

HYPERTENSION SEOUL 2025

2025. 11. 06 (Thu.) - 08 (Sat.)

Conrad Hotel, Seoul, Korea

Healthy BP, Healthier Life



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ABSTRACT BOOK

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로수젯 ROSUZET 노루벳 10/2.5mg 30T(PTP), 100T(병)
 MRS-ROZET Metabolic Syndrome Deslipidemic
 하혈상하혈증 Elderly 대한민국의
 로수젯 ROSUZET 노루벳 10/5mg 30T(PTP), 100T(병)
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 하혈상하혈증 Elderly 대한민국의
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대한민국 1등 로수젯

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 ROSUZET 노루벳 10/20mg 30T(PTP), 100T(병)

- 세계 최초 Rosuvastatin+Ezetimibe 복합제의 CV Outcome 발표²⁾
- 국내사 개발 전문의약품 최초 원외처방조제액 전체 1위¹⁾
- 국내 환자 대상 로수젯 임상 연구 결과 18편, SCIE급 저널 등재 (2025년 9월 기준)
- 한미약품 R&D 및 자체 생산을 통한 Global 진출

10/2.5mg

30T(PTP), 100T(병)



10/5mg

30T(PTP), 100T(병)



10/10mg

30T(PTP), 100T(병)



10/20mg

30T(PTP), 100T(병)



CV, cardiovascular; SCIE, Science Citation Index Expanded; R&D, research and development

Ref) 1. UBIST D1 Sales data. 2024년 원외처방조제액 기준. 2. Kim BK, Hong SJ, Lee YJ, et al. RACING investigators. Long-term efficacy and safety of moderate-intensity statin with ezetimibe combination therapy versus high-intensity statin monotherapy in patients with atherosclerotic cardiovascular disease (RACING): a randomised, open-label, non-inferiority trial. *Lancet*. 2022 Jul 30;400(10349):380-390.



HYPERTENSION SEOUL 2025

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WELCOME MESSAGE

Welcome Message from the Korean Society of Hypertension,

Dear colleagues and scholars from abroad,

The 63rd Annual Scientific Meeting of the Korean Society of Hypertension will be held from November 6 to 8, 2025, at the Conrad Hotel in Seoul under the theme “Healthy Blood Pressure, Healthier Life” as part of the internationally hosted Hypertension Seoul 2025.

Since its foundation in 1994, the Korean Society of Hypertension has been dedicated to establishing standards for hypertension management and promoting public health through a wide range of academic and policy initiatives. In recent years, the Society has sought to lead a new paradigm in hypertension care by integrating artificial intelligence (AI) and digital health technologies into prevention, diagnosis, and treatment.

This year’s meeting will focus on the latest research in hypertension and cardiovascular diseases, featuring sessions led by distinguished domestic and international experts on topics including: ▲ the global status and future of hypertension management ▲ updates in treatment strategies ▲ resistant hypertension therapy ▲ wearable blood pressure monitoring devices and digital health technologies ▲ AI- and big data-based risk prediction. Additional highlights include a joint symposium with the Korean Society of Cardio-cerebrovascular Disease Prevention on the cardio-kidney-metabolic (CKM) syndrome; presentations on the research infrastructure supported by the Korea National Institute of Health and other national organizations; and discussions on multidisciplinary approaches and future directions in chronic disease management.

Notably, Hypertension Seoul 2025 will host editors from prestigious medical journals to deliver a lecture and lead a discussion on “Issues and Changes in Scientific Publication”, offering researchers valuable insights for successful submissions to top-tier journals. Moreover, primary authors of global hypertension guidelines will participate in in-depth debates on key controversies and consensus points in guideline development.

The Plenary Lecture will be delivered by Professor John William McEvoy of Ireland, first author of the 2024 European Society of Cardiology (ESC) Hypertension Guidelines, on the topic “Reflections on Key Messages in the 2024 ESC and 2025 ACC/AHA Blood Pressure Guidelines.” The Special Lecture will be presented by Professor Athanasios Benetos of Nancy University, France—President of the European Geriatric Medicine Society and Chair of the European Society of Hypertension Working Group on Hypertension in Older Adults—on “Antihypertensive Treatment in Older Frail Adults.” In addition, over ten distinguished international speakers will share the latest research findings and participate in panel discussions.

Our Society continues to strengthen its future through various educational programs, including continuing education courses for primary care physicians and residents, as well as the Winter School for developing hypertension specialists. We hope that this year's Annual Scientific Meeting will provide meaningful contributions to your clinical practice and research, further enhancing our capacity to grow into a leading society not only in the Asia-Pacific region but also worldwide.

Dear members, we sincerely ask for your enthusiastic participation and support, and we look forward to welcoming you to the meeting to witness and encourage the continued growth of our Society.

Best wishes to all of you.

November 2025

Prof. Jin-Ok Jeong, Chairman of KSH

Prof. Jinho Shin, President of KSH

Prof. Jeong-Hun Shin, Director of Scientific Committee of KSH



PROGRAM AT A GLANCE

DAY 1_November 6 (Thu.)

Time in	Time out	Studio 4
13:00	14:15	Eng New Therapeutic Strategies for Hypertension Management
14:30	15:45	Eng Asian-Pacific Session: Global Call to Action to Control High Blood Pressure
16:00	17:15	Eng Meet the Editor Session: Issues and Changes in Scientific Publication

DAY 2_November 7 (Fri.)

Time in	Time out	Room A	Room B	Room C	Room D	Studio 8+9+10	
08:40	09:55	Eng Hypertension in Young Adults, When, Why, and How	Proteomics in Hypertension: Unraveling Molecular Mechanisms and Clinical Applications	Working Group on Basic Hypertension Research: The Impact of SGLT2 Inhibitors on Pathogenesis of Hypertension	From Pressure to Prognosis: Vascular Imaging and Risk in Hypertension		
10:05	10:25	Opening Ceremony					
10:35	11:05	Eng Young Investigator Award	Clinical Research Award	Industrial Symposium I	Industrial Symposium II	Poster Presentation I. 10:35-11:45 II. 14:50-16:05 e-Poster 09:00-17:00	
11:15	11:45			Industrial Symposium III			
			 VIATRIS	 Global - R&D Leader Hanmi Pharmaceutical			
			 JW Pharmaceutical				
11:55	12:25	Eng Plenary Lecture					
12:35	13:15	Eng Luncheon Symposium I	Luncheon Symposium II	Luncheon Symposium III	Luncheon Symposium IV		
				BORYUNG 	 		
13:25	14:40	Eng Smart Hypertension Care: AI, Big Data, and Digitalomics	Health Care Policy: Optimizing Hypertension Management through Team-Based Care and Task Shifting	Eng Working Group on Pediatric Hypertension: Pediatric Hypertension Guideline & Public Policy	Familiar Isn't Always Best: Challenging Habits in HTN Care		
14:50	16:05	Eng The Cuffless BP Monitoring Era: Innovation, Validation, and Future Directions	고혈압 국가연구사업의 현황과 미래	Working Group on Hypertensive Cerebrovascular Diseases: The Silent Work of Sleep: Glymphatic System, Brain Health, and Blood Pressure	Exercise Science in Hypertension Research: From Bench to Bedside		
16:15	17:30	Eng Controversies and Consensus in the 2024 ESC Hypertension Guidelines	Advances and Controversies in Renal Denervation	Working Group on Resistant Hypertension: Solving the Unsolved	Contemporary Dietary Approaches to the Prevention and Management of Hypertension		

DAY 3_November 8 (Sat.)

Time in	Time out	Room A	Room B	Room C	Room D	Studio 8+9+10
08:00	08:20			Industrial Breakfast Symposium I 	Industrial Breakfast Symposium II 	Poster Presentation 10:25-11:40 e-Poster 09:00-16:00
08:30	08:50	Industrial Breakfast Symposium III 	Industrial Breakfast Symposium IV 	Industrial Breakfast Symposium V  YUNGIN PHARM 	Industrial Breakfast Symposium VI 	
09:00	10:15	Eng Hypertension in Older Adults: Common and Difficult Problems	Emerging Mechanisms and Targets in Hypertension and Cardiometabolic Diseases	Working Group on Blood Pressure Monitoring: Behavioral and Environmental Factors Influencing Blood Pressure Control	Managing Atrial Fibrillation in the Hypertensive Patient: From Pathophysiology to Treatment	
10:25	11:40	Eng Deep Dive into Hypertensive Disorder of Pregnancy	Intelligent Care: AI in Hypertension Practice	Working Group on Metabolic Syndrome: Recent Insights into Metabolic Syndrome	Neuroendocrine Hypertension: Integrating Pituitary, Adrenal, and Thyroid Axes	
11:50	12:20	Eng Special Lecture				
12:30	13:10	Eng Luncheon Symposium V 	Luncheon Symposium VI 	Luncheon Symposium VII  DONG-A ST 	Luncheon Symposium VIII 	
13:20	14:35	Eng Obesity and Blood Pressure - From Mechanism to Management	Hypertension in Cancer Therapy - Mechanisms, Monitoring, Action	Effective Communication Strategies to Enhance Patient Treatment Adherence	Hypertension, We Often Overlook: What Are We Missing?	
14:45	16:00	Eng Cutting-Edge Hypertension Research: Insights from Leading Experts	[KSH-KSCP Joint Session] CKM Syndrome: Inter-Organ Crossroads and Clinical Implications	Working Group on Hypertension Complication: Hypertension and Heart Failure: From Pathology to Treatment	New Drugs for Hypertension	
16:10	16:40	Closing Ceremony				



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Healthy BP, Healthier Life

Young Investigator Award

DAY 2_November 7 (Fri.), 10:35-11:41

Room A (5F, Park Ballroom)

Chairpersons Jong-Won Ha (Yonsei University), Il-Suk Sohn (Kyunghee University)
Judges Hyun-Jin Kim (Hanyang University), Mi-Hyang Jung (Catholic University),
In-Jeong Cho (Ewha Womans University)

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- YIA-1 Association of Within-Visit Blood Pressure Variability with Cardiovascular Disease and Mortality among Individuals without a History of Hypertension: Results from the UK Biobank**
In Tae Jin (Yonsei University)
- YIA-2 Aldosterone Excess, Blood Pressure Control, and Kidney Outcomes in Chronic Kidney Disease: Findings From the Cardiovascular and Metabolic Disease Etiology Research Center-High Risk (CMERC-HI) Study**
Jong Hyun Jhee (Yonsei University)
- YIA-3 Association between Systemic Inflammation and Long-Term Mortality in Patients with Hypertensive Crisis Visiting the Emergency Department**
Byungwoo Yoo (Hanyang University)
- YIA-4 Age at Hypertension Onset and Long-Term Risk of Cardiovascular Events and Renal Outcomes: A Community-Based Korean Cohort Study**
Soo Jung Park (Hanyang University)
- YIA-5 Genetic Predisposition Recalibrates Blood Pressure Thresholds for Cardiovascular Risk**
Jee Ye Kahng (Seoul National University)
- YIA-6 Blood Pressure Polygenic Score Predicts Long-Term Blood Pressure Control and Treatment-Resistant Hypertension**
So Mi Cho (Harvard University)

YIA-1

Association of Within-Visit Blood Pressure Variability with Cardiovascular Disease and Mortality among Individuals without a History of Hypertension: Results from the UK Biobank

In Tae Jin¹, Seok-Jae Heo², Sunga Bae^{3,4}, Jin Young Park^{4,5}

¹Division of Cardiology, Severance Cardiovascular Hospital, Yonsei University College of Medicine, Seoul, Korea, Republic of

²Division of Biostatistics, Department of Biomedical Systems Informatics, Yonsei University College of Medicine, Seoul, Korea, Republic of

³Yonsei University College of Medicine and Cardiovascular Center, Yongin Severance Hospital, Yongin, Korea, Republic of

⁴Center for Digital Health, Yongin Severance Hospital, Yonsei University Health System, Yongin, Korea, Republic of

⁵Department of Psychiatry, Yongin Severance Hospital, Yonsei University College of Medicine, Yongin, Korea, Republic of

Introduction

Hypertension is a highly consequential yet modifiable risk factor for major adverse cardiovascular events (MACE). Beyond sustained hypertension, blood pressure variability (BPV) has also been recognized as a strong predictor of MACE. While long-term BPV has been extensively investigated, evidence regarding within-visit BPV, a form of very short-term BPV, remains limited. This study aimed to evaluate the association between within-visit BPV and clinical outcomes.

Methods

We analyzed data from the UK Biobank. Blood pressure (BP) was measured twice, with at least 1 minute between measurements, while participants were seated. Within-visit BPV was defined as the absolute difference between two consecutive systolic BP measurements. Participants were categorized into within-visit BPV quartiles. The primary outcome was all-cause mortality, and secondary outcomes included MACE. Cox proportional hazards models were used to estimate hazard ratios (HRs).

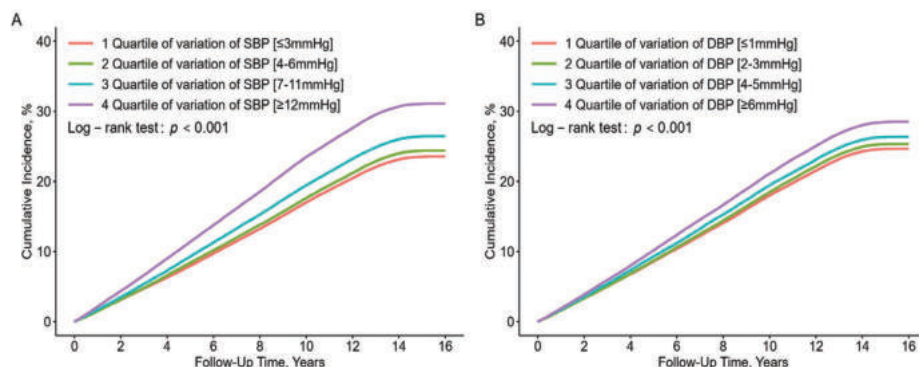
Results

Higher within-visit BPV was associated with elevated systolic and diastolic BP and a higher incidence of hypertension. All-cause mortality and MACE increased progressively across BPV quartiles, and these results remained consistent in fully adjusted models. Compared with the lowest quartile, the highest quartile showed an elevated risk of all-cause mortality (HR [95% confidence interval]: 1.066 [1.037–1.096]), non-fatal myocardial infarction (1.063 [1.014–1.114]), stroke (1.082 [1.024–1.144]), and heart failure (1.057 [1.003–1.114]). BPV as a continuous variable demonstrated a significant linear association without evidence of non-linearity.

Conclusion

Within-visit BPV is independently associated with the development of hypertension and predicts mortality and MACE, supporting its role as a simple, early marker of long-term cardiovascular risk.

Figure



Table

Table 3. Clinical outcomes stratified by quartiles of systolic and diastolic BP variability

	Systolic BP variability			Diastolic BP variability		
	Model 1†	Model 2‡	Model 3§	Model 1†	Model 2‡	Model 3§
All-cause mortality						
Quartile 1	1.000 (Reference)	1.000 (Reference)	1.000 (Reference)	1.000 (Reference)	1.000 (Reference)	1.000 (Reference)
Quartile 2	1.044 (1.015-1.075)	1.019 (0.990-1.049)	1.023 (0.994-1.053)	1.005 (0.978-1.034)	0.996 (0.969-1.024)	1.000 (0.972-1.028)
Quartile 3	1.074 (1.045-1.104)	0.996 (0.969-1.024)	0.998 (0.971-1.026)	1.071 (1.039-1.104)	1.034 (1.004-1.066)	1.033 (1.003-1.065)
Quartile 4	1.280 (1.245-1.316)	1.064 (1.035-1.093)	1.066 (1.037-1.096)	1.186 (1.153-1.219)	1.086 (1.056-1.117)	1.078 (1.048-1.108)
Non-fatal MI						
Quartile 1	1.000 (Reference)	1.000 (Reference)	1.000 (Reference)	1.000 (Reference)	1.000 (Reference)	1.000 (Reference)
Quartile 2	1.018 (0.970-1.068)	1.000 (0.953-1.049)	1.000 (0.953-1.049)	0.993 (0.948-1.040)	0.986 (0.942-1.033)	0.988 (0.943-1.035)
Quartile 3	1.060 (1.013-1.110)	1.014 (0.968-1.061)	1.011 (0.965-1.058)	1.049 (0.997-1.104)	1.021 (0.970-1.074)	1.014 (0.964-1.067)
Quartile 4	1.196 (1.142-1.253)	1.075 (1.026-1.126)	1.063 (1.014-1.114)	1.176 (1.122-1.232)	1.100 (1.050-1.153)	1.079 (1.030-1.130)
Stroke						
Quartile 1	1.000 (Reference)	1.000 (Reference)	1.000 (Reference)	1.000 (Reference)	1.000 (Reference)	1.000 (Reference)
Quartile 2	1.021 (0.963-1.082)	0.997 (0.941-1.057)	1.000 (0.943-1.060)	1.045 (0.988-1.105)	1.037 (0.980-1.096)	1.039 (0.982-1.099)
Quartile 3	1.082 (1.024-1.144)	1.011 (0.956-1.068)	1.011 (0.957-1.069)	1.105 (1.039-1.175)	1.071 (1.007-1.139)	1.070 (1.006-1.137)
Quartile 4	1.282 (1.213-1.355)	1.083 (1.025-1.145)	1.082 (1.024-1.144)	1.239 (1.172-1.311)	1.146 (1.083-1.212)	1.137 (1.075-1.203)
Heart failure						
Quartile 1	1.000 (Reference)	1.000 (Reference)	1.000 (Reference)	1.000 (Reference)	1.000 (Reference)	1.000 (Reference)
Quartile 2	1.053 (0.996-1.112)	1.025 (0.971-1.083)	1.029 (0.974-1.087)	0.989 (0.937-1.043)	0.980 (0.929-1.034)	0.982 (0.931-1.036)
Quartile 3	1.099 (1.043-1.158)	1.018 (0.966-1.073)	1.011 (0.959-1.065)	1.153 (1.089-1.221)	1.113 (1.051-1.178)	1.107 (1.045-1.172)
Quartile 4	1.306 (1.239-1.376)	1.081 (1.026-1.140)	1.057 (1.003-1.114)	1.297 (1.230-1.366)	1.183 (1.122-1.247)	1.161 (1.101-1.224)

† Unadjusted model

‡ Includes adjustment for age, sex, race/ethnicity

§ Includes variables in Model 2 and additional adjustment for education level, smoking status, body mass index, total cholesterol level, hypertension, diabetes, and coronary artery disease

Abbreviations: BP, blood pressure; CI, confidence interval; HR, hazard ratio; MI, myocardial infarction

YIA-2

Aldosterone Excess, Blood Pressure Control, and Kidney Outcomes in Chronic Kidney Disease: Findings From the Cardiovascular and Metabolic Disease Etiology Research Center-High Risk (CMERC-HI) Study

Jong Hyun Jhee¹, Young Su Joo³, Jiwon Seo⁴, Chan Joo Lee², Ye Eun Ko⁵, Soo-Hyun Park⁶, Tae-Hyun Yoo⁵, Sungha Park²

¹Division of Nephrology, Gangnam Severance Hospital, Yonsei University College of Medicine, Seoul, Korea, Republic of

²Division of Cardiology, Severance Cardiovascular Hospital, Yonsei University College of Medicine, Seoul, Korea, Republic of

³Division of Nephrology, Yongin Severance Hospital, Yonsei University College of Medicine, Seoul, Korea, Republic of

⁴Division of Cardiology, Gangnam Severance Hospital, Yonsei University College of Medicine, Seoul, Korea, Republic of

⁵Internal Medicine, College of Medicine, Institute of Kidney Disease Research, Yonsei University, Seoul, Korea, Republic of

⁶Food Functionality Research, Korea Food Research Institute, Wanju, Korea, Republic of

Introduction

Blood pressure (BP) control in chronic kidney disease (CKD) remains suboptimal despite renin-angiotensin system (RAS) blockade, contributing to disease progression. This study examined associations of relative aldosterone excess (RAE) with BP control, and kidney outcomes in CKD.

