disease duration, heavy alcohol consumption, physical inactivity, decreased HDL-C, and elevated LDL-C, UA, and microalbuminuria are significant risk factors for HT in elderly patients with diabetes. A combined assessment of these variables provides strong predictive value for identifying HT risk.

Keywords: Risk factors, elderly diabetic patients, hypertension, predictive potential

Introduction

Hypertension (HT) and diabetes mellitus (DM) are two prevalent chronic conditions among middle-aged and elderly individuals, commonly coexisting and exerting bidirectional influence that accelerates mutual disease progression [1]. DM contributes to the development of HT primarily through renal dysfunction, while HT worsens insulin resistance and vascular inflammation, thereby impairing glycemic control [2]. Their coexistence disproportionately affects aging populations, worsening clinical outcomes and impairing quality of life [3]. Epidemiological data indicate DM-HT comorbidity in 11.27% of men and 10.05% of women aged ≥50 in Korea, with body mass (fat and lean mass) identified as key determinants [4]. Similarly, community-based research in Alabama reported a DM-HT comorbidity prevalence of 17.00% among older adults, underscoring the urgency for targeted healthcare interventions [5]. Meanwhile, a Chinese survey from southwest China reported a 43.5% prevalence of HT among diabetic individuals, irrespective of residency [6]. Mechanistically, obesity-induced hyperinsulinemia, heightened sympathetic nervous activity, and impaired adipokine regulation represent shared pathological pathways between DM and HT, often culminating in accelerated vascular complications [7]. A nationwide cohort study further demonstrated that the coexistence of type 2 DM and HT markedly elevates cardiovascular risks, regardless of which develops first [8]. Recent data also ties this comorbidity to worsened cognitive decline in elderly populations [9].

Despite improvements in healthcare, no definitive solution exists for elderly patients with con-

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current DM and HT, necessitating long-term management [10]. Extended periods of treatment, however, can lead to psychological challenges, such as reduced treatment adherence and loss of confidence, which in turn can negatively impact therapeutic effects, delay functional rehabilitation, and further impair patients' life quality [11]. Therefore, identifying HT-associated risk factors in elderly DM patients is essential for developing effective prevention and intervention strategies.

Materials and methods

Study population

This retrospective study was approved by the Ethics Committee of Beijing Jishuitan Hospital Guizhou Hospital. A total of 139 elderly DM patients admitted to Beijing Jishuitan Hospital Guizhou Hospital between April 2021 and July 2023, were included. Based on the presence or absence of coexisting HT, patients were categorized into an HT group (n=61) and a non-HT group (n=78).

Inclusion criteria: Participants met the diagnostic criteria for DM established by the World Health Organization (WHO) [12], with their fasting plasma glucose (FPG) levels consistently ≥7 mmol/L. Patients in the HT group additionally met the diagnostic thresholds for HT: resting systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg [13]. Additional inclusion requirements were: age ≥60 years, intact communication and cognitive abilities, and complete medical records. Due to the retrospective nature, the consent from patients or their families was waived.

Exclusion criteria: Severe psychiatric or cognitive disorders, hematologic or infectious diseases, life-threatening conditions, physical disabilities, malignancies, or significant cardiopulmonary or other organ dysfunction. Patients with incomplete medical data were also excluded from participation.

Analytical metrics

1. Demographic profiles: Patient characteristics, including age, body mass index (BMI), disease duration, educational attainment, and residential area were retrieved from the hospital's electronic medical records.

2. Lifestyle factors: Data on smoking history, alcohol abuse history, and exercise frequency (categorized as no/occasional or regular/daily) were collected from the medical record system.

3. Serum biochemical indices: Fasting venous blood samples were used to assess the following biochemical parameters: FPG, triglycerides (TG), total cholesterol (TC), high/low-density lipoprotein cholesterol (HDL-C/LDL-C), urine acid (UA), estimated glomerular filtration rate (eGFR), microalbuminuria (mAlb), hypersensitive C-reactive protein (hs-CRP), and interleukin-6 (IL-6). All values were retrieved from the hospital's laboratory information system.

4. Incidence of cardio-cerebrovascular evens: Over a two-year follow-up period, data on the occurrence of stroke, myocardial infarction, cardiovascular-related mortality, and total adverse events were collected through telephone follow-up and review of medical records.

5. Quality of life (QoL): Health-related QoL was assessed using the 36-item Short Form Health Survey (SF-36), which evaluates multiple dimensions, including social functioning, role limitations, physical health, and mental well-being. Each dimension is scored on a 0-100 scale, with higher values indicating better health status.

Statistical analysis

Quantitative data were tested for homogeneity of variance using the Bartlett's test and for normality using the Kolmogorov-Smirnov test, confirming homogeneous variance and an approximately normal distribution. Quantitative data were presented as mean ± standard error of the mean (SEM), and intergroup comparisons were conducted using independent samples t-tests. Categorical variables were described as percentages (%) and compared between groups using the chi-square (χ^2) test.

Binary logistic regression analysis was performed to identify independent risk factors associated with HT among elderly diabetic patients. The predictive performance of each risk factor was evaluated using receiver operating characteristic (ROC) curve analysis, with the area under the curve (AUC) used to assess diagnostic performance. All statistical analyses were carried out using SPSS 22.0 software,

Table 1. Comparison of demographic profiles between the HT and non-HT groups

Indicators	HT group (n=61)	Non-HT group (n=78)	χ^2/t	*P*
Age (years)	65.61±7.38	62.08±10.05	2.300	0.023
BMI (kg/m^2)	24.06±2.33	23.66±2.85	0.888	0.376
Disease duration (years)	8.84±4.80	5.22±2.31	5.854	<0.001
Educational attainment			0.209	0.648
< Senior high school	40 (65.57)	54 (69.23)		
≥ Senior high school	21 (34.43)	24 (30.77)		
Residential area			1.044	0.307
Urban	38 (62.30)	55 (70.51)		
Rural	23 (37.70)	23 (29.49)		

Notes: BMI: body mass index; HT: hypertension.

Table 2. Comparison of lifestyle factors between the HT and non-HT groups

Indicators	HT group (n=61)	Non-HT group (n=78)	χ^2	*P*
Smoking history			4.047	0.044
None	45 (73.77)	68 (87.18)		
Yes	16 (26.23)	10 (12.82)		
Alcohol abuse history			4.913	0.027
None	41 (67.21)	65 (83.33)		
Yes	20 (32.79)	13 (16.67)		
Exercise frequency			4.368	0.037
No or occasional	42 (68.85)	40 (51.28)		
Regular or daily	19 (31.15)	38 (48.72)		

Notes: HT: hypertension.

with a two-tailed *P*-value <0.05 considered statistically significant. Sample size adequacy was determined using G*Power version 3.1 [14]. For a two-tailed independent samples t-test with Cohen's d=0.5, α=0.05, and Power =0.8, along with an allocation ratio of 61:78≈0.78, the achieved power was about 0.82. With a total sample size of 139, the study was sufficiently powered to detect medium or larger effect sizes between groups, satisfying the research needs.

Results

Demographic profiles of elderly diabetic patients with HT

To assess demographic factors potentially associated with HT comorbidity in elderly patients with DM, we analyzed baseline characteristics. Among the 139 participants, 61 (43.88%) were diagnosed with concurrent HT. Comparative analysis revealed no significant differences in BMI, educational attainment, or place of residence between the patients with and without HT (*P*>0.05). However, patients with HT were notably older and had a longer disease duration compared to their non-HT counterparts (*P*<0.05). The detailed findings are summarized in **Table 1**.

Lifestyle factors in elderly diabetic patients with HT

We further examined lifestyle-related variables to identify behavioral risk factors for HT in elderly DM patients. The HT group exhibited significantly higher rates of smoking history, alcohol abuse history, and low physical activity levels compared to their non-HT counterparts (*P*<0.05). Detailed findings are summarized in **Table 2**.