Methods

A total of 745 patients with non-dialysis CKD from the Cardiovascular and Metabolic Disease Etiology Research Center-High Risk (2013–2024) Study were analyzed. BP control status was defined by ambulatory BP: uncontrolled BP (UBP, $\geq 125/75$ mmHg with <3 AHAs), apparent treatment resistant hypertension (aTRH, $\geq 125/75$ mmHg with ≥ 3 AHAs including diuretics or ≥ 4 AHAs), and controlled BP (CBP, $<125/75$ mmHg with <4 AHAs). RAE was defined as baseline serum aldosterone ≥ 10 ng/dL with aldosterone to renin ratio ≥ 30 despite RAS inhibition. The primary kidney outcome was a 40% eGFR decline or end-stage kidney disease.

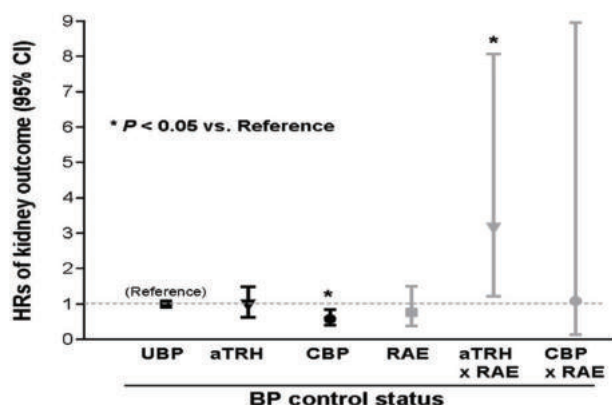
Results

Mean age was 61.5 years, and 53.6% were men. Baseline prevalence was lowest in CBP. RAE was independently associated with higher odds of uncontrolled hypertension (ABPM $\geq 125/75$ mmHg), whereas CBP was associated with lower odds of RAE. Over a median 6.9 years, 244 kidney outcomes occurred. In multivariable Cox models, CBP was associated with reduced risk of kidney outcomes than UBP (HR, 0.58; 95% CI, 0.40–0.84), while aTRH was not (HR, 1.09; 95% CI, 0.72–1.65). However, in the interaction model, aTRH with RAE showed a significantly elevated risk of kidney outcomes (HR, 3.13; 95% CI, 1.21–8.07), whereas the reduced risk of CBP was not modified by RAE.

Conclusion

Monitoring RAE is clinically relevant in CKD with hypertension. RAE-positive aTRH identifies a high-risk subgroup that may benefit from targeted interventions, including mineralocorticoid receptor antagonists.

Figure



Table

Table 1. Prevalence of relative aldosterone excess across BP control status

BP control status					
	UBP	aTRH	CBP	Total	<i>P</i>
Baseline measurement					
Aldosterone, ng/dL	14.2 [10.6-19.2]	14.2 [10.4-18.8]	15.4 [11.1-21.7]	14.5 [10.7-19.6]	0.045
Renin, ng/mL/hr	3.0 [1.0- 8.8]	4.1 [1.0-10.7]	6.2 [2.5-15.9]	3.7 [1.3-10.8]	<0.001
ARR	5.1 [1.6-12.1]	3.5 [1.3-11.7]	2.2 [1.1- 6.5]	4.0 [1.4-11.0]	<0.001
RAE					
No	405 (92.5%)	121 (86.4%)	162 (97.0%)	688 (92.3%)	
Yes	33 (7.5%)	19 (13.6%)	5 (3.0%)	57 (7.7%)	0.002

Data were presented as mean ± standard deviation.

Abbreviation: BP, blood pressure; UBP, uncontrolled BP; aTRH, apparent treatment resistant hypertension; CBP, controlled BP; ARR, aldosterone-to-renin ratio; RAE, relative aldosterone excess

Table 2. The association between BP control groups and kidney outcomes

	Events	1000-PYs	Rate	Model 1		Model 2		Model 3	
				HR (95% CI)	<i>P</i>	HR (95% CI)	<i>P</i>	HR (95% CI)	<i>P</i>
Kidney outcomes									
UBP	146	984977	0.148	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
aTRH	63	324679	0.194	1.19 (0.89 - 1.61)	0.239	1.21 (0.90 - 1.63)	0.208	1.09 (0.72 - 1.65)	0.671
CBP	35	400574	0.087	0.56 (0.39 - 0.82)	0.002	0.58 (0.40 - 0.84)	0.004	0.58 (0.40 - 0.84)	0.004

Note:

Model 1: unadjusted

Model 2: Model 1 + age, sex

Model 3: Model 2 + smoking and alcohol status, BMI, history of CVD or diabetes, use of AHAs, and baseline eGFR

Abbreviation: BP, blood pressure; HR, hazard ratio; CI, confidence interval; UBP, uncontrolled BP; aTRH, apparent treatment resistant hypertension; CBP, controlled BP; BMI, body mass index; CVD, cardiovascular disease; AHA, antihypertensive agents; eGFR, estimated glomerular filtration rate

YIA-3

Association between Systemic Inflammation and Long-Term Mortality in Patients with Hypertensive Crisis Visiting the Emergency Department

Byung Sik Kim¹, Byungwoo Yoo², Hyun-Jin Kim¹, Jeong-Hun Shin¹

¹Cardiology, Hanyang University Guri Hospital, Guri, Korea, Republic of

²Hanyang University College of Medicine, Hanyang University College of Medicine, Seoul, Korea, Republic of

Introduction

Prognostic significance of inflammatory indicators in patients with hypertensive crisis remains unclear. This study aimed to investigate the associations and predictive value of systemic inflammatory indicators, including neutrophil-to-lymphocyte ratio (NLR), lymphocyte-to-monocyte ratio (LMR), platelet-to-lymphocyte ratio (PLR), systemic immune-inflammation index (SII), and C-reactive protein (CRP), with long-term mortality among patients with hypertensive crisis.

Methods

This retrospective study included adult patients who visited the emergency department between 2016 and 2019 with hypertensive crisis, defined as systolic blood pressure ≥ 180 mmHg or diastolic blood pressure ≥ 110 mmHg. A total of 5,320 patients who underwent complete blood counts and CRP assays were included and categorized into tertiles based on each inflammatory indicators at the time of presentation.

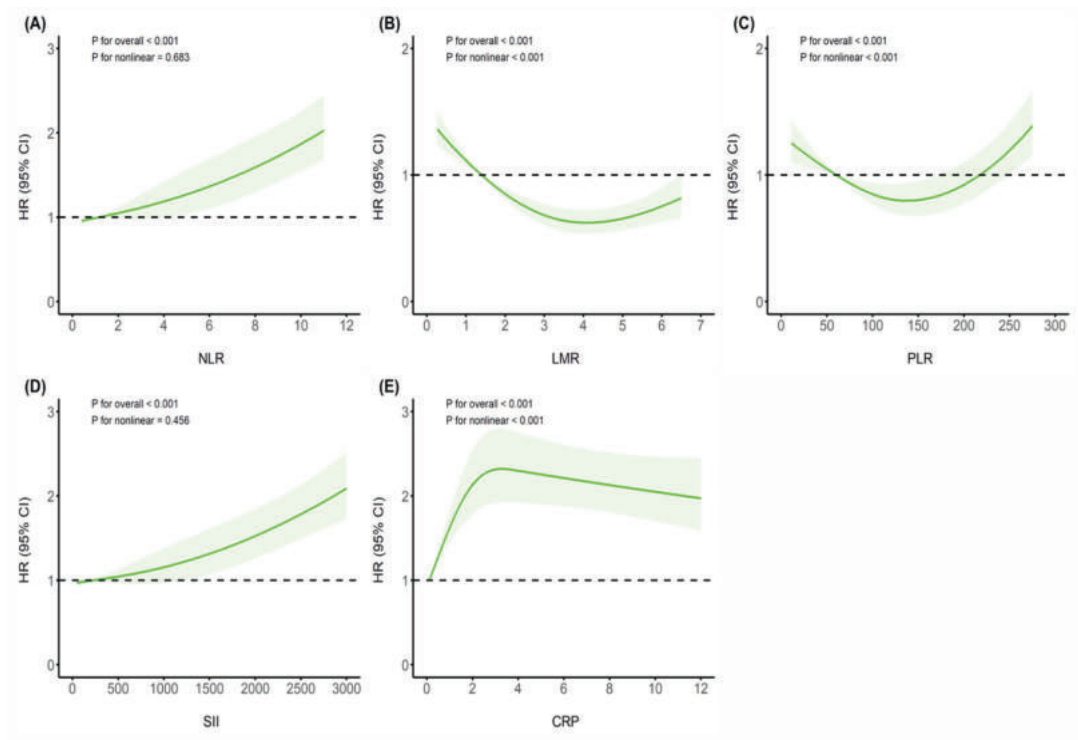
Results

Among 5,320 patients with hypertensive crisis, higher tertiles of NLR, PLR, SII, and CRP were independently associated with increased 3-year all-cause mortality, whereas higher LMR was associated with lower risk. Adjusted hazard ratios (95% confidence intervals) comparing the highest to lowest tertiles were: NLR 1.61 (1.35–1.92), LMR 0.71 (0.60–0.85), PLR 1.22 (1.03–1.44), SII 1.57 (1.33–1.86), and CRP 2.21 (1.84–2.65). Dose-response analyses revealed linear associations for NLR and SII, an inverse J-shaped pattern for LMR, a J-shaped curve for PLR, and a non-linear positive association for CRP. CRP showed the highest prognostic performance, followed by NLR and LMR.

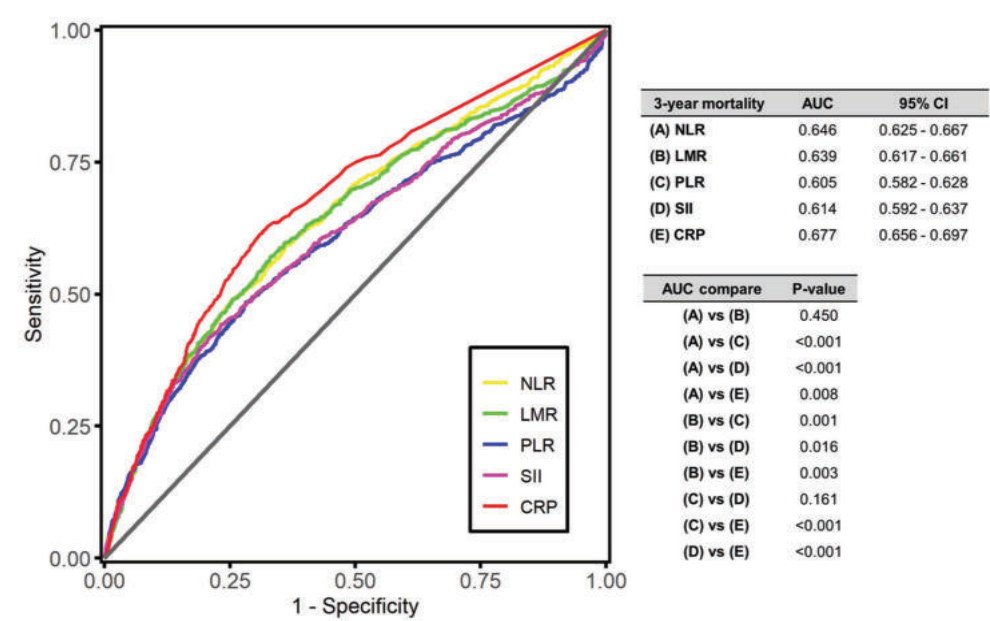
Conclusion

Systemic inflammatory indicators are independently associated with long-term mortality in patients with hypertensive crisis. These markers may improve risk stratification and guide follow-up decisions in high-risk patients.

Figure



Figure



YIA-4

Age at Hypertension Onset and Long-Term Risk of Cardiovascular Events and Renal Outcomes: A Community-Based Korean Cohort Study

Soo Jung Park¹, Byung Sik Kim², Jin-Kyu Park¹

¹Cardiology, Internal Medicine, Hanyang University College of Medicine, Seoul, Korea, Republic of

²Cardiology, Internal Medicine, Hanyang University College of Medicine, Guri/Gyeonggi-do, Korea, Republic of

Introduction

This study aimed to investigate the associations between age at hypertension onset and long-term risks of cardiovascular events, chronic kidney disease (CKD), and mortality in a large community-based Korean cohort.

Methods

We analyzed 9,644 participants from the Ansan–Ansung cohort of the Korean Genome and Epidemiology Study. Participants were categorized into normotensive individuals and four hypertensive groups according to age at onset: <45, 45–54, 55–64, and ≥65 years. Multivariable logistic regression and Cox proportional hazards models were used to assess associations between age at onset and hypertension-mediated organ damage (HMOD), incident CKD, major adverse cardiovascular events (MACE), and all-cause mortality over a median follow-up of 15.5 years.

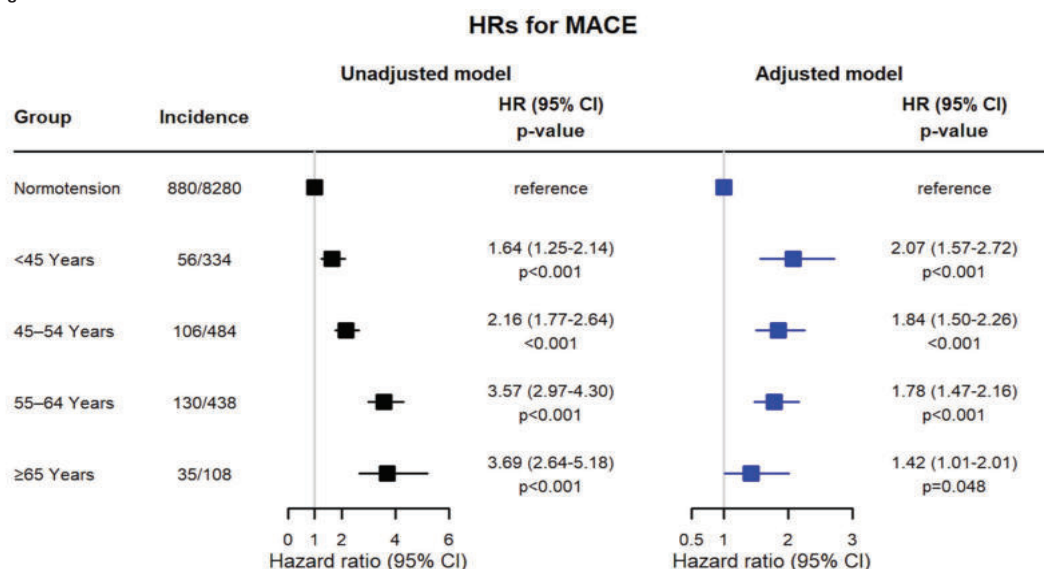
Results

Compared with normotensive individuals, participants with hypertension had significantly higher odds of HMOD, particularly those with onset at <45 years (adjusted OR 2.35; 95% CI 1.85–3.00) and ≥65 years (adjusted OR 2.19; 95% CI 1.46–3.29). Early-onset hypertension (<45 years) conferred the highest risk of MACE (adjusted HR 2.07; 95% CI 1.57–2.72), while late-onset hypertension (≥65 years) was most strongly associated with all-cause mortality (adjusted HR 1.53; 95% CI 1.14–2.07). Incident CKD risk was increased among participants with onset before 65 years, with the greatest risk observed in the 45–54 years group (HR 1.60; 95% CI 1.33–1.93).

Conclusion

Both early- and late-onset hypertension were associated with heightened long-term risks of cardiovascular and renal outcomes, though the patterns differed by age of onset. These findings highlight the importance of early detection and tailored management strategies for hypertension across the lifespan.

Figure



Genetic Predisposition Recalibrates Blood Pressure Thresholds for Cardiovascular Risk

Jee Ye Kahng^{1,2}, Tae-Min Rhee^{1,3}, Jaewon Choi⁴, Hyunsuk Lee^{2,5}, Heesun Lee^{1,3}, Jun-Bean Park^{2,3}, Soo Heon Kwak^{2,3}, Su-Yeon Choi^{1,3}

¹Internal Medicine, Seoul National University Hospital Healthcare System Gangnam Center, Seoul, Korea, Republic of

²Internal Medicine, Seoul National University Hospital, Seoul, Korea, Republic of

³Internal Medicine, Seoul National University College of Medicine, Seoul, Korea, Republic of

⁴Biomedical Sciences, Seoul National University College of Medicine, Seoul, Korea, Republic of

⁵Translational Medicine and Genomic Medicine Institute, Seoul National University College of Medicine, Seoul, Korea, Republic of

Introduction

Prompt, individually targeted blood pressure control is essential in managing hypertension, and a precision public health approach incorporating genetic information may further refine risk prediction and management. Polygenic risk scores (PRS) derived from genome-wide association studies (GWAS) allow estimation of genetically predicted systolic blood pressure (SBP). Whether genetically predicted SBP modifies the relationship between measured SBP and clinical outcomes has not been fully evaluated.

Methods

We analyzed 277,663 European-ancestry participants from the UK Biobank without prior hypertension or cardiovascular disease. Using PRS-CS calculated from external GWAS summary statistics, we developed an SBP prediction model in a training set ($n=194,363$) and conducted outcome analyses in an independent test set ($n=83,300$). Genetically predicted SBP was categorized as low (<120 mmHg), intermediate (120 – 139 mmHg), and high (≥ 140 mmHg). Baseline measured SBP was grouped as <120 , 120 – 129 , 130 – 139 , 140 – 159 , and ≥ 160 mmHg. The primary endpoint was incident major adverse cardiovascular events (MACE: cardiovascular death, myocardial infarction, stroke, or heart failure) during up to 13 years of follow-up. Multivariable Cox models estimated adjusted hazard ratios (aHRs). For external validation, 9,565 adults from an independent Korean health check-up cohort were examined. Predicted SBP strata were defined analogously, and outcomes were defined as any occurrence of target organ damage (TOD) involving the brain, retina, heart, kidney, or large vessels, identified through routine health check-ups over up to 11 years.

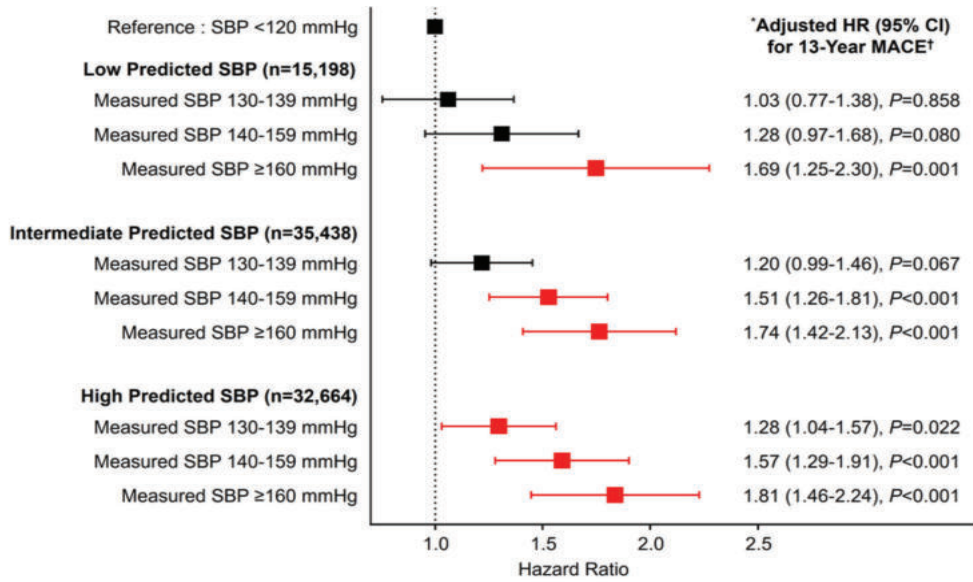
Results

In the UK Biobank test set, 4,349 MACE events occurred. Each 10 mmHg increase in measured SBP was associated with progressively higher risk of MACE across predicted SBP strata (aHR 1.08 [95% CI 1.03–1.13] in the low, 1.10 [1.07–1.13] in the intermediate, and 1.11 [1.08–1.14] in the high group). With measured SBP <120 mmHg as the reference group, the threshold at which risk of MACE became significant shifted downward with increasing genetic predisposition. In the low predicted SBP group, risk elevation appeared only at ≥ 160 mmHg (aHR 1.69 [1.25–2.30]). In the intermediate group, risk was significant from 140 mmHg (aHR 1.51 [1.26–1.81]) and above (≥ 160 mmHg, aHR 1.74 [1.42–2.13]), while in the high group, risk was already evident at 130–139 mmHg (aHR 1.28 [1.04–1.57]) and further increased at higher levels (140–159 mmHg, aHR 1.57 [1.29–1.91]; ≥ 160 mmHg, aHR 1.81 [1.46–2.24]). In the Korean cohort, adjusted odds ratios (aORs) of TOD were also analyzed with measured SBP <120 mmHg as the reference group. No significant associations were seen in the low predicted SBP group. In the intermediate group, association became evident at ≥ 130 mmHg (aOR 1.30 [1.02–1.66]). In the high group, association was already significant at 120–129 mmHg (aOR 1.32 [1.12–1.55]) and rose further at ≥ 130 mmHg (aOR 1.45 [1.24–1.70]).

Conclusion

Genetically predicted SBP may recalibrate the threshold of measured SBP at which association between TOD or cardiovascular events becomes significant. Higher genetic predisposition corresponds to risk emerging at lower SBP levels. As a precision medicine approach, genotype-stratified thresholds support incorporating PRS-derived measures into risk stratification to help personalize BP targets and guide treatment intensity.

Figure



* Adjusted for age, sex, genotype array, genetic PC 1 to 10, household income before tax, current smoking, diabetes mellitus, dyslipidemia, and taking antiplatelet medication.

† MACE : A composite of cardiovascular death, myocardial infarction, stroke, or heart failure.

YIA-6

Blood Pressure Polygenic Score Predicts Long-Term Blood Pressure Control and Treatment-Resistant Hypertension

So Mi Cho^{1,2}, Yunfeng Ruan², Hyeok-Hee Lee³, Satoshi Koyama^{1,2}, Stephen Juraschek⁴, Norrina Allen⁵, Eugene Yang⁶, John Mcevoy⁷, Eric Secemsky³, Michael Honigberg⁸, Akl Fahed⁸, Aniruddh Patel⁸, Whitney Hornsby⁸, Pradeep Natarajan⁸

¹Cardiovascular Research Center, Massachusetts General Hospital, Boston, United States

²Program in Medical and Population Genetics and the Cardiovascular Disease Initiative, Broad Institute of MIT and Harvard, Cambridge, United States

³Richard A. and Susan F. Smith Center for Outcomes Research in Cardiology, Beth Israel Deaconess Medical Center, Boston, United States

⁴Department of Medicine, Beth Israel Deaconess Medical Center, Boston, United States

⁵Department of Preventive Medicine, Northwestern University Feinberg School of Medicine, Chicago, United States

⁶Division of Cardiology, University of Washington School of Medicine, Seattle, United States

⁷Cardiology Department, Galway University Hospital and University of Galway School of Medicine, Galway, Ireland

⁸Cardiology Division, Massachusetts General Hospital, Boston, United States

Introduction

Suboptimal blood pressure (BP) control remains a major cardiovascular disease risk factor globally. Whether genetic contributors to elevated BP independently predict long-term BP control and treatment-resistant hypertension is unknown. We examined the associations of BP polygenic score (PGS) with long-term BP control and treatment-resistant hypertension among patients with hypertension.

Methods

Using Mass General Brigham Biobank nested within the U.S. healthcare system, we identified 22,466 individuals aged ≥ 18 years with established hypertension between January 2018 and May 2019. Multiancestral BP PGS was fine-tuned using the external UK Biobank cohort. Longitudinal BP control was defined as cumulative duration above target systolic BP (SBP) ≥ 130 mmHg or diastolic BP (DBP) ≥ 80 mmHg in percentage over a 5-year follow-up. Treatment-resistant hypertension was defined as SBP ≥ 140 or DBP ≥ 90 mmHg despite the concurrent use of 3 antihypertensive classes, use of ≥ 4 antihypertensive classes at any BP level, or physician adjudication. Using multivariable regression, we assessed the associations of BP PRS with 5-year BP control and lifetime resistant hypertension incidence adjusting for traditional cardiometabolic risk factors and comorbidities. Incremental prognostic utility of BP PRS was assessed based on improvement in discrimination C-index or the likelihood ratio test.

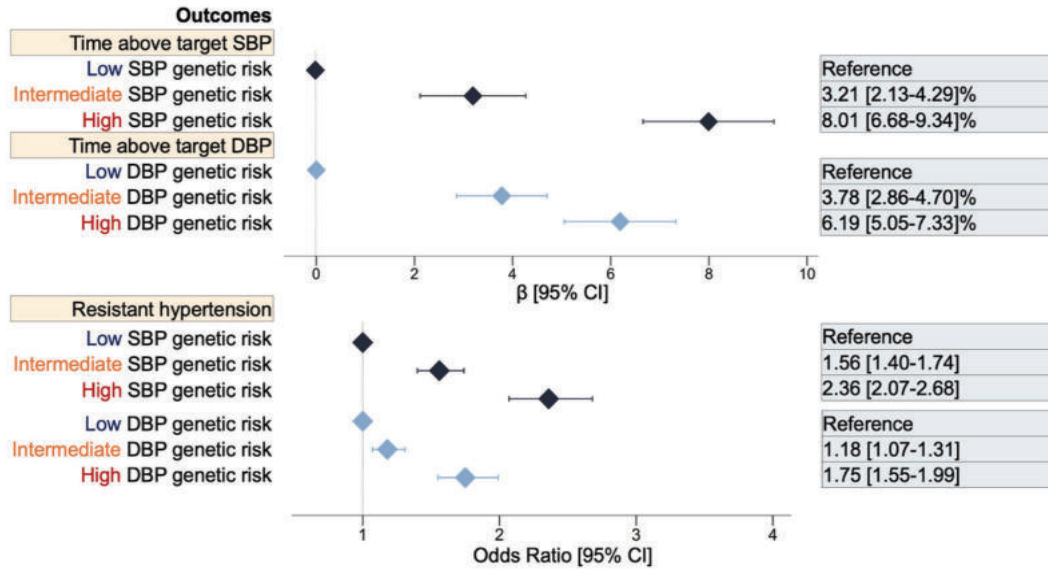
Results

The mean SBP/DBP (standard deviation) at index date was 132(18) / 75(11) mmHg, and 4126 (18.4%) developed resistant hypertension over a lifetime. In reference to the low (<20th percentile) PGS group, the high (≥ 80 th percentile) genetic risk group was associated with 8.01 [6.68-9.34]% longer duration lived with above-target SBP and 6.19 [5.05-7.33]% longer with high DBP. In parallel, the high SBP genetic risk group had a 2.36 [2.07-2.68]-folds higher odds of developing treatment-resistant hypertension. Adding BP PGSs to traditional risk factors improved discrimination C-index [95% CI] for predicting resistant hypertension from 0.74 [0.73-0.75] to 0.78 [0.77-0.79] ($P < 0.001$). BP PGS consistently predicted longitudinal BP management in the validation population-based UK Biobank cohort in adherence to the UK clinical guideline.

Conclusion

BP PGS predicts long-term BP control and treatment-resistant hypertension. Harnessing BP PGS may inform anticipated trends in long-term BP control to better enable optimal hypertension management.

Figure



Clinical Research Award

DAY 2_November 7 (Fri.), 10:35-11:41

Room B (3F, Grand Ballroom)

Chairpersons 편육범 (이화의대), 박성하 (연세의대)
Judges 신정훈 (한양의대), 정우백 (가톨릭의대), 조정선 (가톨릭의대)

- CRA-1 From Children to the Entire Population: A Decade of Successful Sodium Intake Reduction in South Korea**
이무용 (동국의대)
- CRA-2 The Variability of Pulse Wave Velocity and Long-Term Cardiovascular Outcome:
a Prospective Observational Study**
김학령 (서울의대)
- CRA-3 Comparative Prognostic Value of Absolute and Fitness-Adjusted Exercise Systolic Blood Pressure
Metrics for All-Cause and Cardiovascular Mortality**
제세영 (서울시립대학교)
- CRA-4 Distinct Effects of Antihypertensive Drug Classes on Blood Pressure Variability**
주형준 (고려의대)
- CRA-5 Efficacy and Safety of Fimasartan/Indapamide Combination Therapy Versus Fimasartan Monotherapy in
Patients with Essential Hypertension: A Randomized, Double-Blind, Multicenter, Phase III Study**
이소영 (가톨릭의대 서울성모병원)
- CRA-6 Comparison of Intensive Versus Standard Care and Education for Dyslipidemia in Patients with
Hypertension and Diabetes**
허성호 (가톨릭의대)

CRA-1

From Children to the Entire Population: A Decade of Successful Sodium Intake Reduction in South Korea

Moo-Yong Rhee¹, Yoonna Lee², Jae-Sik Jang¹, Ki-Chul Sung³, Kwang-Il Kwon⁴, Cho-Il Kim⁵, Byung Hee Oh⁶, Soon Kyu Lee⁷

¹Cardiology, Dongguk University Ilsan Hospital, Goyang, Korea, Republic of

²Food and Nutrition, Shingu College, Seongnam, Korea, Republic of

³Cardiology, Kangbuk Samsung Hospital, Seoul, Korea, Republic of

⁴Evaluation Planning & Coordination Division, National Institute of Food and Drug Safety, Ministry of Food and Drug Safety, Cheongju, Korea, Republic of

⁵Food and Nutrition, Seoul National University, Seoul, Korea, Republic of

⁶Cardiology, Incheon Sejong Hospital, Incheon, Korea, Republic of

⁷Dietary and Nutritional Safety Policy Division, Food and Consumer Safety Bureau, Ministry of Food and Drug Safety, Cheongju, Korea, Republic of

Introduction

This study evaluated the effectiveness of South Korea's decade-long government-led sodium intake reduction initiatives, initially targeting children and later expanding to adults.

Methods

A comprehensive government-led sodium intake reduction policy was initiated with the Special Act on Safety Management of Children's Dietary Lifestyle (2009) and expanded to the First and Second National Plans to Reduce Sodium Intake (2012 and 2016). Key interventions include sodium-reduced meals at meal services, voluntary industry reformulation, enhanced nutrition labeling, and extensive public education campaigns. Sodium intake trends were analyzed using data from the Korea National Health and Nutrition Examination Survey from 2010 to 2019 (72,020 individuals aged ≥1 year).

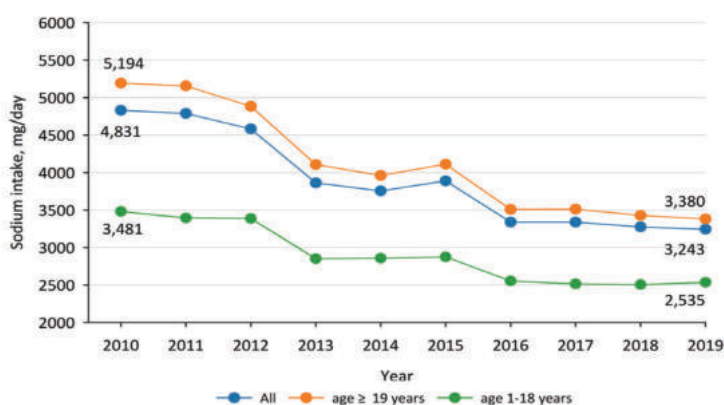
Results

From 2010 to 2019, the mean sodium intake declined by 32.9% from 4,831 mg/day to 3,243 mg/day ($p < 0.0001$). Sodium intake decreased across all sexes, ages, and income levels. The decline remained significant when analyzed as sodium intake per 1,000 kcal of energy intake, indicating that it was not merely due to reduced food consumption. The proportion of individuals meeting the WHO-recommended sodium intake threshold increased from 11.6% to 25.8%. Sodium intake steadily decreased until 2016, but no further significant decline has been observed since 2017.

Conclusion

South Korea achieved substantial reductions in sodium intake through a unique, child-focused strategy that was later extended to adults, suggesting the potential of early-life interventions. Despite remarkable success, intake remains above WHO recommendations and has plateaued since 2017, indicating the need for policy adjustments to sustain progress.

Figure



CRA-2

The Variability of Pulse Wave Velocity and Long-Term Cardiovascular Outcome: a Prospective Observational Study

Hack-Lyoung Kiim

Division of Cardiology, Department of Internal Medicine, Boramae Medical Center, Seoul National University College of Medicine, Seoul, Korea, Republic of

Introduction

The clinical significance of pulse wave velocity (PWV) variability over time remains largely unexplored. This study aimed to investigate whether brachial-ankle PWV (baPWV) variability is associated with long-term cardiovascular outcomes.

Methods

This prospective observational study included patients who visited the cardiovascular center of a tertiary general hospital for the evaluation and management of cardiovascular disease. Study participants underwent baPWV measurements at 0, 1, 6, and 12-month intervals. PWV variability was assessed using the coefficient of variation (CV) of baPWV. The primary endpoint was the occurrence of major adverse cardiovascular events (MACE), including cardiac death, non-fatal myocardial infarction, non-fatal ischemic stroke, and coronary revascularization.

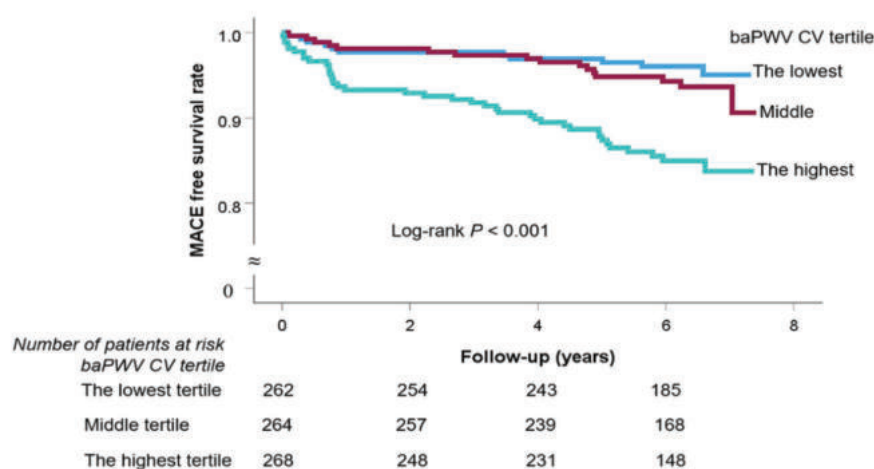
Results

A total of 794 patients were analyzed. The mean age was 62.6 ± 10.6 years, and 40.9% of the study population were female. During a median follow-up period of 6.31 years (interquartile range: 5.42–6.72 years), 66 cases of MACE (8.31%) were observed. Subjects with MACE had significantly higher baPWV CV than those without ($11.25\% \pm 6.87\%$ vs. $7.45\% \pm 5.16\%$, $P < 0.001$). Kaplan-Meier survival analysis showed a significant difference in MACE-free survival rates across baPWV tertiles (log-rank $P < 0.001$). In multivariable Cox regression analysis, higher baPWV CV remained an independent predictor of MACE (hazard ratio, 2.94; 95% confidence interval, 1.38–6.26; $P = 0.05$), even after adjusting for potential confounders.

Conclusion

Higher baPWV variability was independently associated with an increased risk of MACE. Longitudinal fluctuations in arterial stiffness provide additional prognostic value beyond a single PWV measurement.

Figure



Table

Independent predictors for MACE

Variable	HR (95% CI)	P
Age $\geq$ 65 years	1.55 (0.89-2.69)	0.116
Female sex	1.17 (0.65-2.09)	0.587
Coronary artery disease	2.32 (1.18-4.13)	0.013
Current smoking	2.21 (1.21-4.46)	0.011
GFR $<$ 60 mL/min/1.73m ²	1.22 (0.50-2.50)	0.780
Glycated hemoglobin $\geq$ 6.5%	0.96 (0.52-1.76)	0.907
Antiplatelets	1.81 (0.78-4.20)	0.166
Beta-blockers	1.14 (0.65-2.00)	0.628
RAS blockers	1.89 (0.96-3.72)	0.063
Statins	1.22 (0.34-4.35)	0.757
<i>baPWV CV tertile</i>		
The lowest	1 (reference)	-
Middle	1.76 (0.79-3.94)	0.166
The highest	2.94 (1.38-6.26)	0.005

MACE, major adverse cardiovascular event; HR, hazard ratio; CI, confidence interval; GFR, glomerular filtration rate; RAS, renin-angiotensin system blocker; baPWV, brachial-ankle pulse wave velocity; CV, coefficient of variance.

CRA-3

Comparative Prognostic Value of Absolute and Fitness-Adjusted Exercise Systolic Blood Pressure Metrics for All-Cause and Cardiovascular Mortality

Sae Young Jae¹, Sudhir Kurl², Setor Kunutsor³, Jari Laukkanen²

¹*Sport Science, University of Seoul, Seoul, Korea, Republic of*

²*Department of Medicine, University of Eastern Finland, Kuopio, Finland*

³*Department of Internal Medicine, University of Manitoba, Winnipeg, Canada*

Introduction

An exaggerated systolic blood pressure (SBP) response during exercise is a known indicator of increased cardiovascular risk. However, it remains unclear whether submaximal or peak SBP better predicts mortality, and whether SBP indices adjusted for cardiorespiratory fitness (VO₂max) offer advantages over absolute SBP values. We aimed to determine whether submaximal or peak fitness-adjusted SBP indices, expressed as SBP per VO₂max, provide superior predictive power for mortality compared to absolute submaximal or peak SBP measures.

Methods

We analyzed data from 2,410 adults aged 42–61 years who underwent cardiopulmonary exercise testing with direct measurement of VO₂max. Systolic blood pressure (SBP) was recorded at both submaximal workload (4 minutes into exercise) and peak exercise. Fitness-adjusted SBP indices were calculated as SBP divided by VO₂max (mmHg/ml·kg⁻¹·min⁻¹). The primary outcomes were all-cause and cardiovascular mortality over a median follow-up of 26 years.

Results

Higher submaximal SBP and submaximal SBP/VO₂max indices were significantly associated with increased risks of all-cause and cardiovascular mortality. Each 1-SD increase in the submaximal SBP/VO₂max index was associated with a 28% higher risk of both all-cause (HR 1.28, 95% CI 1.20–1.37) and cardiovascular mortality (HR 1.28, 95% CI 1.16–1.41). In contrast, peak SBP showed no significant association with mortality. Among all exercise BP metrics, the submaximal SBP/VO₂max index demonstrated the highest discriminative ability for cardiovascular mortality (AUC = 0.664), outperforming both absolute SBP values and peak SBP/VO₂max.

Conclusion

A submaximal, fitness-adjusted SBP index provides superior long-term prognostic value for all-cause and cardiovascular mortality compared to absolute SBP measures or peak exercise responses. These findings support the clinical utility of incorporating cardiorespiratory fitness-adjusted SBP metrics at submaximal levels into routine exercise testing for improved risk stratification.

CRA-4**Distinct Effects of Antihypertensive Drug Classes on Blood Pressure Variability**

Hyung Joon Joo¹, Dong-Hyuk Cho¹, Seung Yong Shin⁴, Eung Ju Kim³, Kyung-Hee Cho²

¹Cardiology, Korea University Anam Hospital, Seoul, Korea, Republic of

²Neurology, Korea University Anam Hospital, Seoul, Korea, Republic of

³Cardiology, Korea University Guro Hospital, Seoul, Korea, Republic of

⁴Cardiology, Korea University Ansan Hospital, Seoul, Korea, Republic of

Introduction

Blood pressure variability (BPV) has emerged as a prognostically significant metric, complementing mean blood pressure (BP) in risk stratification and hypertension management. The class-specific impact of antihypertensive agents on BPV—especially when contrasting office and home settings—remains poorly characterized, and real-world data are sparse.