Serum biochemical markers in elderly diabetic patients with HT

To explore potential metabolic and inflammatory correlates of HT in elderly DM patients, a comparative evaluation of four serum biomarker categories (glucose-lipid metabolism, renal

Table 3. Comparison of serum biomarkers between the HT and non-HT groups

Indicators	HT group (n=61)	Non-HT group (n=78)	t	*P*
FPG (mmol/L)	13.99±6.23	12.24±4.24	1.967	0.051
TG (mmol/L)	4.55±1.88	4.07±1.76	1.549	0.124
TC (mmol/L)	6.34±2.43	5.97±2.14	0.953	0.342
HDL-C (mmol/L)	1.17±0.13	1.26±0.19	3.164	0.002
LDL-C (mmol/L)	3.86±1.23	3.37±1.31	2.247	0.026
UA (μmol/L)	430.75±129.67	367.13±100.25	3.263	0.001
eGFR (mL/min/1.73 m^2)	57.62±17.29	67.04±20.25	2.899	0.004
mAlb (mg/g Cr)	57.36±30.76	28.90±14.71	7.192	<0.001
hs-CRP (mg/L)	4.00±1.89	2.82±1.21	4.468	<0.001
IL-6 (pg/mL)	7.23±3.40	5.15±2.14	4.404	<0.001

Notes: HT, hypertension; FPG, fasting plasma glucose; TG, triglycerides; TC, total cholesterol; HDL-C/LDL-C, high-/low-density lipoprotein cholesterol; UA, urine acid; eGFR, estimated glomerular filtration rate; mAlb, microalbuminuria; hs-CRP, hypersensitive C-reactive protein; IL-6, interleukin-6.

Table 4. Independent risk factors for comorbid hypertension in elderly diabetic patients

Indicators	β	SE	Wald	*P*	OR	95% CI
Age (years)	0.031	0.031	0.990	0.320	1.031	0.971-1.096
Disease duration (years)	0.266	0.082	10.573	0.001	1.305	1.112-1.533
Smoking history	1.123	0.738	2.315	0.128	3.074	0.723-13.060
Alcohol abuse history	1.923	0.712	7.299	0.007	6.839	1.695-27.589
Exercise frequency	1.722	0.632	7.433	0.006	5.596	1.623-19.297
HDL-C (mmol/L)	-3.863	1.786	4.679	0.031	0.021	0.001-0.696
LDL-C (mmol/L)	0.650	0.230	7.969	0.005	1.916	1.220-3.009
UA (μmol/L)	0.005	0.002	5.070	0.024	1.005	1.001-1.010
eGFR (mL/min/1.73 m^2)	-0.004	0.014	0.083	0.773	0.996	0.968-1.024
mAlb (mg/g Cr)	0.047	0.014	11.555	0.001	1.048	1.020-1.076
hs-CRP (mg/L)	0.296	0.182	2.642	0.104	1.345	0.941-1.922
IL-6 (pg/mL)	0.143	0.096	2.223	0.136	1.153	0.956-1.391

Notes: OR, odds ratio; CI, confidence interval; HDL-C/LDL-C, high-/low-density lipoprotein cholesterol; UA, urine acid; eGFR, estimated glomerular filtration rate; mAlb, microalbuminuria; hs-CRP, hypersensitive C-reactive protein; IL-6, interleukin-6.

function, inflammatory markers, and UA metabolism) was conducted. No significant differences were observed in FPG, TG, or TC between the two groups ($P>0.05$). However, the HT group displayed notably lower HDL-C and eGFR levels, but higher LDL-C, UA, mAlb, hs-CRP, and IL-6 levels, compared to the non-HT group ($P<0.05$, **Table 3**).

Analysis of risk factors for HT in elderly diabetic patients

Variables demonstrating significant differences in univariate analyses were included as independent variables, with HT status serving as the dependent variable. Binary logistic regression identified disease duration, alcohol abuse history, exercise frequency, HDL-C, LDL-C, UA, and mAlb as independent predictors of HT in elderly diabetic patients ($P<0.05$, **Table 4**).

Predictive performance of risk factors for HT: ROC analysis

ROC curve analysis was conducted to evaluate the predictive performance of each risk factor for HT in elderly patients with diabetes.

Disease duration yielded an AUC of 0.736, with an optimal cutoff value of 8.50 years, demonstrating a specificity of 54.10%, sensitivity of 91.03%, and accuracy of 74.82%. Alcohol abuse history showed an AUC of 0.581, with an optimal threshold of 0.50, yielding a specificity of 32.79%, sensitivity of 83.33%, and accuracy of 61.15%. Exercise frequency dem-

Table 5. Predictive performance of each risk factor for comorbid hypertension in elderly diabetic patients

Indicators	AUC	95% CI	*P*	Cutoff	Specificity	Sensitivity	Accuracy
Disease duration (years)	0.736	0.645-0.826	<0.001	8.50	54.10%	91.03%	74.82%
Alcohol abuse history	0.581	0.484-0.677	<0.001	0.50	32.79%	83.33%	61.15%
Exercise frequency	0.588	0.493-0.683	<0.001	0.50	68.85%	48.72%	57.55%
HDL-C (mmol/L)	0.656	0.564-0.747	<0.001	1.15	57.38%	69.23%	64.03%
LDL-C (mmol/L)	0.618	0.524-0.711	<0.001	4.08	47.54%	73.08%	61.87%
UA (μmol/L)	0.670	0.576-0.763	<0.001	413.50	65.57%	70.51%	68.35%
mAlb (mg/g Cr)	0.735	0.649-0.821	<0.001	42.50	62.30%	80.77%	72.66%
Combined prediction	0.910	0.862-0.959	<0.001	0.42	83.60%	84.62%	84.17%

Notes: AUC, area under the curve; CI, confidence interval; HDL-C/LDL-C, high-/low-density lipoprotein cholesterol; UA, urine acid; mAlb, microalbuminuria.

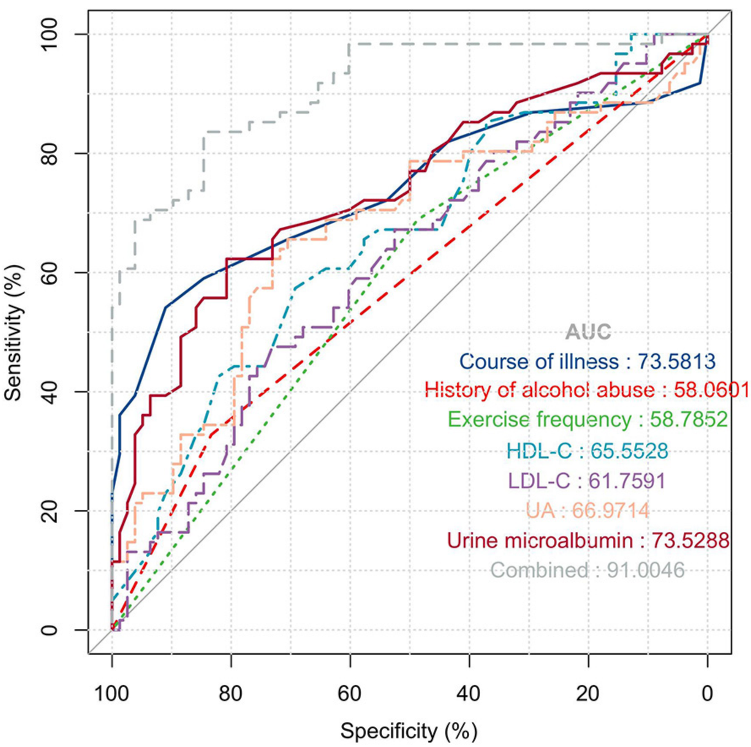

Figure 1. ROC curve for each risk factor in predicting comorbid hypertension in elderly diabetic patients. Notes: ROC, receiver operating characteristic; AUC, area under the curve; HDL-C/LDL-C, high-/low-density lipoprotein cholesterol; UA, urine acid; mAlb, microalbuminuria.

onstrated modest predictive performance, yielding an AUC of 0.588, with an optimal cutoff value of 0.50, achieving a specificity of 68.85%, a sensitivity of 48.72%, and an overall accuracy of 57.55%.

HDL-C showed an AUC of 0.656 at an optimal threshold of 1.15 mmol/L, resulting in a specificity of 57.38%, sensitivity of 69.23%, and accuracy of 64.03%. LDL-C showed an AUC of 0.618 at a cutoff value of 4.08 mmol/L, with specificity, sensitivity, and accuracy of 47.54%, 73.08%, and 61.87%, respectively. UA exhibited favorable predictive value for HT comorbidity, demonstrating an AUC of 0.670; the optimal diagnostic threshold was established at 413.50 μmol/L, with corresponding specificity of 65.57%, sensitivity of 70.51%, and diagnostic accuracy of 68.35%. mAlb displayed superior predictive performance, as evidenced by a higher AUC of 0.735; at the cutoff level of 42.50 mg/L, mAlb showed balanced diagnostic characteristics with 62.30% specificity, 80.77% sensitivity, and 72.66% overall accuracy.