Methods

This cross-sectional analysis included 495 adults with hypertension drawn from a multicenter Korean home BP registry between 2024 and 2025. Eligible participants recorded ≥ 10 home and ≥ 5 office BP readings, meeting international and Korean guideline-recommended thresholds for BPV assessment. The effects of four main antihypertensive drug classes—renin-angiotensin system inhibitors (RAASI), beta-blockers, dihydropyridine calcium channel blockers (DHP-CCBs), and diuretics—on systolic and diastolic average real variability (ARV) were estimated using inverse probability of treatment weighting and doubly robust regression. Additional models accounted for the white-coat effect using both continuous and binary approaches based on guideline definitions. BP control rates at home and office were compared across drug classes using IPTW Poisson modeling. Baseline clinical characteristics and comorbidities were robustly balanced through statistical adjustment.

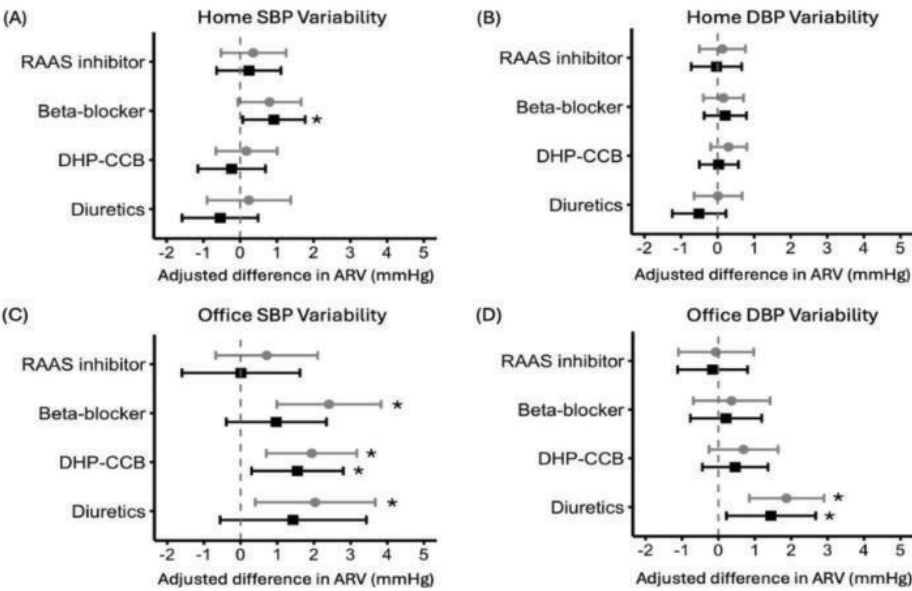
Results

Figure 1 illustrates drug class-specific associations with BPV. Among 495 participants, drug exposures were RAASI (77.6%), beta-blockers (34.3%), DHP-CCBs (62.0%), and diuretics (21.0%). Home BPV (ARV) exhibited minimal differentiation by antihypertensive class after adjustment, with only a modest beta-blocker association for increased home systolic ARV; this signal was attenuated in models correcting for mean BP and patient characteristics. By contrast, office BPV revealed prominent drug class effects: DHP-CCBs were consistently associated with higher office systolic ARV (doubly robust estimate +1.55 mmHg, 95% CI 0.30–2.80), and diuretics with increased office diastolic ARV (+1.44 mmHg, 95% CI 0.22–2.67). These associations persisted, though slightly attenuated, after rigorous white-coat effect adjustment (office SBP ARV for DHP-CCB +1.79 mmHg; office DBP ARV for diuretics +1.38 mmHg). Notably, BP control at home did not differ significantly across drug classes, while DHP-CCB exposure predicted a lower probability of office BP control below current guideline targets. The findings highlight a measurement-environment-sensitive component to BPV, with drug class effects being blunted outside the clinical (stressful) context.

Conclusion

In this prospective, real-world registry, antihypertensive drug classes exerted environment-dependent effects on BPV: minimal and largely non-differentiated at home, but more pronounced and class-specific in the office setting—particularly with DHP-CCBs and diuretics—even after adjusting for white-coat effect. These observations provide mechanistic insight suggesting that BPV, as measured in-office, may reflect acute pharmacologic and physiologic responses not captured by home readings. The data reinforce the primacy of home BP monitoring in clinical decision-making and suggest that in-office BPV may flag patients for intensified evaluation and tailored therapy strategies.

Figure



CRA-5

Efficacy and Safety of Fimasartan/Indapamide Combination Therapy Versus Fimasartan Monotherapy in Patients with Essential Hypertension: A Randomized, Double-Blind, Multicenter, Phase III Study

So-Young Lee¹, Sang-Hyun Ihm², Jong-Chan Youn¹

¹Cardiology, Division of Cardiology, Department of Internal Medicine, Seoul St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea, Republic of

²Cardiology, Division of Cardiology, Department of Internal Medicine, Bucheon St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Gyeonggi-do, Korea, Republic of

Introduction

Effective blood pressure (BP) control often requires combination therapy. Indapamide sustained release (IND SR), a thiazide-like diuretic, provides potent antihypertensive efficacy while causing fewer electrolyte disturbances. Given the high prevalence of salt-sensitive hypertension in elderly patients, combining IND SR with an angiotensin II receptor blocker (ARB) represents a promising therapeutic strategy.

Methods

In this randomized, double-blind, multicenter study, adults with essential hypertension who remained hypertensive after 4 weeks of fimasartan (FMS) 30 mg were randomized (1:1) to receive FMS/IND SR 1.5 mg or FMS monotherapy. Treatment was administered once daily for 4 weeks, followed by forced titration to FMS 60 mg or FMS 60 mg/IND SR 1.5 mg for 4 weeks. The primary endpoint was the change in mean sitting systolic BP (SiSBP) from baseline to week 8.

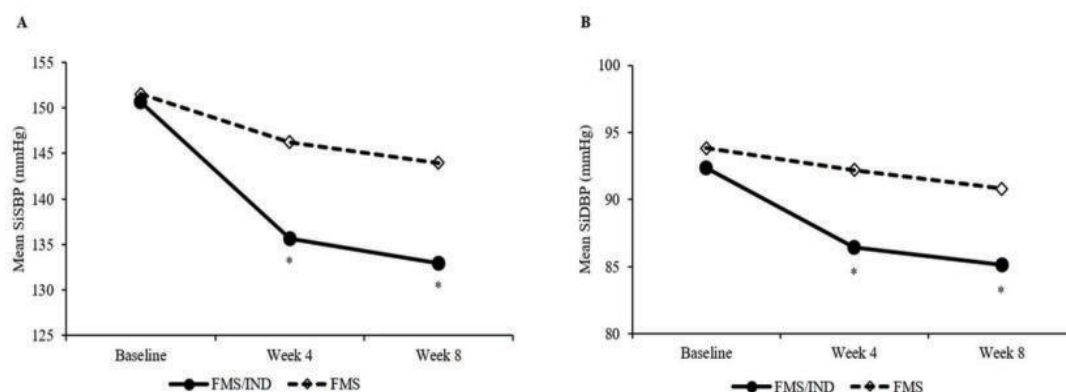
Results

Of 511 patients screened, 248 were randomized (FMS/IND SR, n=126; FMS, n=122). At week 8, the least-squares mean ($\pm$ SE) change in SiSBP was -17.9 (1.4) mmHg with FMS/IND SR versus -7.4 (1.4) mmHg with FMS alone, yielding a between-group difference of -10.5 (95% CI: -14.4 to -6.6 ; $P<0.0001$). Reductions in diastolic BP, BP control, and response rates were also significantly greater with combination therapy. Efficacy was consistent across all prespecified subgroups, including patients aged ≥ 65 years. The incidence of treatment-emergent adverse events, including hypokalemia, was low and comparable between groups, and no severe drug-related events were observed, even among older adults.

Conclusion

FMS/IND SR combination therapy provided superior BP reduction compared with FMS monotherapy, without increasing adverse events. Its strong antihypertensive effect, reduced risk of electrolyte imbalance compared with conventional thiazides, and favorable tolerability in elderly patients support FMS/IND SR as a clinically valuable alternative to standard ARB–thiazide regimens.

Figure



CRA-6

Comparison of Intensive Versus Standard Care and Education for Dyslipidemia in Patients with Hypertension and Diabetes

Sung-Ho Her

Cardiology, The Catholic University of Korea, Seoul, Korea, Republic of

Introduction

Dyslipidemia is a common comorbidity in patients with hypertension (HTN) and diabetes mellitus (DM), significantly increasing cardiovascular risk. Structured patient education is crucial for optimal management. This study was designed to compare the effectiveness of an intensive care and education program versus a standard approach on improving lipid profiles in this high-risk population.

Methods

This is a prospective, randomized controlled trial conducted with patients registered at the Hanam City Hypertension Diabetes Registration Education Center. A total of 348 patients with HTN and/or DM were randomly assigned on a 1:1 basis to either the intensive care group (n=173) or the standard care group (n=175). Randomization was stratified by the presence of diabetes and the use of lipid-lowering medication. The standard group received a single educational session on HTN and DM at baseline. The intensive group received the standard education plus additional, repeated educational sessions on dyslipidemia at baseline and 3 months, which were reinforced by telephone counseling at 2 and 4 months. The primary endpoint is the percentage change in lipid profiles (Total Cholesterol, Triglycerides, HDL-C, LDL-C) from baseline to 6 months. Secondary endpoints include changes in blood pressure, HbA1c, and quality of life assessed by SF-36.

Results

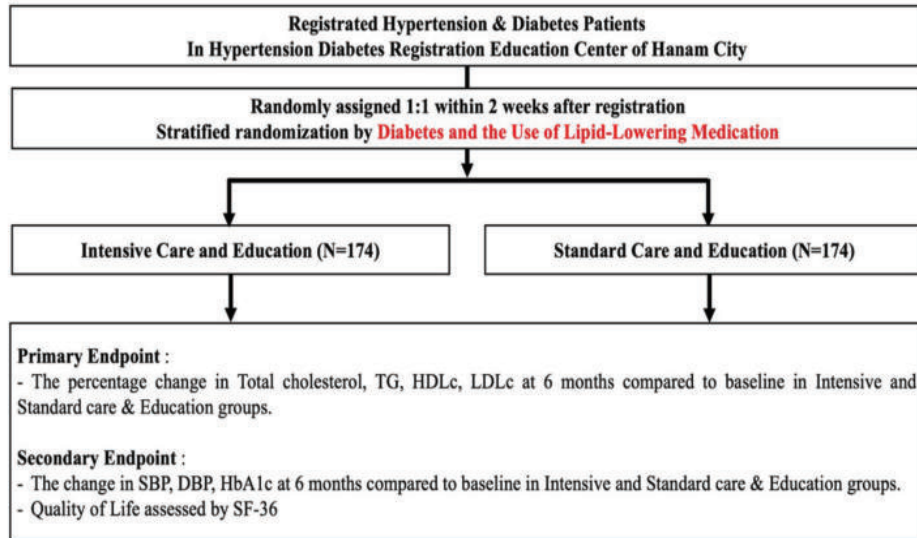
This abstract reports the baseline characteristics of the enrolled population. The two groups were well-matched at baseline. The mean age, sex distribution, and clinical parameters showed no significant differences between the intensive and standard groups. For instance, the mean baseline LDL-cholesterol was 86.3 ± 26.6 mg/dL in the intensive group and 87.4 ± 30.0 mg/dL in the standard group ($p=0.728$). Similarly, the mean baseline systolic blood pressure was 132.7 ± 16.4 mmHg and 136.3 ± 18.2 mmHg, respectively ($p=0.055$). Key comorbidities such as the prevalence of diagnosed dyslipidemia (78.6% vs. 78.9%) and medication adherence were also comparable. The 6-month follow-up for the primary and secondary endpoints is currently underway.

Conclusion

In this randomized controlled trial evaluating a structured educational program for dyslipidemia, the baseline characteristics of the intensive and standard care groups were well-balanced. The final results of this study will provide crucial evidence on whether an intensive and repeated educational intervention can effectively improve lipid profiles and cardiovascular risk factors in patients with hypertension and diabetes.

Figure

Comparison of Intensive Versus Standard Care and Education for Dyslipidemia in Patients with Hypertension and Diabetes



Table

group	Intensive Group	Standard Group	p
	(N=173)	(N=175)	
pre_wt	62.9 ± 10.3	64.2 ± 11.9	0.262
pre_BMI	24.7 ± 3.3	25.6 ± 7.4	0.148
pre_Pulse	74.9 ± 11.2	76.2 ± 10.7	0.291
pre_FBS	111.1 ± 26.0	113.3 ± 36.5	0.511
pre_HbA1c	6.5 ± 1.0	6.6 ± 1.1	0.499
pre_SBP	132.7 ± 16.4	136.3 ± 18.2	0.055
pre_DBP	73.4 ± 9.9	76.2 ± 12.5	0.025
pre_TC	160.6 ± 29.2	162.8 ± 34.3	0.522
pre_TG	119.1 ± 62.1	125.5 ± 75.2	0.381
pre_HDLc	58.5 ± 13.0	58.4 ± 14.6	0.920
pre_LDLc	86.3 ± 26.6	87.4 ± 30.0	0.728
pre_HbA1c	6.5 ± 1.0	6.6 ± 1.1	0.499

Poster Presentation

Day 2_November 7 (Fri.)

PP-A1 10:35-11:45

Zone A, Studio 8+9+10

- PP-01 **Urinary Sodium to Potassium (Na/K) Ratio: Effect of Single and Combined Antihypertensive Therapy in Rodents**
Cesar Andres Romero (USA)
- PP-02 **Resveratrol Attenuates Myocardial Fibrosis and Improves Metabolic and Left Ventricular Diastolic Dysfunction in a High-Fat Diet-Induced Obese Hypertensive Model**
Kyung An Kim (Catholic University)
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- PP-07 **The Systemic Hemodynamic Atherosclerotic Syndrome among Hypertension with Optimal Office Blood Pressure: An Effective Predictor of MACCEs**
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Brijalkumar Patel (India)
- PP-10 **Impact of Health Education Combined with a Salt Meter on Salt Reduction Behaviors and Blood Pressure in Southern Thailand**
Sornsupang Kongniam (Thailand)

PP-A2 14:50-16:05

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- PP-11 Causal Inference on the Changes in Metabolic Syndrome Components and Cardiovascular Disease Incidence Attributable to Air Pollution Exposure**
Yong Whi Jeong (Yonsei University)
- PP-12 Dual AI-Agent Reasoning over Cardiovascular Knowledge Graphs for Explainable Diagnosis and Dynamic Risk Stratification in Heart Failure**
Rao Faizan (Pakistan)
- PP-13 Precision Simulation of Metabolic Risk Reduction: A Digital Twin Framework for Nonpharmacologic Blood Pressure Control**
Javad Alizargar (Iran, Islamic Republic of)
- PP-14 Uncertainty-Aware Machine Learning Model for Beat-to-Beat Blood Pressure Estimation and Short-Term Hypertensive Event Forecasting Across Clinical Domains**
Prihantini Prihantini (Indonesia)
- PP-15 Comorbid Hypertension and Diabetes Mellitus in Erectile Dysfunction among Hemodialysis Patients with Chronic Kidney Disease: A Regression Analysis**
Tohari Tohari (Indonesia)

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- PP-16 Combined Impact of Proteinuria and Blood Pressure Variability on Clinical Outcomes after Percutaneous Coronary Intervention**
Byung Sik Kim (Hanyang University)
- PP-17 The Association between Arterial Stiffness and Socioeconomic Status: A Cross-Sectional Study Using Estimated Pulse Wave Velocity**
Hack-Lyoung Kim (Seoul National University)
- PP-18 Gender Differences in Ideal Cardiovascular Health among Patients with Hypertension: A Cross-Sectional Study in Thai Primary Care**
Wichai Arab (Thailand)
- PP-19 Regional Inequities in the Cost of Hypertension and Comorbidities: Lessons for Indonesia's Health Policy**
Pisi Bethania Titalessy (Indonesia)
- PP-20 Ideal Cardiovascular Health, Person and Clinical Factors, and Their Association with Microalbuminuria in Patients with Hypertension: A Cross-Sectional Study in Thai Primary Care**
Jom Suwanno (Thailand)
- PP-21 Investigation of Screening for Primary Aldosteronism in an Adrenalectomy Population: A Multicenter Cross Sectional Study**
Yang Yu (China)
- PP-22 Triple Antihypertensive in a Single Pill Therapy: A Multi-Center Study in Western Part of India**
Jatinkumar Dhanani (India)

Day 2_November 7 (Fri.)

PP-A1_ 10:35-11:45

PP-01

Urinary Sodium to Potassium (Na/K) Ratio: Effect of Single and Combined Antihypertensive Therapy in Rodents

Veronica Posse, Clara Ryu, Sihyun Jeon, Cesar Andres Romero*Renal Division, Emory University School of Medicine, Atlanta, Georgia, United States*

Introduction

The urinary sodium-to-potassium ratio (Na/K) is linked to hypertension, with ratios >2 indicating excess sodium or insufficient potassium intake. The effect of antihypertensive drugs on urinary Na/K is unknown. We hypothesized that antihypertensives acutely alter Na/K.

Methods

C57BL/6J mice (male/female, 14 weeks; separate cohort, 24 months) received chow (NaCl 0.4%) or high-salt diet (4%). Blood pressure was measured thrice weekly. Na/K was assessed in spot and 24h urine; spot accuracy was validated. After baseline, mice received 2 weeks of enalapril (25 mg/kg/day), hydrochlorothiazide (25 mg/kg/day), amlodipine (10 mg/kg/day), or combinations, via gel food. Na/K ratios on day 1 (acute) and day 8 (subacute) were compared with vehicle using two-way ANOVA.

Results

On chow, Na/K was 0.65 ± 0.58 ($n=15$) without sex- or age-interactions (all $p>0.5$). High salt increased Na/K to 4.5 ± 2.2 ($p<0.01$ vs. chow), unchanged over 2 weeks. Enalapril and hydrochlorothiazide had no effect ($p>0.05$). Amlodipine lowered Na/K in acute and subacute periods (3.9 ± 1.1 vs. 2.6 ± 1.3 ; $p<0.001$), with no sex or age effect. Enalapril+amlodipine blunted this decrease ($p>0.05$). 24h urine suggested increased K excretion with amlodipine, restored by enalapril. Urinary aldosterone rose with amlodipine and fell with enalapril.

Conclusion

Na/K reflects salt and potassium intake. Enalapril and hydrochlorothiazide do not alter Na/K. Amlodipine lowers Na/K via RAAS activation, prevented by co-treatment with enalapril

PP-02

Resveratrol Attenuates Myocardial Fibrosis and Improves Metabolic and Left Ventricular Diastolic Dysfunction in a High-Fat Diet-Induced Obese Hypertensive Model

Kyung An Kim¹, Byung-Kwan Lim², Ji-Wha Shin², Sang-Hyun Ihm³

¹Cardiology, Incheon St. Mary's Hospital, The Catholic University of Korea, Seoul, Korea, Republic of

²Biological Science, Jungwon University, Goesan-gun, Korea, Republic of

³Cardiology, Bucheon St. Mary's Hospital, The Catholic University of Korea, Seoul, Korea, Republic of

Introduction

Obesity-induced myocardial fibrosis is associated with left ventricular (LV) diastolic dysfunction and ultimately heart failure. Resveratrol is a polyphenol that has been reported to have anti-diabetic, anti-fibrotic, and cardio-protective effects. We investigated whether resveratrol could ameliorate myocardial fibrosis and LV dysfunction in high fat diet induced obese hypertensive model.