When these seven variables were combined into a predictive model, the AUC significantly improved to 0.910, yielding 83.60% specificity, 84.62% sensitivity, and 84.17% overall accuracy. Comprehensive results are summarized in **Table 5** and **Figure 1**.

Incidence of cardio-cerebrovascular events in elderly diabetic patients with HT

A two-year follow-up was conducted to assess the incidence of cardio-cerebrovascular diseas-

Table 6. Comparison of incidence of cardio-cerebrovascular events between the HT and non-HT groups

Indicators	HT group (n=61)	Non-HT group (n=78)	χ^2	*P*
Stroke	7 (11.48)	2 (2.56)	4.489	0.034
Myocardial infarction	2 (3.28)	1 (1.28)	0.646	0.422
Cardiovascular death	4 (6.56)	3 (3.85)	0.526	0.468
Total events	13 (21.31)	6 (7.69)	5.380	0.020

Table 7. Comparison of quality of life between the HT and non-HT groups

Indicators	HT group (n=61)	Non-HT group (n=78)	t	*P*
Social functioning	66.98±7.27	75.45±7.17	6.869	<0.001
Role limitations	64.05±5.39	72.69±7.74	7.421	<0.001
Physical health	68.07±6.54	74.95±7.44	5.702	<0.001
Mental well-being	65.90±6.24	74.24±9.30	6.022	<0.001

es in both groups. Over a 2-year follow-up period, the HT group experienced a significantly higher incidence of stroke and overall cardio-cerebrovascular events compared to the non-HT group ($P<0.05$, **Table 6**).

Quality of life in elderly diabetic patients with HT

The SF-36 scale was used to evaluate health-related quality of life across various domains, including social functioning, role limitations, physical functioning, and mental well-being. Patients in the HT group scored significantly lower across all SF-36 domains compared to those without HT ($P<0.05$, **Table 7**), indicating a substantial reduction in overall quality of life.

Discussion

Diabetes mellitus (DM) complicated by HT constitutes a chronic, lifelong condition currently with no definitive cure. Clinical treatment primarily focuses on optimizing blood glycemic levels and blood pressure control to improve patient outcomes [15]. This study takes a preventive approach by identifying key risk factors for HT in elderly patients with DM, aiming to inform targeted clinical interventions that may mitigate HT development in this high-risk group.

In this cohort, the prevalence of comorbid HT approximated 43.88%. Disease duration, alcohol abuse history, low exercise frequency, decreased HDL-C, and elevated LDL-C, UA, and mAlb were identified as significant independent predictors of HT. These findings indicate that elderly DM patients with HT tend to have a protracted disease course, unhealthy lifestyle behaviors, and metabolic dysregulation. Prolonged disease duration may increase treatment resistance and disease complexity, thereby heightening HT risk in elderly diabetic patients [16]. Alcohol abuse has been shown to impair cardiovascular homeostasis, disrupt hemodynamic regulation, further contributing to blood pressure elevation [17]. Physical inactivity, promotes insulin resistance, metabolic imbalance, and vascular endothelial dysfunction, each of which predisposes individuals to HT development [18]. Dyslipidemia, particularly characterized by decreased HDL-C and elevated LDL-C, reflects underlying metabolic disturbances and is frequently associated with poor dietary and lifestyle habits [19, 20]. Elevated UA levels, commonly correlated with metabolic disturbances and impaired renal excretion, may induce oxidative stress, vascular inflammation, and vasoconstriction, thereby increasing HT susceptibility [21]. Additionally, increased mAlb excretion may indicate early glomerular endothelial dysfunction and dysregulated sodium metabolism, both of which are associated with systemic low-grade inflammatory responses and intravascular volume expansion, important contributors to blood pressure elevation [22]. Collectively, these factors may heighten the risk of HT comorbidity in patients with DM.

Numerous prior studies have investigated the potential risk factors and clinical treatment strategies for the co-existence of DM and HT. For instance, Almalki ZS et al. [23] identified age, gender, obesity, multiple comorbidities, and polypharmacy as significant predictors of poorly controlled HT among diabetic patients. Similarly, psychosocial stress, unhealthy lifestyle, and improper dietary patterns have been widely recognized as key contributors to suboptimal DM and HT control [24]. In the work of Zhang S et al. [25], interventions like lifestyle modifications, blood pressure management, regular monitoring, and complication screening not only improved blood pressure control but also enhanced life quality in DM+HT patients, while also reducing HT-related complications.

Our ROC analysis revealed notable differences in the predictive power of individual risk factors. Among them, disease duration emerged as the strongest predictor of HT in elderly diabetic patients, with an AUC of 0.736, along with a sensitivity of 91.03% and an overall accuracy of 74.82%. In contrast, alcohol abuse history demonstrated the lowest AUC value of 0.581. However, the combination of disease duration, alcohol consumption, exercise frequency, HDL-C, LDL-C, UA, and mAlb significantly improved the predictive performance, achieving an AUC of 0.910, with enhanced specificity (83.60%), sensitivity (84.62%), and accuracy (84.17%). These results are consistent with prior research. For instance, Cai X et al. [26] developed a risk prediction model for the 5-year incidence of type 2 DM in hypertensive patients, identifying age, BMI, FPG, and TC as key predictors, with an AUC of 0.878. Similarly, Adavi M et al. [27] identified age, family history, and physical inactivity as significant predictors of HT-DM comorbidity, with an AUC of 0.780. Additionally, recent advancements in machine learning have enabled the development of high-precision models for predicting future HT, with AUCs ranging from 0.850 to 0.890, offering a promising tool for early identification of high-risk individuals and facilitating timely, non-pharmacological interventions [28].

Moreover, elderly patients with coexisting DM+HT experienced markedly higher rates of stroke and overall cardio-cerebrovascular events during the 2-year follow-up period. These findings underscore the detrimental impact of DM-HT comorbidity on long-term outcomes and highlight the urgent need for effective preventive and therapeutic strategies. Supporting our data, Alloubani A et al. [29] identified both HT and DM as independent predictors of stroke, while Wang Z et al. [30] demonstrated a strong link between DM, HT, and increased cardio-cerebrovascular risks. In addition, quality of life, as assessed by the SF-36 scale, including social functioning, role limitations, physical functioning, and mental well-being, was significantly lower in elderly DM patients with HT compared to their non-HT peers.

Based on our ROC analysis, the following thresholds were identified as indicative of high HT risk in elderly diabetic patients: disease duration >8.50 years, history of alcohol abuse, physical inactivity, HDL-C<1.15 mmol/L, LDL-C>4.08 mmol/L, UA>413.50 μmol/L, and mAlb>42.50 mg/g Cr. Patients meeting one or more of these criteria should be classified as high-risk and considered for personalized management strategies. For this high-risk population, personalized treatment strategies should be tailored according to individual pathophysiological characteristics. Pharmacological management may include nifedipine and enalapril for blood pressure control, alongside glimepiride and metformin for glycemic modulation. Furthermore, for elderly diabetic patients, healthcare providers should focus on implementing lifestyle-based interventions. Health education programs should emphasize the importance of alcohol abstinence, low-fat diet, and regular physical activity. Additionally, educating patients about the mechanisms by which alcohol abuse, dyslipidemia, and obesity contribute to HT development may enhance behavioral adherence.

This study has several limitations. First, the sample size was calculated based on a medium effect size, potentially limiting statistical power to detect smaller effects (e.g., Cohen's d values below 0.3). Subsequent research should consider increasing sample size to improve sensitivity for identifying subtle but clinically relevant differences. Second, this study did not adopt a randomized controlled trail design, which restricts the ability to draw causal inferences about the effectiveness of interventions based on identified risk factors. Future studies could incorporate RCTs to refine preventive measures for elderly individuals with DM and HT.