Methods

Eight-week-old male Wistar-Kyoto rats (WKY, n=8) and spontaneously hypertensive rats (SHR) fed an HFD were randomized to resveratrol (25 mg/kg/day; SHR-HFD-R, n=8) or control (SHR-HFD-C, n=8) for 12 weeks. At 20 weeks, metabolic studies, blood pressure measurements, and Doppler echocardiography were performed. Histological fibrosis, myocardial mRNA expression (TGF- β 1, collagen)

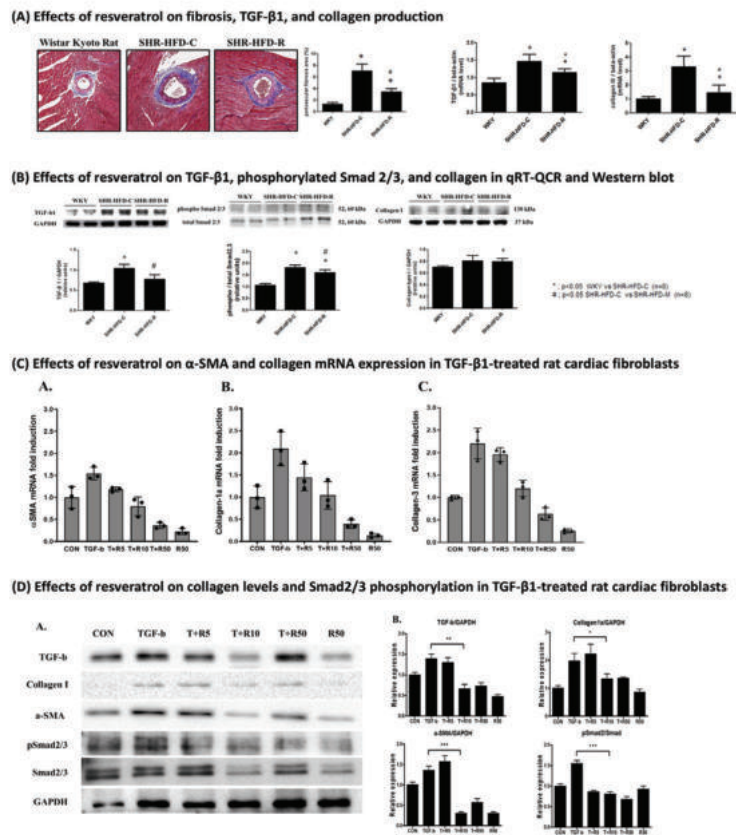
Results

Compared with WKY, SHR-HFD-C developed significant hypertension, hyperglycemia, and perivascular fibrosis. Resveratrol improved glucose tolerance, reduced systolic blood pressure, and ameliorated LV diastolic dysfunction (E/A ratio, 1.38 ± 0.05 vs. 1.57 ± 0.11 ; E/e', 26.8 ± 7.7 vs. 17.9 ± 3.6 ; both $p < 0.05$). However, LV hypertrophy and systolic dysfunction were not improved. Resveratrol significantly downregulated myocardial TGF- β 1 expression, inhibited Smad2/3 phosphorylation, and reduced collagen deposition. In vitro, resveratrol suppressed TGF- β 1-induced collagen production and Smad2/3 activation in cardiac fibroblasts.

Conclusion

Diet-induced obese hypertensive rats exhibited elevated blood pressure, LV diastolic dysfunction and aggravated myocardial fibrosis. Resveratrol effectively improved metabolic and hemodynamic profiles and reduced fibrosis through modulation of the TGF- β /Smad pathway, supporting its therapeutic potential in obesity-related hypertensive heart disease.

Figure



Table

Variables	WKY	SHR-HFD-C	SHR-HFD-R
General characteristics			
Pre-body weight, g	213±5.7	206±7.0	204±8.9
Post-body weight, g	425±12.6	443±25.5	431±18.2
Heart weight, g	1.15±0.06	1.55±0.12*	1.52±0.04*
Tibia length, cm	3.88±0.10	3.85±0.06	3.92±0.08
Heart/tibia ratio, g/cm	0.30±0.01	0.40±0.04*	0.39±0.01*
Systolic BP, mmHg	127±2	226±5*	213±6*#
Intraperitoneal glucose tolerance test results			
Fasting glucose(mg/dL)	124±7	136±5*	137±9*
After 30m glucose (mg/dL)	203±27	297±12*	268±17*#
After 1hr glucose (mg/dL)	147±11	223±12*	183±22*#
After 2hr glucose (mg/dL)	124±6	152±10*	145±7*
Echocardiographic parameters			
IVSd, mm	1.06±0.07	1.25±0.18*	1.27±0.15*
LVPWd, mm	1.02±0.04	1.24±0.18*	1.23±0.17*
LVIDd, mm	8.28±0.86	9.20±0.37*	9.47±0.66*
LVIDs, mm	5.31±0.88	6.00±0.30	6.28±0.78
FS, %	36.15±4.30	34.78±1.42	33.88±4.05
E/A ratio	1.74±0.03	1.38±0.05*	1.57±0.11*#
DT, msec	30.31±2.77	34.77±4.95	32.80±2.36
E/E'	16.66±4.08	26.80±7.72	17.89±3.63#

PP-03

Epicardial Adipose Tissue Impairs Left Atrial Mechanics and Mediates Insulin Resistance Effects in Hypertensive Overweight/Obese Patients

Yan Liu, Xu Zhao, Shuang Yin, Yu Pan, Tingting Fu, Chongfu Jia, Yinong Jiang

Cardiology, The First Affiliated Hospital of Dalian Medical University, Dalian, China

Introduction

Epicardial adipose tissue (EAT) is a visceral fat depot implicated in cardiovascular disease pathogenesis. However, its impact on left atrial (LA) mechanics in hypertensive overweight/obese patients remains unclear. We aimed to investigate the association between EAT volume (EATV) and LA dysfunction in this high-risk patients.

Methods

In this cross-sectional study, 264 hypertensive overweight/obese patients ($\text{BMI} \geq 24 \text{ kg/m}^2$) underwent coronary computed tomography angiography (CCTA) for EATV quantification and two-dimensional speckle-tracking echocardiography (2D-STE) for LA strain analysis. Participants were stratified by median EATV (72.67 cm^3) into low-EATV ($<72.67 \text{ cm}^3$, $n=132$) and high-EATV ($\geq 72.67 \text{ cm}^3$, $n=132$) groups. LA reservoir (LAs-s), conduit (LAs-e), and booster (LAs-a) strains, and LA stiffness index (LASI) were assessed. Multivariable regression and mediation analyses (Hayes' PROCESS) evaluated associations adjusted for cardiometabolic confounders.

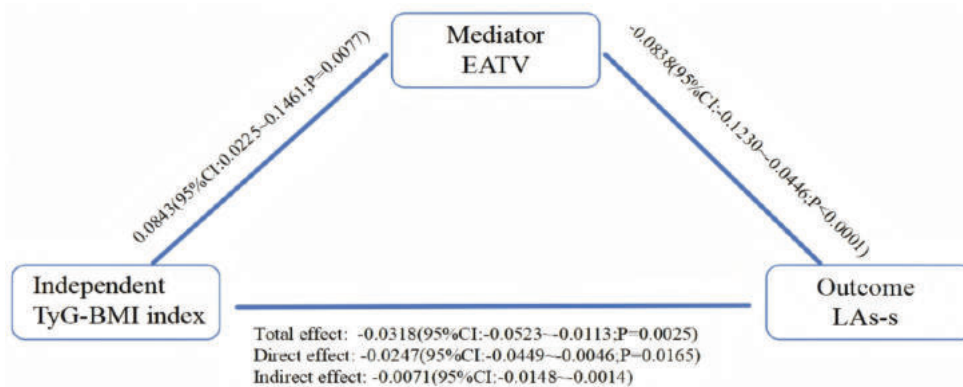
Results

High-EATV patients exhibited higher male prevalence (75.0% vs. 55.3%, $p=0.001$), BMI (29.03 vs. 28.02 kg/m^2 , $p=0.035$), smoking rates (46.2% vs. 32.6%, $p=0.023$), and TyG-BMI (45.11 vs. 38.02 , $p=0.019$). Despite similar conventional echocardiographic parameters, high-EATV patients showed impaired LA mechanics: reduced LAs-s ($24.40 \pm 6.44\%$ vs. $27.00 \pm 6.26\%$, $p=0.001$), LAs-e (median 10.00% vs. 11.63% , $p<0.05$), LAs-a (13.50% vs. 14.34% , $p<0.05$), and elevated LASI (0.37 vs. 0.31 , $p=0.001$). EATV correlated negatively with LA strains (LAs-s: $\beta=-0.230$, $p<0.001$; LAs-e: $\beta=-0.187$, $p=0.002$; LAs-a: $\beta=-0.178$, $p=0.004$) and positively with LASI ($\beta=0.218$, $p<0.001$). After multivariable adjustment, EATV independently predicted LAs-s, LAs-a, and LASI ($p<0.05$ for all). Mediation analysis revealed that EATV mediated 22.3% of TyG-BMI's adverse effect on LAs-s (indirect effect: $\beta=-0.0071$, 95% CI: -0.0148 to -0.0014).

Conclusion

Increased EATV independently associated with impaired LA mechanics and stiffness in hypertensive overweight/obese patients. Furthermore, EATV mediated partially the effect of insulin resistance's impact on LA reservoir strain. EATV quantification may enhance early risk stratification for atrial cardiomyopathy in metabolic hypertension.

Figure



Table

Comparison of Cardiac Structure and Function among Different EATV Groups

	Group I EATV<72.67cm ³ N=132	Group II EATV≥72.67cm ³ N=132	P
LVEF (%)	60.00(58.25,60.00)	60.00(59.00,60.00)	0.914
LVMI (g/m ²)	93.25(82.01,110.92)	99.97(87.71,115.07)	0.067
E/A ratio	0.86(0.74,1.11)	0.84(0.73,1.07)	0.561
E/e' ratio	8.36(6.80,10.00)	9.00(7.00,11.00)	0.061
LAVI (g/m ²)	29.24(22.69,36.16)	29.98(24.40,37.36)	0.347
LAS-s (%)	27.00±6.26	24.40±6.44	0.001*
LAS-e (%)	11.63(8.98,15.40)	10.00(7.58,13.48)	0.007*
LAS-a (%)	14.34(12.41,16.95)	13.50(11.02,15.90)	0.024*
LASI	0.31(0.22,0.40)	0.37(0.28,0.48)	0.001*

EATV epicardial adipose tissue volume, LVEF left ventricular ejection fraction, LVMI left ventricular mass index, E/A the early to late diastolic transmitral flow velocity ratio, E/e' the ratio of early diastolic transmitral flow velocity to early diastolic mitral annular velocity, LAVI left atrial volume index, LAS-s left atrial reservoir strain, LAS-e left atrial conduit strain, LAS-a left atrial booster strain, LASI Left atrial stiffness index. **p* < 0.05.

PP-04

Tobacco Control and Hypertension Burden in ASEAN: A Comparative Analysis of Country Responses to Risk Factor Exposure

Bertha Lovita Dwi Intania Permana

Public Policy, YAMADA Consulting & Spire, Indonesia, Jakarta, Indonesia

Introduction

To compare tobacco policy responses across ASEAN countries and examine how these responses relate to smoking prevalence that leads to the burden of hypertension.

Methods

This study utilized data from the WHO NCD Country Profiles (2019–2023) covering ten ASEAN countries and were analyzed through three main components: Policy Response Assessment: 13 (thirteen) policy indicators were reviewed from the WHO NCD portal, including national policies, treaties, surveillance, clinical guidelines, and medicines. Five WHO demand-reduction strategies were also included: excise taxes, smoke-free policies, health warnings/plain packaging, advertising bans, and mass media campaigns. Scoring & Categorization: each measure was scored (Fully Achieved/Yes = 2; Partially Achieved = 1; Not Achieved/No = 0). Scores were summed, converted to a 0–100% Policy Strength Score, and countries were categorized as Strong ($\geq 67\%$), Moderate (46–66%), or Weak ($< 46\%$). Tobacco Use Prevalence: current tobacco use among adults aged 15+ (2022) was extracted from the WHO NCD Portals (Tobacco Use) of Country Profiles. Note: 1) The latest available year of data varies across countries (2015–2023). To ensure comparability, WHO-modeled, age-standardized estimates were used. Interpretations focus on cross-country differences rather than temporal trends. 2) Countries with Not Applicable items were normalized based on fewer indicators.

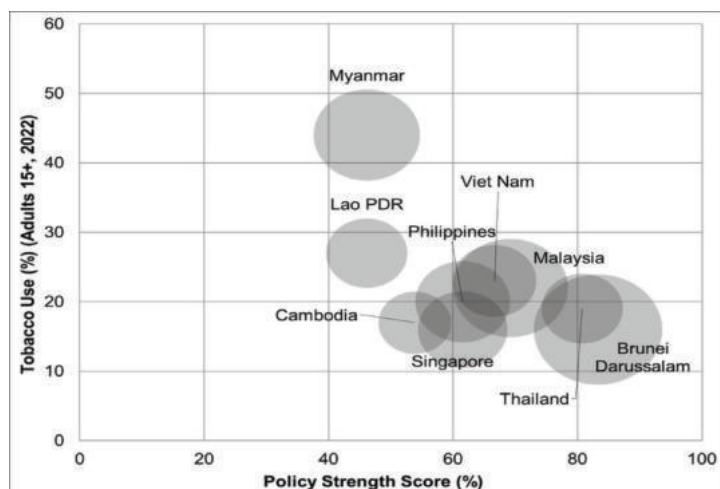
Results

Policy responses to tobacco control varied considerably across ASEAN countries. Brunei (83.33%) and Thailand (80.77%) achieved the strongest policy frameworks, with most measures fully implemented, though Brunei's score excluded excise taxation, which limits direct comparability. Malaysia (69.23%) and Viet Nam (66.67%) also scored in the strong range, reflecting substantial adoption of tobacco control strategies. Countries with moderate scores included Singapore (61.54%), the Philippines (61.54%), Cambodia (53.85%), Myanmar (46.15%), and Lao PDR (46.15%), where many measures were only partially achieved. In contrast, Indonesia (34.62%) demonstrated the weakest policy response, with multiple indicators not achieved, particularly in taxation, advertising bans, and cessation support. Across ASEAN, an inverse association is observed between tobacco control policy strength and tobacco use: stronger frameworks correspond with lower tobacco use (e.g., Thailand 80.77% policy, 19% use; Viet Nam 66.67% policy, 23% use), while weaker environments show higher tobacco use (Indonesia 34.62% policy, 38% use; Myanmar 46.15% policy, 44% use). Hypertension burden shows mixed outcomes: it is high in some strong-policy countries (Brunei 83.33% policy, 16% use, 46% hypertension) indicating other drivers (obesity, diet, salt, care access), but remains consistently high where policies are weak and smoking is high (Indonesia, Myanmar). Cambodia (53.85% policy, 17% use, 26% hypertension) illustrates how moderate policy with effective implementation can coincide with low-risk exposure and lower burden.

Conclusion

Stronger tobacco control policies in ASEAN are linked to lower smoking prevalence and improved hypertension control, whereas weak policy environments sustain high risk exposure and uncontrolled disease burden. Tobacco control must be complemented by broader NCD prevention strategies addressing diet, obesity, and healthcare access.

Figure



Table

Indicator Name	IDN	MYS	SGP	BRN	VNM	PHL	KHM	LAO	MMR	THA
Policies and targets										
Has an operational tobacco policy	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓
Has national target addressing tobacco use	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
International treaties										
Party to the WHO Framework Convention on Tobacco Control (FCTC)	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓
Party to the Protocol to Eliminate Illicit Trade in Tobacco Products	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Advertising restrictions, packaging regulations and smoke-free legislation										
Smoke-free policies	○	○	○	●	○	○	●	●	○	●
Large graphic health warnings/plain packaging	○	●	●	●	●	●	●	●	●	●
Bans on advertising, promotion and sponsorship	○	○	○	○	○	○	○	●	○	○
Anti-tobacco public awareness campaigns										
Mass media campaigns	○	●	○	○	●	○	○	○	○	●
Fiscal interventions										
Increased excise taxes and prices	○	○	○	Not Applicable	Not Applicable	○	○	○	○	●
Surveillance										
Conducted recent, national survey covering tobacco use	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓
Clinical management guidelines										
Has management guidelines for tobacco dependence	✓	✓	✗	✓	✓	✓	✗	✗	✓	✓
Medicines										
Nicotine replacement therapy generally available	✗	✓	✓	✓	✗	✗	✗	✗	✗	✗
Non-nicotine cessation medication generally available	✗	✗	✗	✓	✗	✗	✗	✗	✗	✓
Policy Strength Score (%)	34.62	69.23	61.54	83.33	66.67	61.54	53.85	46.15	46.15	80.77
Policy Strength Category	Weak	Strong	Moderate	Strong	Strong	Moderate	Moderate	Moderate	Moderate	Strong

PP-05

Bridging the Universal Health Coverage Index in ASEAN: Hypertension as a Tracer for Noncommunicable Diseases

Deda Annasia Yuliasatri

Division of Consumer Research, Yamada Consulting & Spire, Indonesia, Jakarta, Indonesia

Introduction

To compare overall UHC and UHC-NCD indices across ASEAN countries and to assess how gaps in coverage relate to the hypertension care cascade of diagnosis, treatment, and control.

Methods

This study used secondary data from: 1) The WHO/World Bank UHC Service Coverage Index (2021), including the sub-index on noncommunicable diseases 2) The WHO Hypertension Country Profiles (2019), which report age-standardized prevalence among adults aged 30–79 years. 3) The UHC–NCD gap was calculated by subtracting NCD sub-index values from overall UHC scores. 4) Hypertension outcomes were assessed using the cascade of diagnosis, treatment, and control. Cross-country comparisons were conducted to examine the relationship between UHC–NCD gaps and performance along the hypertension cascade.

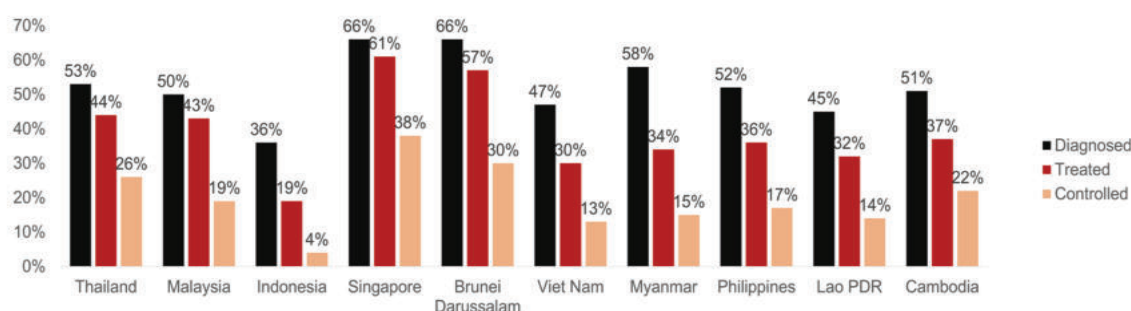
Results

There are noticeable differences between the UHC index for NCD services and the general UHC index in ASEAN countries. Most countries show lower performance in NCD-related services, indicating that although overall health coverage is improving, non-communicable diseases, including hypertension, are still not being adequately addressed. Significant disparities emerged across ASEAN. The largest gaps were seen in Malaysia, Thailand, and Indonesia, indicating that high overall UHC has not been converted into sufficient NCD service readiness. While Cambodia and the Philippines scored better in NCD services, despite having less general coverage, Singapore and Myanmar demonstrated a more balanced performance, which suggests a specific policy focus. Comparing the UHC–NCD gap with the hypertension care cascade highlights which countries can translate coverage into effective diagnosis, treatment, and control, and which remain constrained by weak NCD integration. ASEAN countries fall into three clusters. Thailand, Malaysia, and Indonesia show a high gap–low control pattern, where strong overall UHC has not translated into effective NCD services. Singapore and Brunei represent the low gap–high control group, reflecting how integrated NCD services support better hypertension outcomes. The remaining countries, including Viet Nam, Myanmar, Philippines, Cambodia, and Lao PDR, fall into a moderate group with partial progress but persistent misalignment between UHC and control. These disparities underscore the need to move beyond diagnostic access, focusing on strengthening treatment and control, integrating NCD services within UHC, and addressing broader health determinants. Bridging these gaps is critical for effective and sustainable UHC for NCDs in ASEAN.