Despite these limitations, the present study makes several key contributions: (1) Multi-dimensional analysis: this investigation comprehensively compared elderly DM patients with and without HT in terms of demographic profiles, lifestyle factors, and serum biochemical biomarkers, and identified and verified multiple HT-associated risk factors, supporting the development of an integrated risk assessment model. (2) Quantitative predictive assessment: using ROC curve analysis, the study quantitatively assessed the predictive performance of individual risk indicators for HT development. (3) Longitudinal outcome data: leveraging 24-month follow-up data, this study assesses the incidence of cardiovascular/cerebrovascular events, along with health-related quality of life metrics, providing valuable longitudinal evidence of HT's clinical impact in this vulnerable populations.

Conclusion

Elderly diabetic patients with a protracted disease course, a history of alcohol abuse, low physical activity, decreased HDL-C, and elevated LDL-C, UA, and mAlb levels are at a substantially increased risk of developing comorbid HT. Early identification of these risk factors and implementation of individualized treatment and care strategies are essential for preventing HT and improving quality of life in this vulnerable population. Moreover, integrating these risk factors into a combined predictive model markedly enhances diagnostic accuracy.

Disclosure of conflict of interest

None.

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References

[1] Lauder L, Mahfoud F, Azizi M, Bhatt DL, Ewen S, Kario K, Parati G, Rossignol P, Schlaich MP, Teo KK, Townsend RR, Tsioufis C, Weber MA, Weber T and Bohm M. Hypertension management in patients with cardiovascular comorbidities. Eur Heart J 2023; 44: 2066-2077.

[2] Yamazaki D, Hitomi H and Nishiyama A. Hypertension with diabetes mellitus complications. Hypertens Res 2018; 41: 147-156.

[3] Tatsumi Y and Ohkubo T. Hypertension with diabetes mellitus: significance from an epidemiological perspective for Japanese. Hypertens Res 2017; 40: 795-806.

[4] Chi JH and Lee BJ. Risk factors for hypertension and diabetes comorbidity in a Korean population: a cross-sectional study. PLoS One 2022; 17: e0262757.

[5] Sims OT, Oh H, Noh H, Melton PA, Sheffield S, Ingram K and Sawyer P. Prevalence and predictors of co-occurring diabetes and hypertension in community-dwelling older adults. Geriatr Gerontol Int 2018; 18: 1356-1360.

[6] Zhao Y, Li HF, Wu X, Li GH, Golden AR and Cai L. Rural-urban differentials of prevalence and lifestyle determinants of pre-diabetes and diabetes among the elderly in southwest China. BMC Public Health 2023; 23: 603.

[7] Usui I. Common metabolic features of hypertension and type 2 diabetes. Hypertens Res 2023; 46: 1227-1233.

[8] Yen FS, Wei JC, Chiu LT, Hsu CC and Hwu CM. Diabetes, hypertension, and cardiovascular disease development. J Transl Med 2022; 20: 9.

[9] Mone P, Gambardella J, Lombardi A, Pansini A, De Gennaro S, Leo AL, Famiglietti M, Marro A, Morgante M, Frullone S, De Luca A and Santulli G. Correlation of physical and cognitive impairment in diabetic and hypertensive frail older adults. Cardiovasc Diabetol 2022; 21: 10.

[10] Mahler RJ. Diabetes and hypertension. Horm Metab Res 1990; 22: 599-607.

[11] Jia G and Sowers JR. Hypertension in diabetes: an update of basic mechanisms and clinical disease. Hypertension 2021; 78: 1197-1205.

[12] Schleicher E, Gerdes C, Petersmann A, Muller-Wieland D, Muller UA, Freckmann G, Heinemann L, Nauck M and Landgraf R. Definition, classification and diagnosis of diabetes mellitus. Exp Clin Endocrinol Diabetes 2022; 130: S1-S8.

[13] Nugroho P, Andrew H, Kohar K, Noor CA and Sutranto AL. Comparison between the world health organization (WHO) and international society of hypertension (ISH) guidelines for hypertension. Ann Med 2022; 54: 837-845.

[14] Hamad AA and Ahmed SK. Understanding the lower and upper limits of sample sizes in clinical research. Cureus 2025; 17: e76724.

[15] Ali W and Bakris GL. How to manage hypertension in people with diabetes. Am J Hypertens 2020; 33: 935-943.