Conclusion

The gap between the national UHC index and the achievement of NCD service coverage, along with the low rates of hypertension control across most ASEAN countries, underscores the critical need to strengthen the integration of NCD services within the UHC framework. Hypertension serves as an effective tracer, illuminating key challenges within ASEAN's health systems in their pursuit of inclusive and equitable Universal Health Coverage.

Figure



Table

Table 1. UHC Index vs UHC for NCD Services in ASEAN (2021)

Country	UHC Service Coverage Index 2021	UHC sub-index on noncommunicable diseases 2021	Gap
Thailand	82	67	15
Malaysia	76	61	15
Singapore	89	77	12
Brunei Darussalam	78	67	11
Indonesia	55	44	11
Viet Nam	68	58	10
Myanmar	52	50	2
Philippines	58	62	-4
Lao PDR	52	56	-4
Cambodia	58	64	-6

Source: World Health Organization, Universal Health Coverage Index (2021)

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PP-06

Association of Complete Blood Count-Derived Inflammatory Markers with All-Cause and Cardiovascular Disease Mortality in Hypertensive Patients Receiving Loop Diuretics Therapy: An Analysis of NHANES 1999-2018

Junxian Liu, Yin Hua Zhang

Department of Physiology and Biomedical Sciences, Seoul National University College of Medicine, Seoul, Korea, Republic of

Introduction

Loop diuretics (LDs) are commonly prescribed for hypertensive (HTN) patients. However, LDs are well recognized to be associated with increased mortality. Inflammation-based prognostic markers for the mortality in this population remain identified. This study investigated the associations of complete blood count (CBC)-derived inflammatory markers with all-cause and cardiovascular disease (CVD) mortality in HTN patients using LDs.

Methods

A total of 1,292 HTN individuals who received LDs therapy were identified from the National Health and Nutrition Examination Survey (NHANES, 1999–2018). Cox regression, restricted cubic spline (RCS), and stratified analyses were conducted to evaluate the associations of all-cause and CVD mortality with six CBC-derived inflammatory markers: neutrophil-to-lymphocyte ratio (NLR), monocyte-to-lymphocyte ratio (MLR), platelet-to-lymphocyte ratio (PLR), systemic immune-inflammation index (SII), systemic inflammation response index (SIRI), aggregate index of systemic inflammation (AISI). Time-dependent receiver operating characteristic (ROC) curve analysis was applied to compare the predictive performance of these markers at 3, 5, and 10 years.

Results

Over a median follow-up of 78.4 months, 686 deaths (53.1%) occurred, including 292 (22.6%) CVD deaths. After adjusting for all confounders, Cox regression analysis exhibited that all inflammation markers were positively correlated with all-cause and CVD mortality. Stratified analysis showed consistent associations across subgroups, while stronger all-cause mortality risks were observed in younger (<65 years) individuals with high NLR, MLR, SII, or AISI, and in obese (Body mass index (BMI) ≥ 30) individuals with high MLR; notably, older (≥ 65) individuals in the second quartile of SIRI had increased risks of both all-cause and CVD mortality. RCS analysis indicated that MLR was the only marker with a linear association with all-cause mortality, whereas the other five markers exhibited non-linear associations. For CVD mortality, linear associations were observed for all markers except SII, which showed a non-linear relationship. Time-dependent ROC analysis demonstrated that MLR exhibited the strongest predictive performance for both outcomes.

Conclusion

Elevated inflammatory markers were associated with all-cause and CVD mortality in HTN patients received LDs therapy. Especially, MLR demonstrated the most superior predictive performance. These CBC-derived inflammatory markers may serve as cost-effective and widely accessible prognostic tools to improve individualized risk stratification in HTN patients treated with LDs.

PP-07

The Systemic Hemodynamic Atherosclerotic Syndrome among Hypertension with Optimal Office Blood Pressure: An Effective Predictor of MACCEs

Doan Pham Phuoc Longd^{1,2}, Thi Lan Nhi Nguyen³

¹Department of Internal Medicine, Hue University of Medicine and Pharmacy, Hue University, Hue, Vietnam

²Hypertension Research and Advanced Treatment Unit, Vietnam Hypertension Society, Hue, Vietnam

³Department of Pharmacology, Hue University of Medicine and Pharmacy, Hue University, Hue, Vietnam

Introduction

Even when office blood pressure (BP) is optimally controlled (<120/80 mmHg), hypertensive patients continue to suffer major adverse cardiovascular and cerebrovascular events (MACCE). The Systemic Hemodynamic Atherosclerotic Syndrome (SHATS) - a composite score that incorporates arterial stiffness, endothelial function, nocturnal surge and home BP variability has been proposed as a marker of residual risk. We investigated SHATS as an independent predictor of MACCE in 841 hypertensive patients who achieved optimal office BP over 18 months.

Methods

Prospective multicentre cohort (3 tertiary hospitals, Hue City, Vietnam). From October 2022 to February 2024 we enrolled 841 adults with hypertension and office SBP/DBP <120/80 mmHg on ≥3 consecutive visits. Baseline SHATS was calculated from carotid - femoral pulse wave velocity, flow - mediated dilation, CIMT, nocturnal surge (ABPM) and home BP (24 hour ABPM + 7 day home monitoring). Patients were managed with monotherapy (n = 210), dual therapy (n = 312) or triple therapy (n = 319). The primary endpoint was a composite of cardiovascular death, myocardial infarction/unstable angina, ischemic/haemorrhagic stroke or heart failure admission. Cox proportional hazards models adjusted for age, sex, diabetes, LDL - C and statin use were used to estimate hazard ratios (HRs); ROC analysis assessed SHATS discriminative ability.

Results

192 MACCE occurred during a median follow - up of 18 months (22.8%). SHATS ≥12 identified patients at high risk (HR: 1.17 per point, 95% CI: 1.09–1.26; p < 0.001). Dual therapy reduced MACCE risk by 56% (HR: 0.44, 95% CI: 0.30–0.65) and triple therapy by 70% (HR: 0.30, 95% CI: 0.18–0.51) relative to monotherapy after adjustment. Home BP and mean SHATS score fell progressively with treatment intensity (11.6 to 9.8 to 7.7 mmHg; 12.4 to 10.3 to 8.2). The SHATS cut - off of 12 had 90% sensitivity, 84% specificity and an AUC of 0.87 for predicting MACCE over the study period. Day - by - day home BP variability—but not visit - to - visit or diurnal variation alone was significantly associated with MACCE (p < 0.01).

Conclusion

In hypertensive patients who attain optimal office BP, SHATS remains a powerful independent predictor of MACCE and provides additional prognostic information beyond conventional BP control. Incorporating SHATS into routine risk assessment could identify high - risk individuals who may benefit from intensified pharmacologic strategies.

Figure

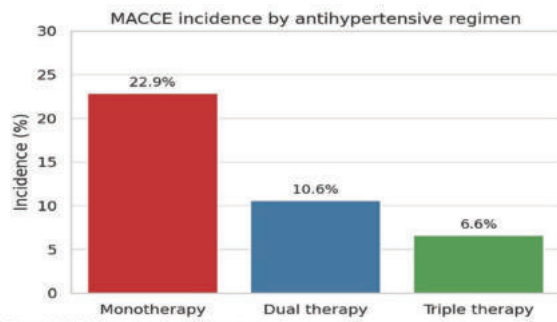


Figure 1 MACCE Incidence by Antihypertensive Regimen

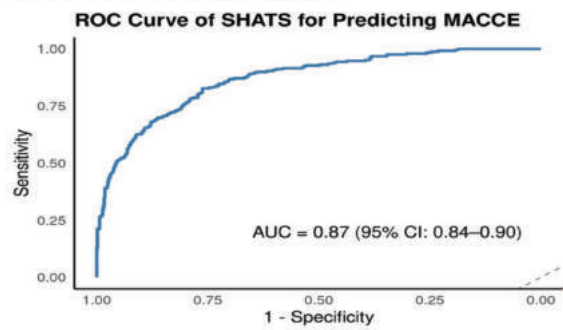


Figure 2 – ROC Curve for SHATS Predicting MACCE

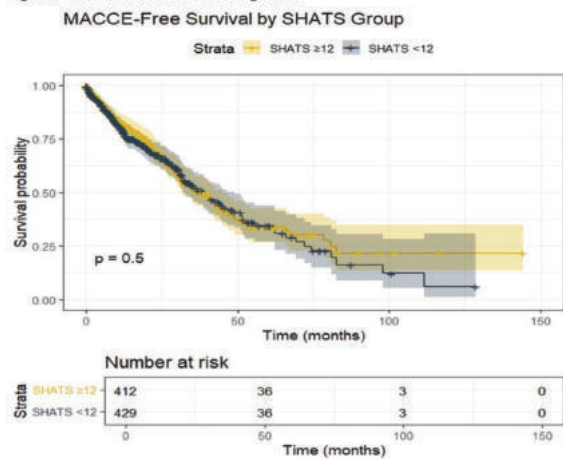


Figure 3 – Kaplan–Meier Curves by SHATS Group

Table

Table 1: Baseline characteristics of the study cohort

Variable	Value
Age, yr	58.3 ± 12.9
Male sex	463 (55 %)
Diabetes mellitus	186 (22 %)
Hyperlipidaemia	327 (39 %)
Current smoker	124 (15 %)
Office SBP/DBP, mmHg	122.5 ± 6.4 / 76.3 ± 4.9
Home BP SD, mmHg	10.8 ± 3.2
Mean SHATS score	11.0 ± 3.5
SHATS ≥12	287 (34 %)

Table 2. Outcomes by antihypertensive regimen

Regimen	n	Home BP SD (mmHg)	Mean SHATS score	MACCE incidence (%)	Adjusted HR vs monotherapy
Monotherapy	210	11.6 ± 3.2	12.4 ± 3.5	22.9	Reference
Dual therapy	312	9.8 ± 2.9	10.3 ± 3.1	10.6	0.44 (0.30–0.65)
Triple therapy	319	7.7 ± 2.5	8.2 ± 2.9	6.6	0.30 (0.18–0.51)

Table 3 – Multivariable Cox Model for MACCE

Variable	HR	95 % CI	p-value
SHATS (per point)	1.15	1.07–1.24	<0.001
Age (year)	1.04	1.02–1.06	<0.001
Male sex	1.12	0.90–1.40	0.28
Diabetes	1.31	0.98–1.75	0.07
LDL-C (mg/dl)	1.01	0.99–1.02	0.42
Statin use	0.83	0.60–1.15	0.27

Table 4 compares the predictive performance of the full SHATS score with a model that uses each component separately

Model	Variable(s)	HR per unit	95 % CI	AIC	C-statistic
A (components)	cfPWV	1.07	1.03–1.11	1123	0.84
	FMD	0.93	0.88–0.98		
	CIMT	1.12	1.06–1.18		
	Nocturnal surge	1.04	1.01–1.07		
	Home-BP SD	1.09	1.05–1.13		
B (composite)	SHATS per point	1.15	1.07–1.24	1129	0.87

PP-08

The Association between Nocturnal Systolic and Diastolic Blood Pressure and Preeclampsia Risk in Pregnancy

Nilamkumari Patel, Hitesh Patel

Health and Family Welfare Department, ESIS General Hospital, Surat, Gujarat, India

Introduction

The clinical implications of isolated elevations in systolic or diastolic blood pressure, as opposed to concurrent elevations in both, remain understudied in pregnant women. This study investigates the relationship between specific blood pressure components (daytime vs. nocturnal, systolic vs. diastolic) and the development of preeclampsia (PE) across various gestational stages.

Methods

We conducted a historical cohort study of 1402 high-risk pregnant women (mean age 30 ± 6 years). Ambulatory blood pressure monitoring (ABPM) was performed during three gestational periods: 12-19 weeks ($n = 392$), 20-27 weeks ($n = 802$), and 28-36 weeks ($n = 1184$). We constructed three statistical models to analyze blood pressure patterns: an unadjusted model (Model 1), a model adjusting for diurnal variations (Model 2), and a fully adjusted model (Model 3) accounting for maternal demographics, medical history, and medication use.

Results

Preeclampsia incidence increased with gestational age, affecting 16.2%, 20.2%, and 21.6% of women evaluated at 12-19, 20-27, and 28-36 weeks, respectively (Table 1). After 20 weeks, sustained and isolated nocturnal hypertension strongly predicted preeclampsia. In contrast, before 20 weeks, only sustained hypertension increased risk. The predictive value of ambulatory blood pressure monitoring (ABPM) components improved after 20 weeks. In late pregnancy, systolic and diastolic ABPM levels, as well as nocturnal hypertension (isolated systolic, isolated diastolic, and combined systolic-diastolic), were significantly associated with preeclampsia risk. Systolic-diastolic nocturnal hypertension conferred the highest risk. Notably, nocturnal ABPM levels outperformed daytime levels in predicting preeclampsia.

Conclusion

Our findings underscore the prognostic significance of nocturnal blood pressure elevations, specifically systolic and diastolic components, in predicting preeclampsia beyond 20 weeks of gestation. Moreover, the robust association between nocturnal hypertension and preterm preeclampsia persists despite adjustment for diurnal blood pressure variability and other potential covariates, highlighting the importance of nocturnal blood pressure monitoring in identifying high-risk pregnancies.

Table

Table 1. Risk of preeclampsia and preterm PE of ABPM phenotypes across gestational periods

Gestational periods	Parameter	All women	Normotension	Isolated daytime	Isolated nocturnal	Sustained
12-19 weeks	ABPM phenotype, n	392	280	10	37	65
	Age, mean $\pm$ SD	30 $\pm$ 7	30 $\pm$ 6	31 $\pm$ 6	30 $\pm$ 7	32 $\pm$ 8
	Risk of PE per 100	16.2%	10.1%	24.1%	9.4%	35.2%
	Risk of preterm PE per 100	10.4%	6.9%	12.6%	6.9%	25.6%
20-27 weeks	ABPM phenotype, n	802	581	21	102	98
	Age, mean $\pm$ SD	30 $\pm$ 7	30 $\pm$ 6	31 $\pm$ 7	29 $\pm$ 7	32 $\pm$ 6
	Risk of PE per 100	20.2%	10.2%	4.2%	35.6%	48.2%
	Risk of preterm PE per 100	12.2%	5.6%	4.2%	28.6%	36.2%
28-36 weeks	ABPM phenotype, n	1184	718	21	207	238
	Age, mean $\pm$ SD	30 $\pm$ 7	30 $\pm$ 8	29 $\pm$ 6	31 $\pm$ 6	29 $\pm$ 6
	Risk of PE per 100	21.6%	7.9%	9.6%	30.6%	49.6%
	Risk of preterm PE per 100	10.2%	1.1%	5.2%	12.8%	34.6%

PP-09

The Triglyceride-Glucose Index and Hypertension in Chronic Kidney Disease: Associations with Resistant and Refractory Hypertension

Brijalkumar Patel, Jatin Dhanani

Pharmacology Department, GMERS Medical College and Hospital, Navsari, Gujarat, India

Introduction

Although the triglyceride-glucose (TyG) index has been linked to hypertension, its relationship with resistant hypertension and hypertension severity in patients with chronic kidney disease (CKD) remains understudied. This study examines the association between the TyG index and resistant hypertension, as well as hypertension severity, in the CKD population.

Methods

We analyzed data from 4046 participants with chronic kidney disease (CKD). Using binary and ordered logistic regression, we evaluated the relationship between the triglyceride-glucose (TyG) index and hypertension categories (uncontrolled, resistant, and refractory) and severity. Three models were constructed: Model 1 (unadjusted); Model 2 (adjusted for demographics, lifestyle factors, and body mass index); and Model 3 (further adjusted for lipid profiles, kidney function, diabetes, cardiovascular disease, and medication use).

Results

A striking association emerged between elevated TyG index quartiles and increased odds of hypertension categories, persisting even after covariate adjustment. Compared to the lowest quartile, the highest quartile had odds ratios (ORs) of 1.72 (95% CI: 1.29-2.46) for uncontrolled hypertension, 2.28 (95% CI: 1.46-3.62) for resistant hypertension, and 2.18 (95% CI: 1.21-4.02) for refractory hypertension (Table 1). The continuous TyG index mirrored these trends. Furthermore, higher TyG index levels were linked to greater hypertension severity, with ORs of 1.30 (95% CI: 1.12-1.72), 1.38 (95% CI: 1.14-1.86), and 1.82 (95% CI: 1.42-2.62) for quartiles 2-4 compared to quartile 1. Each unit increase in the TyG index amplified the odds of hypertension severity by 1.36 times (95% CI: 1.16-1.56).

Conclusion

Our investigation conclusively establishes a robust association between elevated TyG index levels and heightened susceptibility to diverse hypertension phenotypes, including uncontrolled, resistant, and refractory hypertension, alongside exacerbated disease severity. By elucidating the intricate relationship between TyG index levels and hypertension outcomes, our findings highlight the index's utility as a biomarker for identifying high-risk patients and informing targeted interventions in community settings.

Table

Table 1: Binary logistic regression analysis for the associations of TyG index with uncontrolled, resistant, and refractory hypertension

Hypertension category	Quartiles	Model 1		Model 2		Model 3	
		OR (95 % CI)	P value	OR (95 % CI)	P value	OR (95 % CI)	P value
Uncontrolled	Q1	Ref		Ref		Ref	
	Q2	1.82 (1.42-2.30)	<0.01	1.46 (1.08-1.74)	0.004	1.36 (1.10-1.84)	0.026
	Q3	1.94 (1.42-2.62)	<0.01	1.41 (1.06-1.72)	0.014	1.28 (0.94-1.69)	0.064
	Q4	2.72 (2.01-3.79)	<0.001	2.18 (1.68-2.92)	<0.001	1.72 (1.29-2.46)	<0.001
	Continuous	1.56 (1.37-1.82)	<0.001	1.48 (1.31-1.72)	<0.001	1.31 (1.16-1.52)	0.005
Resistant	Q1	Ref		Ref		Ref	
	Q2	1.72 (1.08-2.52)	0.045	1.32 (0.78-2.01)	0.372	1.32 (0.78-2.14)	0.242
	Q3	1.96 (1.32-3.14)	0.002	1.38 (0.82-2.34)	0.162	1.36 (0.82-2.18)	0.156
	Q4	2.96 (1.92-4.82)	<0.001	2.62 (1.54-4.24)	<0.001	2.28 (1.46-3.62)	<0.001
	Continuous	1.52 (1.21-1.68)	<0.001	1.62 (1.29-1.96)	<0.001	1.52 (1.26-1.98)	<0.001
Refractory	Q1	Ref		Ref		Ref	
	Q2	1.38 (0.72-2.42)	0.256	0.96 (0.54-1.81)	0.842	0.90 (0.48-1.58)	0.842
	Q3	2.14 (1.18-3.68)	0.012	1.42 (0.78-2.62)	0.206	1.41 (0.82-2.64)	0.224
	Q4	3.18 (1.72-5.82)	<0.001	2.74 (1.48-4.82)	<0.001	2.18 (1.21-4.02)	0.014
	Continuous	1.50 (1.16-1.92)	<0.001	1.64 (1.18-2.21)	<0.001	1.42 (0.86-2.24)	0.052

PP-10

Impact of Health Education Combined with a Salt Meter on Salt Reduction Behaviors and Blood Pressure in Southern Thailand

Sornsupang Kongniam

Department of Family Medicine, Huai Yot Hospital, Trang, Thailand, Trang, Thailand, Thailand

Introduction

To evaluate the impact of health education combined with a salt meter on salt-reduction behaviors, food saltiness, blood pressure, and knowledge in Southern Thailand.

Methods

An experimental study was conducted among community participants in Huai Nang Subdistrict, Trang Province, Thailand. All participants received structured health education and were provided with a salt meter to monitor food saltiness. Outcomes, including salt-reduction behaviors, food saltiness measured by a salt meter, blood pressure, and knowledge scores, were assessed at baseline and re-evaluated at 1, 3, and 6 months after the intervention.