[16] Walther D, Curjuric I, Dratva J, Schaffner E, Quinto C, Schmidt-Trucksass A, Eze IC, Burdet

L, Pons M, Gerbase MW, Imboden M, Schindler C and Probst-Hensch N. Hypertension, diabetes and lifestyle in the long-term - results from a Swiss population-based cohort. Prev Med 2017; 97: 56-61.

[17] Vacca A, Bulfone L, Cicco S, Brosolo G, Da Porto A, Soardo G, Catena C and Sechi LA. Alcohol intake and arterial hypertension: retelling of a multifaceted story. Nutrients 2023; 15: 958.

[18] Wyszynska J, Luszczki E, Sobek G, Mazur A and Deren K. Association and risk factors for hypertension and dyslipidemia in young adults from poland. Int J Environ Res Public Health 2023; 20: 982.

[19] Zhai Z, Yang Y, Lin G, Lin W, Wu J, Liu X, Zhang S, Zhou Q, Liu H and Hao G. The hypertension and hyperlipidemia status among type 2 diabetic patients in the community and influencing factors analysis of glycemic control. Diabetol Metab Syndr 2023; 15: 73.

[20] Gao J, Pan X, Li G, Chatterjee E and Xiao J. Physical exercise protects against endothelial dysfunction in cardiovascular and metabolic diseases. J Cardiovasc Transl Res 2022; 15: 604-620.

[21] Gherghina ME, Peride I, Tiglis M, Neagu TP, Niculae A and Checherita IA. Uric acid and oxidative stress-relationship with cardiovascular, metabolic, and renal impairment. Int J Mol Sci 2022; 23: 3188.

[22] Mule G, Castiglia A, Cusumano C, Scaduto E, Geraci G, Altieri D, Di Natale E, Cacciatore O, Cerasola G and Cottone S. Subclinical kidney damage in hypertensive patients: a renal window opened on the cardiovascular system. Focus on Microalbuminuria. Adv Exp Med Biol 2017; 956: 279-306.

[23] Almalki ZS, Albassam AA, Alhejji NS, Alotaibi BS, Al-Oqayli LA and Ahmed NJ. Prevalence, risk factors, and management of uncontrolled hypertension among patients with diabetes: a hospital-based cross-sectional study. Prim Care Diabetes 2020; 14: 610-615.

[24] Dey S, Mukherjee A, Pati MK, Kar A, Ramanaik S, Pujar A, Malve V, Mohan HL, Jayanna K and N S. Socio-demographic, behavioural and clinical factors influencing control of diabetes and hypertension in urban Mysore, South India: a mixed-method study conducted in 2018. Arch Public Health 2022; 80: 234.

[25] Zhang S, Yang Y, Chen X, Fan L, Wu J, Liu X, Lin W, Zhai Z, Lin G, Liu H and Zhou Q. Diabetes mellitus and hyperlipidemia status among hypertensive patients in the community and influencing factors analysis of blood pressure control. J Clin Hypertens (Greenwich) 2025; 27: e14965.

[26] Cai X, Zhu Q, Wu T, Zhu B, Aierken X, Ahmat A and Li N. Development and validation of a novel model for predicting the 5-year risk of type 2 diabetes in patients with hypertension: a retrospective cohort study. Biomed Res Int 2020; 2020: 9108216.

[27] Adavi M, Salehi M and Roudbari M. Artificial neural networks versus bivariate logistic regression in prediction diagnosis of patients with hypertension and diabetes. Med J Islam Repub Iran 2016; 30: 312.

[28] Kanegae H, Suzuki K, Fukatani K, Ito T, Harada N and Kario K. Highly precise risk prediction model for new-onset hypertension using artificial intelligence techniques. J Clin Hypertens (Greenwich) 2020; 22: 445-450.

[29] Alloubani A, Saleh A and Abdelhafiz I. Hypertension and diabetes mellitus as a predictive risk factors for stroke. Diabetes Metab Syndr 2018; 12: 577-584.

[30] Wang Z, Yang T and Fu H. Prevalence of diabetes and hypertension and their interaction effects on cardio-cerebrovascular diseases: a cross-sectional study. BMC Public Health 2021; 21: 1224.