Results

A total of 120 participants were enrolled in the program. Participants showed improvements in dietary behaviors related to salt reduction, accompanied by a significant decrease in the mean saltiness of food measured by a salt meter ($p < 0.001$). The mean knowledge scores also significantly increased across all follow-up periods. The mean systolic blood pressure (SBP) at baseline was 131.05 mmHg, which declined to 129.56, 128.43, and 127.54 mmHg at 1, 3, and 6 months, respectively; however, these changes were not statistically significant. When stratified by baseline blood pressure, participants with poorly controlled blood pressure ($SBP \geq 140$ mmHg) showed a significant reduction in mean SBP, from 148.46 mmHg at baseline to 132.75, 132.80, and 129.29 mmHg at 1, 3, and 6 months, respectively ($p < 0.001$, $p = 0.002$, and $p = 0.002$). In contrast, the mean diastolic blood pressure (DBP) showed no statistically significant changes throughout the follow-up period. No new cases of hypertension were identified among participants during the study.

Conclusion

Health education combined with the use of a salt meter reduced sodium intake, improved blood pressure, and promoted sustainable behavior change. Salt meters should be integrated into clinical and community practice to support global salt reduction initiatives.

Causal Inference on the Changes in Metabolic Syndrome Components and Cardiovascular Disease Incidence Attributable to Air Pollution Exposure

Yong Whi Jeong¹, Dae Ryong Kang²

¹*Department of Medical Informatics and Biostatistics, Graduate School of Yonsei University, Wonju, Korea, Republic of*

²*Department of Precision Medicine, Yonsei University, Wonju College of Medicine, Wonju, Korea, Republic of*

Introduction

Cardiovascular disease is a leading global cause of death and disability, and ambient air pollution is a modifiable risk factor. Mechanistic and epidemiologic evidence indicate that pollution perturbs blood pressure, glucose metabolism, and lipids through systemic inflammation, oxidative stress, endothelial dysfunction, and autonomic imbalance, thereby increasing the risk of metabolic syndrome (MetS) and CVD. Nevertheless, the causal pathway “air pollution → MetS components/MetS → CVD” and the role of MetS as an effect modifier remain insufficiently defined because of limitations such as imperfect temporal ordering, residential exposure misclassification, and high intercorrelation among co-pollutants. This study investigates the pathway from ambient air pollution (PM_{2.5}, PM₁₀, NO₂, SO₂, O₃, CO) to cardiovascular outcomes, focusing on metabolic syndrome (MetS) components—including waist circumference, systolic/diastolic blood pressure (SBP/DBP), fasting glucose, triglycerides, and low HDL cholesterol—as potential mediators and effect modifiers, and identifying biologically plausible exposure windows across short- and long-term scales.

Methods

The National Health Insurance Service–National Sample Cohort (NHIS-NSC) was used for analysis. Among beneficiaries who underwent ≥2 health screenings between 2009 and 2013 (n = 296,539), adults aged ≥50 years who were free of cancer, hypertension, and CVD at baseline were included, yielding a final analytic cohort of 84,941 individuals. For PM₁₀, NO₂, SO₂, CO, and O₃, daily concentrations were obtained from AirKorea monitoring stations and linked to participants’ residential areas. For PM_{2.5}, high-resolution (1 km × 1 km) estimates were assigned using the AiMS-CREATE machine learning exposure model. Exposure metrics were constructed for multiple temporal scales: (i) short-term lags (1–14 days), (ii) monthly moving averages (1–12 months), and (iii) annual moving averages (1–5 years). Mediators included MetS components (WC, SBP/DBP, fasting glucose, TG, and HDL) and incident MetS (harmonized definition). Outcomes included incident hypertension and incident CVD (myocardial infarction, angina, stroke), as well as CVD and all-cause mortality. Short-term effects were assessed using distributed lag non-linear models (DLNM), and long-term effects were estimated using Cox proportional hazards models (standard and time-dependent) with moving average exposures. To reduce confounding, generalized propensity score (GPS) methods (matching or weighting) were applied to each continuous exposure. Covariate balance was evaluated using both global diagnostics (mean absolute correlation between exposure and covariates; target <0.10) and local diagnostics (block-wise standardized bias). A pre-specified directed acyclic graph (DAG) was constructed through three steps: (1) identification of biologically plausible exposure windows based on DLNM, regression, and Cox models; (2) regression-based confounder selection for the exposure–outcome (X→Y), exposure–mediator (X→M), and mediator–outcome (M→Y) pathways; and (3) conditional independence testing for structure learning to validate adjustment sets. Under this DAG, total effects were decomposed into natural direct and indirect effects through MetS components. Causal mediation analysis (CMA) was conducted using three complementary approaches: (i) standard regression-based CMA (linear/logistic for X→M, Cox for M→Y), (ii) doubly robust augmented inverse-probability weighting (AIPW), and (iii) double machine learning (DML) mediation with cross-fitting. Exposure–mediator interactions were included when biologically plausible. Uncertainty was quantified using a nonparametric bootstrap (≥2,000 resamples).

Results

Short- and long-term exposures to PM₁₀, PM_{2.5}, SO₂, NO₂, CO, and O₃ were significantly associated with elevated levels of MetS components—particularly SBP/DBP, fasting glucose, TG, and low HDL—and with increased risks of hypertension, CVD (myocardial infarction, angina), and mortality. Notably, 5-year average exposures to PM_{2.5} and NO₂ showed consistent associations with incident hypertension and MetS components (e.g., SBP/DBP and TG), with the strongest effects observed at lag 6–14 days (short-term) and 1–5 years (long-term). GPS weighting achieved robust covariate balance, with global correlations reduced to <0.01 (mean: 0.0058), block-wise bias <0.20 (mean: 0.0055), and effective sample size preserved at 93%. GPS weighting-based causal mediation analysis demonstrated partial mediation through WC in selected exposure–outcome pathways. For example, the effect of long-term PM₁₀ exposure (5-year average) on all-cause mortality was mediated through WC by 2.3%. Similarly, NO₂ exposure (1–4-year moving averages) was associated with incident hypertension, with 1.4%–1.6% of the effect mediated through WC. Most pollutant–outcome relationships exhibited statistically significant total and direct effects, while indirect effects through MetS components were modest in magnitude. Specifically, PM₁₀, SO₂, and NO₂ exposures demonstrated mediation pathways through WC and SBP, contributing to myocardial infarction, stroke, and CVD mortality risk. These findings were robust across all three estimation approaches—regression-based CMA, AIPW, and DML—confirming

the stability of the proposed causal structure.

Conclusion

This study provides robust evidence that both short- and long-term exposure to ambient air pollution contributes to cardiometabolic dysregulation and increased risk of hypertension, CVD, and mortality. Although most effects were direct, partial mediation through WC—particularly linking PM10 to all-cause mortality and NO₂ to hypertension—supports the hypothesis that metabolic pathways partially mediate pollution-related cardiovascular risks.

PP-12

Dual AI-Agent Reasoning over Cardiovascular Knowledge Graphs for Explainable Diagnosis and Dynamic Risk Stratification in Heart Failure

Rao Faizan

Computer Science and Engineering, Kyung Hee University, Yongin, Korea, Republic of

Introduction

Timely and accurate diagnosis of heart failure (HF), especially heart failure with preserved ejection fraction, remains a critical challenge due to its clinical heterogeneity and overlapping symptoms with other conditions. This research proposes a dual-agent AI framework leveraging a cardiovascular knowledge graph to enable explainable diagnostic reasoning and dynamic risk stratification, aiming to improve patient-specific management strategies.

Methods

We introduce two specialized AI agents, Diagnostica and StratifAI, each serving a distinct role in the reasoning process. Both agents operate over a semantically enriched, ontology-aligned construct from structured EHRs, unstructured clinical notes, imaging metadata, and lab values. Diagnostica, the diagnostic agent, applies neuro-symbolic reasoning and graph traversal algorithms to identify candidate conditions, validate symptom clusters, and infer differential diagnoses based on contextual cues (e.g., comorbidities, time of onset, medication history). StratifAI, the stratification agent, uses temporal graph neural networks (TGNNs) to monitor evolving patient trajectories and predict short- and long-term HF-related outcomes by learning embeddings from the knowledge graph. The agents communicate asynchronously via a shared message-passing interface and refine each other's outputs through iterative belief revision and feedback, enhancing both explainability and model adaptability.

Results

In retrospective evaluations on real-world datasets (MIMIC-IV), the Diagnostica agent improved diagnostic accuracy for HFpEF by 22% compared to rule-based systems, while StratifAI reduced 30-day readmission prediction errors by 18%. The combined framework provided real-time, graph-based clinical narratives that were positively rated by clinicians (average interpretability score: 4.5/5).

Conclusion

The dual-agent, knowledge-graph-driven approach represents a novel paradigm for interpretable, dynamic reasoning in heart failure care. Future work will explore integration with digital health apps, adaptive learning in live environments, and expansion to multimorbidity reasoning across cardiovascular, renal, and metabolic disorders.

PP-13

Precision Simulation of Metabolic Risk Reduction: A Digital Twin Framework for Nonpharmacologic Blood Pressure Control

Javad Alizargar

Medicine, Kashan University, Kashan, Iran, Islamic Republic of

Introduction

Hypertension remains a leading cause of global morbidity and mortality. Traditional interventions often overlook population-wide scalability or the individualized impact of modifiable risk factors.

Methods

Using a large real-world dataset from the MJ Health Database (MJHD), we conducted multivariable regression and digital twin-based simulations to estimate blood pressure (BP) reductions under clinically safe modifications in body mass index (BMI), waist circumference, and the triglyceride-glucose (TyG) index. Adjusted regression coefficients were used to recalculate systolic and diastolic BP following 1 standard deviation reductions in each factor, while maintaining thresholds for clinical safety.

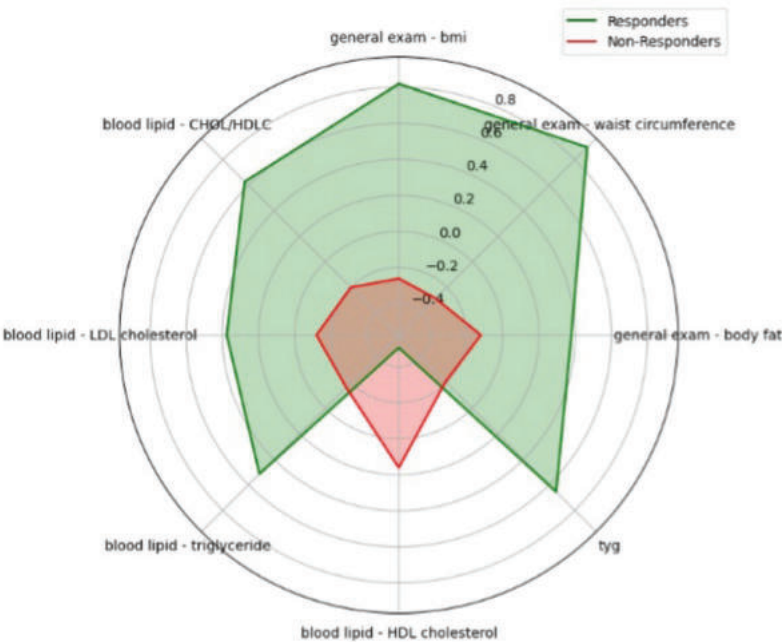
Results

Simulated reductions in TyG, BMI, and waist circumference led to meaningful decreases in both systolic and diastolic BP, with the combined intervention of all three variables yielding an average systolic BP reduction of 19.9 mmHg and reclassification of 22,770 individuals to lower American Heart Association (AHA) hypertension categories. Visualizations including waterfall, SHAP-style, and radar plots illustrated variable contributions and responder profiles.

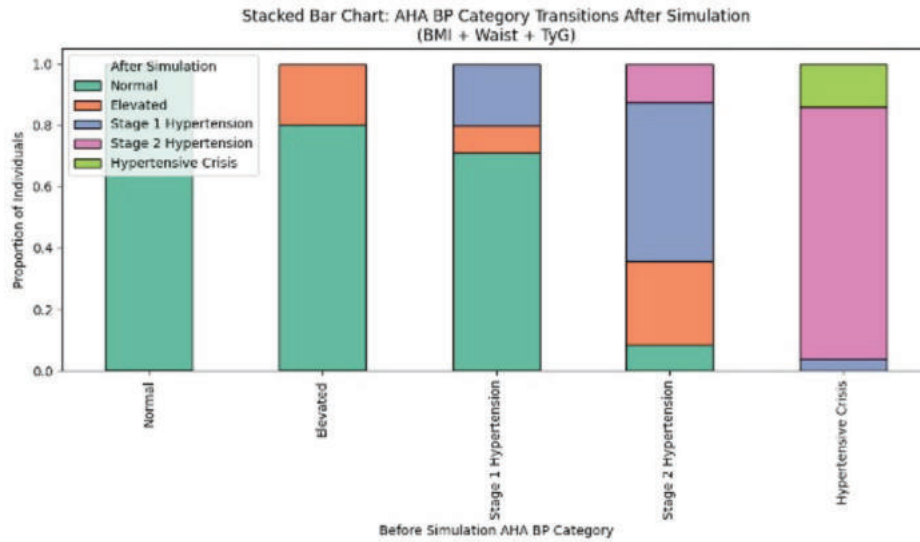
Conclusion

Digital twin simulations constrained by real-world safety thresholds provide a scalable, nonpharmacologic strategy for personalized hypertension prevention. This approach supports precision public health by prioritizing individuals with high baseline metabolic risk for lifestyle-based intervention.

Figure



Figure



Uncertainty-Aware Machine Learning Model for Beat-to-Beat Blood Pressure Estimation and Short-Term Hypertensive Event Forecasting Across Clinical Domains

Prihantini Prihantini¹, Sahnaz Vivinda Putri², Rini Winarti³, Rifaldy Fajar¹

¹AI-BioMedicine Research Group, IMCDS-BioMed Research Foundation, Jakarta, Indonesia

²Management, Indonesia Open University, Makassar, Indonesia

³Biology, Yogyakarta State University, Sleman, Indonesia

Introduction

Cuffless blood pressure (BP) estimation using photoplethysmography (PPG) and electrocardiography (ECG) is attractive but remains unreliable across diverse clinical environments, limiting translation into perioperative and critical care. Anticipating short-term hypertensive surges before they occur could significantly improve patient safety and monitoring efficiency. This study aimed to develop and evaluate an uncertainty-aware machine learning framework that integrates physiology-constrained decoding, conformal calibration, and cross-dataset validation to provide accurate beat-to-beat BP estimation and 60-second hypertensive event forecasting across clinical domains.

Methods

Two open-access waveform databases were analyzed. VitalDB (6,388 surgical cases, 500 Hz multimodal recordings) supplied invasive arterial blood pressure (ABP), PPG, and ECG signals, segmented into 8–16 second windows, yielding ~3.21 million labeled segments with patient-level splits. PulseDB (5,361 subjects, standardized 10-second ECG/PPG/ABP segments) was used for external testing under protocol-defined metrics to assess cross-dataset generalization. The modeling pipeline included self-supervised pretraining with masked-channel reconstruction and contrastive learning at both instance and subject levels. A physiology-constrained decoder, based on a monotone neural ordinary differential equation enforcing $SBP > DBP$ and Windkessel-inspired compliance priors, mapped latent features to SBP, DBP, and MBP. Supervised regression heads applied quantile loss to generate P10–P90 uncertainty intervals. A forecasting head estimated the probability of hypertensive events, defined as $SBP \geq 160$ mmHg or $\Delta SBP \geq 30$ mmHg within 60 seconds. Conformal prediction was applied for calibrated uncertainty intervals. Domain shift adaptation was performed using adaptive layer normalization and test-time entropy minimization. Out-of-distribution gating was implemented using Mahalanobis distance on latent embeddings. OpenAI-based tools were used to assist with coding and debugging tasks, including function refactoring, resolving tensor-related errors, and drafting loaders and training loops. All data preprocessing, model training, statistical analyses, and validation were executed in Python. Primary endpoints were mean absolute error (MAE) of SBP/DBP compared to invasive ABP. Secondary endpoints included expected calibration error (ECE), interval coverage, area under the curve (AUC) for event forecasting, and decision-curve net benefit.

Results

On held-out VitalDB patients ($n=1,120$), the model achieved SBP MAE 7.3 mmHg (95% CI 7.1–7.5), RMSE 10.8 mmHg, and 86.4% within ± 10 mmHg; DBP MAE 5.0 mmHg (4.9–5.1), RMSE 7.6 mmHg, and 94.2% within ± 10 mmHg. Uncertainty intervals (P10–P90) achieved 88.7% coverage (88.2–89.2) with mean band width 19.6 mmHg, ECE 0.021. For hypertensive event forecasting, AUC was 0.812 (0.801–0.823), sensitivity 66.8% (64.9–68.6) at a 10% alert rate, with median lead time 37 s (IQR 27–47). Decision-curve analysis showed net benefit +0.043 (0.032–0.054) compared with fixed-threshold monitoring. Clinical yield analysis indicated 5.2 additional true hypertensive events detected per 100 patients and an 18.6% reduction in false positive events (17.1–20.1). External evaluation on PulseDB ($n=5,361$) yielded SBP MAE 8.9 mmHg (8.7–9.2), 78.3% within ± 10 mmHg, DBP MAE 6.2 mmHg (6.1–6.4), 91.5% within ± 10 mmHg, with calibration stable (ECE 0.024) and interval coverage 87.9% (87.4–88.4). Out-of-distribution gating suppressed 37.8% (36.9–38.7) of low-quality segments and reduced large errors $> \pm 20$ mmHg by 29.4% (27.5–31.3).

Conclusion

This uncertainty-aware machine learning framework provided accurate beat-to-beat BP estimates, delivered reliable per-beat confidence intervals, and forecasted hypertensive surges up to 60 seconds in advance. It generalized across independent databases and retained calibration under domain shifts. The model achieved clinically meaningful improvements by capturing more true events while reducing false positives, supporting its translational potential for perioperative, intensive care, ward-based, and home monitoring applications.

PP-15

Comorbid Hypertension and Diabetes Mellitus in Erectile Dysfunction among Hemodialysis Patients with Chronic Kidney Disease: A Regression Analysis

Tohari Tohari

Department of Internal Medicine, Abu Hanifah General Hospital, Bangka Belitung, Indonesia

Introduction

Chronic kidney disease (CKD) represents a major global health burden and ranks as the 18th leading cause of mortality worldwide. Defined by structural or functional renal abnormalities, CKD not only leads to progressive renal failure but also to systemic complications. Among them, erectile dysfunction (ED) is highly prevalent in patients with stage V CKD, profoundly reducing quality of life. The contribution of comorbid hypertension and diabetes mellitus to ED in this population remains insufficiently characterized. This study aims to investigate the correlation of hypertension and diabetes mellitus with erectile dysfunction in CKD patients receiving maintenance hemodialysis.

Methods

A retrospective cohort study was conducted on 120 CKD patients undergoing regular hemodialysis at Abu Hanifah General Hospital, Bangka Belitung, Indonesia. ED was assessed using the validated International Index of Erectile Function-5 (IIEF-5) questionnaire after dialysis sessions. Regression analysis was performed to examine the correlation between comorbidities and erectile function.

Results

Body mass index (BMI) differed significantly between patients with and without comorbidities ($p = 0.003$). No significant differences were observed in age ($p = 0.607$), occupation ($p = 0.863$), alcohol consumption ($p = 0.593$), smoking status ($p = 0.757$), or hemoglobin levels ($p = 0.910$). Regression analysis revealed a moderate, significant negative correlation between diabetes mellitus and erectile function scores ($r = -0.438$, $p = 0.006$). Conversely, hypertension demonstrated no significant association with ED ($r = -0.136$, $p = 0.438$).

Conclusion

Diabetes mellitus, but not hypertension, is independently associated with erectile dysfunction in CKD patients on hemodialysis. These findings emphasize the importance of comprehensive diabetes control to improve sexual health and overall quality of life in this high-risk group. Further multicenter prospective studies are recommended to validate these associations and explore targeted interventions.

Table

Table 1. Subject Characteristics					
	Comorbidity (-) n=2	Comorbidity (-) n=2 %	Comorbidity (+) n=118	Comorbidity (+) n=118 %	p Value
Age (years)	54.5 ± 9.19		50.10 ± 11.97		0.607
Occupation					0.863
Unemployed	1	50.0%	73	61.9%	
Employee	1	50.0%	34	28.8%	
Freelance	0	0.0%	11	9.3%	
BMI (WHO)					0.003
Underweight	2	100.0%	4	3.4%	
Normal	0	0.0%	56	47.5%	
Overweight	0	0.0%	27	22.9%	
Obesity I	0	0.0%	25	21.2%	
Obesity II	0	0.0%	6	5.1%	
Alcohol Consumption					0.593
No	2	100.0%	90	76.3%	
Yes	0	0.0%	28	23.7%	
Smoking					0.757
No	1	50.0%	43	36.4%	
Yes	1	50.0%	75	63.6%	
Hemoglobin level					0.910
Anemia	2	100.0%	112	94.9%	
Non-anemia	0	0.0%	6	5.1%	

Table

Table 2. Results of Regression Analysis						
	Regression Coefficient	t Statistic	p Value	Correlation Coefficient (R)	Beta	Effective Contribution
Hypertension (HT)	-0.136	-0.779	0.438	-0.025	-0.071	0.18%
Diabetes Mellitus (DM)	-0.493	-2.778	0.006	-0.24	0.253	6.07%
R square = 0.062						
Note: Effective Contribution = Correlation Coefficient × Beta						

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PP-16

Combined Impact of Proteinuria and Blood Pressure Variability on Clinical Outcomes after Percutaneous Coronary Intervention

Byung Sik Kim¹, Jeong-Hun Shin¹, Jinho Shin², Young-Hyo Lim²

¹Cardiology, Hanyang University Guri Hospital, Guri, Korea, Republic of

²Cardiology, Hanyang University Seoul Hospital, Seoul, Korea, Republic of

Introduction

Proteinuria and blood pressure variability (BPV) are individually associated with adverse cardiovascular outcomes in patients with coronary artery disease (CAD). Their combined prognostic impact after percutaneous coronary intervention (PCI) has not been investigated. We investigated the combined association of proteinuria and BPV with long-term outcomes following PCI.

Methods

We analyzed 2,539 patients from a prospective PCI registry. Proteinuria was defined as $\geq 1+$ on dipstick urinalysis at index hospitalization. BPV was calculated as the standard deviation of systolic blood pressure from follow-up visits and dichotomized at the median. Patients were categorized into four groups by proteinuria and BPV status. The primary endpoint was net adverse clinical events (NACE: all-cause death, non-fatal myocardial infarction, non-fatal stroke, any revascularization, or major bleeding) over 5 years.

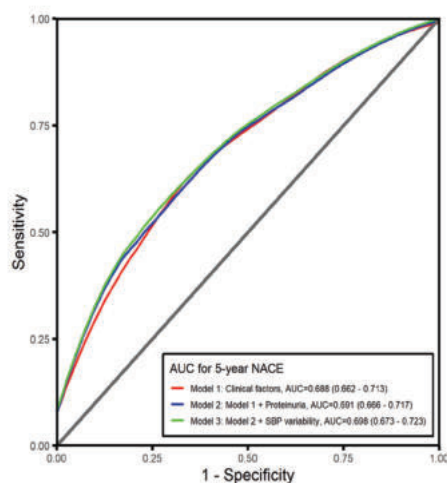
Results

During a median 5.64-year follow-up, NACE occurred in 689 patients (27.1%). Proteinuria (hazard ratio [HR] 1.530, 95% confidence interval [CI] 1.279–1.830) and high BPV (per 1-SD: HR 1.187, 95% CI 1.093–1.290) were independently associated with higher risk of NACE. Patients with concomitant proteinuria and high BPV had the highest risk for NACE (HR 1.696; 95% CI 1.341–2.146 vs. those with no proteinuria and low BPV). The addition of proteinuria and BPV to conventional risk models significantly improved risk discrimination and reclassification for NACE.

Conclusion

Proteinuria and high BPV are independent predictors of adverse long-term outcomes after PCI, and their coexistence is associated with a substantially higher risk profile. Simple dipstick urinalysis and routine BPV assessment may provide complementary prognostic information for patients undergoing PCI.

Figure



	AUC (95% CI) of timeROC	p-value (vs model 1)	p-value (vs model 2)
Model 1 ^a	0.688 (0.662 - 0.713)	reference	
Model 2 ^b	0.691 (0.666 - 0.717)	0.374	reference
Model 3 ^c	0.698 (0.673 - 0.723)	0.024	0.034

Table

Table. Clinical outcomes according to combined proteinuria status and SBP variability categories.

	Events (%)	Univariable analysis		Multivariable analysis ^a	
		Hazard ratio (95% CI)	p-value	Hazard ratio (95% CI)	p-value
NACE ^b					
No proteinuria & Low BPV	204/1039 (19.6)	1 (reference)		1 (reference)	
No proteinuria & High BPV	256/936 (27.4)	1.412 (1.175–1.698)	<0.001	1.123 (0.928–1.359)	0.234
Proteinuria & Low BPV	74/230 (32.2)	1.805 (1.383–2.354)	<0.001	1.532 (1.161–2.021)	0.003
Proteinuria & High BPV	155/334 (46.4)	2.809 (2.279–3.462)	<0.001	1.696 (1.341–2.146)	<0.001
MACCE ^c					
No proteinuria & Low BPV	153/1039 (14.7)	1 (reference)		1 (reference)	
No proteinuria & High BPV	184/936 (19.7)	1.313 (1.060–1.627)	0.013	1.077 (0.863–1.344)	0.511
Proteinuria & Low BPV	52/230 (22.6)	1.608 (1.174–2.202)	0.003	1.393 (1.007–1.927)	0.045
Proteinuria & High BPV	103/334 (30.8)	2.296 (1.788–2.947)	<0.001	1.503 (1.141–1.979)	0.004
Major bleeding ^d					
No proteinuria & Low BPV	79/1039 (7.6)	1 (reference)		1 (reference)	
No proteinuria & High BPV	121/936 (12.9)	1.727 (1.301–2.293)	<0.001	1.293 (0.964–1.732)	0.086
Proteinuria & Low BPV	36/230 (15.7)	2.230 (1.503–3.307)	<0.001	1.813 (1.201–2.737)	0.005
Proteinuria & High BPV	102/334 (30.5)	4.695 (3.499–6.299)	<0.001	2.262 (1.622–3.156)	<0.001
All-cause death					
No proteinuria & Low BPV	31/1039 (3.0)	1 (reference)		1 (reference)	
No proteinuria & High BPV	46/936 (4.9)	1.624 (1.030–2.560)	0.037	0.869 (0.539–1.400)	0.564
Proteinuria & Low BPV	19/230 (8.3)	2.880 (1.627–5.098)	<0.001	1.807 (0.988–3.304)	0.055
Proteinuria & High BPV	53/334 (15.9)	5.837 (3.747–9.093)	<0.001	1.765 (1.064–2.926)	0.028
Non-fatal MI					
No proteinuria & Low BPV	30/1039 (2.9)	1 (reference)		1 (reference)	
No proteinuria & High BPV	34/936 (3.6)	1.235 (0.756–2.018)	0.399	1.112 (0.675–1.833)	0.676
Proteinuria & Low BPV	8/230 (3.5)	1.256 (0.576–2.741)	0.566	1.014 (0.460–2.234)	0.973
Proteinuria & High BPV	12/334 (3.6)	1.355 (0.694–2.648)	0.373	1.117 (0.568–2.196)	0.748
Non-fatal stroke					
No proteinuria & Low BPV	17/1039 (1.6)	1 (reference)		1 (reference)	
No proteinuria & High BPV	15/936 (1.6)	0.962 (0.480–1.925)	0.912	0.612 (0.300–1.246)	0.176
Proteinuria & Low BPV	9/230 (3.9)	2.458 (1.096–5.514)	0.029	1.982 (0.858–4.578)	0.109
Proteinuria & High BPV	17/334 (5.1)	3.377 (1.724–6.617)	<0.001	1.798 (0.859–3.766)	0.12
Any revascularization					
No proteinuria & Low BPV	114/1039 (11.0)	1 (reference)		1 (reference)	
No proteinuria & High BPV	134/936 (14.3)	1.285 (1.001–1.650)	0.049	1.217 (0.942–1.572)	0.133
Proteinuria & Low BPV	30/230 (13.0)	1.243 (0.831–1.858)	0.29	1.164 (0.777–1.745)	0.462
Proteinuria & High BPV	48/334 (14.4)	1.408 (1.005–1.974)	0.047	1.167 (0.814–1.673)	0.401

BPV, blood pressure variability; CI, confidence interval; MACCE, major adverse cardiac and cerebrovascular events; MI, myocardial infarction; NACE, net adverse clinical events; PCI, percutaneous coronary intervention, SBP, systolic blood pressure; SD, standard deviation.

^aAdjustment for age, sex, body mass index, presentation with MI, current smoking, hypertension, diabetes mellitus, dyslipidemia, chronic kidney disease, previous PCI, previous stroke, left ventricular ejection fraction, troponin-I, estimated glomerular filtration rate, multivessel disease, and use of anticoagulants, statins, angiotensin blockades, β -blockers, and average SBP during the follow-up.

^bNACE was defined as a composite of all-cause death, non-fatal MI, non-fatal stroke, any revascularization, or major bleeding.

^cMACCE was defined as a composite of all-cause death, non-fatal MI, non-fatal stroke, or any revascularization.

^dMajor bleeding was defined as Bleeding Academic Research Consortium (BARC) 3 or 5 bleeding.

PP-17

The Association between Arterial Stiffness and Socioeconomic Status: A Cross-Sectional Study Using Estimated Pulse Wave Velocity

Hack-Lyoung Kim

*Division of Cardiology, Department of Internal Medicine, Boramae Medical Center, Seoul National University College of Medicine,
Seoul, Korea, Republic of*

Introduction

The impact of socioeconomic status (SES) on arterial stiffness remains unclear. This study aimed to explore the association between both personal and household income, as well as education level, and estimated pulse wave velocity (ePWV).

Methods

A total of 13,539 participants (mean age 52.9 ± 16.7 years; 57.1% women) from the Korean National Health and Nutrition Survey database were analyzed. For SES variables, information on personal and household income and education level was collected using standardized questionnaires.

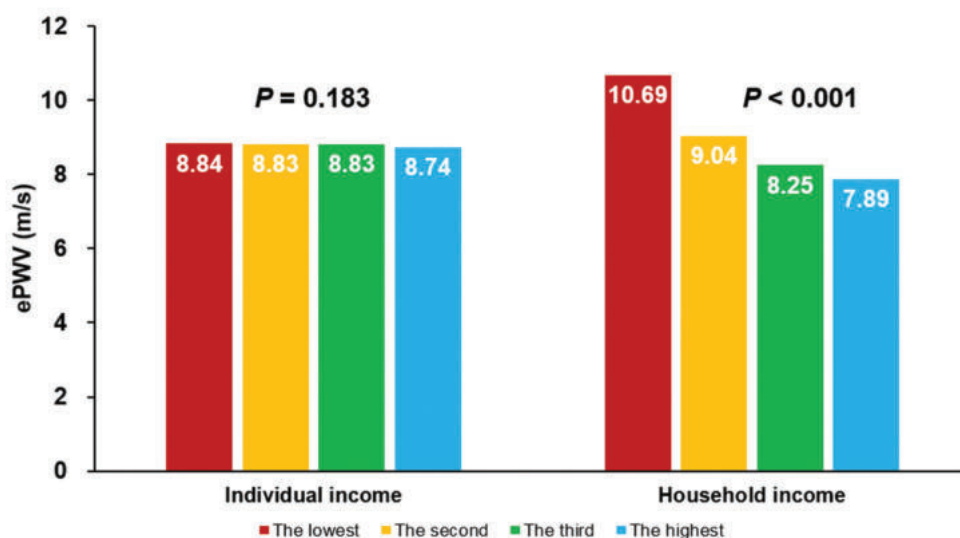
Results

The ePWV did not show significant differences across groups categorized by individual income levels ($P = 0.183$). However, there was a noticeable trend of decreasing ePWV with increasing household income levels ($P < 0.001$). Additionally, ePWV demonstrated a significant negative correlation with higher education levels, indicating that ePWV decreased in groups with higher educational attainment ($P < 0.001$). In multiple linear regression analyses, both household income ($\beta = -0.055$; $P < 0.001$) and education level ($\beta = -0.076$; $P < 0.001$) were negatively associated with ePWV, even after adjusting for potential confounders.

Conclusion

Lower household income and lower education levels were associated with higher ePWV, providing further evidence of the influence of SES on arterial stiffness.

Figure



Table

Binary logistic linear regression analyses showing the associations of higher ePWV (≥ 8.47 m/s) with household income and education level

	Unadjusted		Adjusted*	
	OR (95% CI)	P	aOR (95% CI)	P
<i>Household income</i>				
The highest	1	-	1	-
The second	1.30 (1.18-1.43)	< 0.001	1.32 (1.13-1.55)	< 0.001
The third	2.44 (2.22-2.69)	< 0.001	1.99 (1.69-2.34)	< 0.001
The lowest	8.30 (7.37-9.33)	< 0.001	3.13 (2.58-3.79)	< 0.001
<i>Education level</i>				
College graduation or higher	1	-	1	-
High school graduation	2.18 (2.00-2.38)	< 0.001	1.34 (1.17-1.54)	< 0.001
Middle school graduation	15.18 (12.97-17.75)	< 0.001	3.17 (2.55-3.95)	< 0.001
No schooling or elementary school only	90.02 (71.87-112.75)	< 0.001	11.42 (8.68-15.02)	< 0.001

*Following clinical covariates were controlled during the analysis: age, sex, body mass index, hypertension, diabetes mellitus, dyslipidemia, cigarette smoking, glomerular filtration rate and uric acid. ePWV, estimated pulse wave velocity; OR, odds ratio; CI, confidence interval; aOR, adjusted odds ratio.

Gender Differences in Ideal Cardiovascular Health among Patients with Hypertension: A Cross-Sectional Study in Thai Primary Care

Wichai Arab¹, Jom Suwanno²

¹*Baan Huainang Subdistrict Health Promotion Hospital, Ministry of Public Health, Trang, Thailand*

²*Walailak University School of Nursing, Walailak university, Nakhon Si Thammarat, Thailand*

Introduction

Ideal cardiovascular health (ICVH), as defined by the American Heart Association's Life's Simple 7 (LS7), is strongly associated with lower risks of cardiovascular morbidity and mortality. Despite this, evidence on gender-specific differences in achieving ICVH among patients with hypertension remains limited, especially within Southeast Asian primary care populations. We evaluated gender differences in individual LS7 metrics and overall ICVH among Thai patients with hypertension, and to determine person and clinical factors independently associated with achieving ICVH.

Methods

We conducted a cross-sectional study among patients with hypertension receiving care in Thai primary care clinics. Eligible participants were adults with a physician diagnosis of hypertension; patients with severe cognitive impairment or acute illness were excluded. Cardiovascular health was assessed using the American Heart Association's Life's Simple 7 metrics: smoking, diet, physical activity, body mass index, blood pressure, cholesterol, and fasting glucose. Each metric was classified as poor (0), intermediate (1), or ideal (2), with a total LS7 score ranging from 0 to 14. Gender differences in mean scores for individual LS7 metrics and overall LS7 were examined using independent t-tests. Person factors (e.g., age, education, income) and clinical factors (e.g., history of diabetes, hyperlipidemia, and antihypertensive drug classes) were compared between men and women using univariate tests. Variables significantly associated with cardiovascular health in univariate analyses were entered into multivariable regression models to identify independent factors associated with achieving ideal levels of LS7 metrics and overall ICVH.

Results

Among 1,493 participants (mean age 66.26 ± 11.98 years; 422 (28.3%) men and 1,071 (71.7%) women), the mean overall LS7 score was 6.66 ± 2.46 in men and 6.89 ± 1.07 in women ($p = 0.069$). By individual metrics, women scored significantly higher in smoking and blood pressure. In contrast, men had significantly higher scores in body mass index, physical activity, and cholesterol. Univariate analysis showed that person factors (age, marital status, education, employment status, and income) and clinical factors (history of diabetes, history of hyperlipidemia, and HDL-C) differed between women and men. After adjusting for these variables in the multivariate analysis, gender differences remained for several individual cardiovascular health metrics but not for the overall LS7 score. Women were more likely to achieve the ideal metrics for smoking (OR 58.41, 95% CI 30.70–111.16) and diet (OR 1.46, 95% CI 1.01–2.09). Conversely, they were less likely to achieve ideal status for body mass index (OR 0.49, 95% CI 0.38–0.64), physical activity (OR 0.76, 95% CI 0.59–0.99), and cholesterol (OR 0.59, 95% CI 0.42–0.83). No significant gender differences were observed for blood pressure and plasma glucose. Achieving overall LS7 was positively associated with older age (OR 1.61, 95% CI 1.06–2.44) and having at least secondary school education (OR 1.72, 95% CI 1.03–2.88). In contrast, it was inversely associated with a history of diabetes (OR 0.39, 95% CI 0.24–0.64), a history of hyperlipidemia (OR 0.34, 95% CI 0.23–0.50), and elevated HDL-C (OR 0.65, 95% CI 0.46–0.92). When examining individual cardiovascular health metrics, several personal and clinical factors were identified. Older age was associated with ideal BMI (OR 3.22, 95% CI 2.46–4.22). Secondary school education or higher was linked to ideal blood pressure (OR 0.55, 95% CI 0.30–0.99). Being employed was associated with ideal BMI (OR 0.60, 95% CI 0.45–0.77) and diet (OR 0.68, 95% CI 0.49–0.96). Having sufficient income was associated with ideal blood pressure (OR 0.70, 95% CI 0.51–0.96). High HDL-C was associated with both BMI (OR 0.57, 95% CI 0.44–0.73) and cholesterol (OR 1.68, 95% CI 1.20–2.35). Having a spouse was associated with physical activity (OR 1.44, 95% CI 1.08–1.91). A history of diabetes was associated with cholesterol (OR 1.85, 95% CI 1.14–2.78), while a history of hyperlipidemia was associated with blood pressure (OR 0.63, 95% CI 0.46–0.86).

Conclusion

Gender differences were evident in several LS7 components but not in overall ICVH scores. Women were more successful in achieving ideal smoking and diet behaviors, while men performed better in BMI, physical activity, and cholesterol. Importantly, the unexpected finding of a negative association between elevated HDL-C and overall cardiovascular health challenges conventional understanding and warrants further investigation. These findings emphasize the need for gender- and context-specific strategies to improve cardiovascular health among hypertensive patients in Thai primary care.

Table

	Men (N = 422)	Women (N = 1,071)	Total (N = 1,493)	t-test (P)	Univariate unadjusted model			
					Factors	β (SE)	P	OR (95%CI)
ICVH								
LS7 total	6.66 ± 2.46	6.89 ± 1.07	6.83 ± 2.18	-1.82 (0.069)	Women (vs. Men)	-0.13 (0.178)	0.443	0.87 (0.616-1.236)
Smoking	1.25 ± 0.96	1.98 ± 0.20	1.77 ± 0.63	-15.31 (0.000)	Women (vs. Men)	4.05 (0.319)	0.000	57.67 (30.84-107.83)
Body mass index	1.12 ± 0.88	0.89 ± 0.90	0.96 ± 0.90	4.47 (0.000)	Women (vs. Men)	-0.43 (0.117)	0.000	0.65 (0.516-0.814)
Physical activity	0.91 ± 0.85	0.70 ± 0.85	0.76 ± 0.85	4.31 (0.000)	Women (vs. Men)	-0.35 (0.126)	0.006	0.70 (0.551-0.902)
Diet	0.39 ± 0.68	0.44 ± 0.74	0.42 ± 0.74	-1.23 (0.202)	Women (vs. Men)	0.33 (0.174)	0.055	1.39 (0.9993-1.963)
Cholesterol	1.09 ± 0.75	0.93 ± 0.73	0.98 ± 0.74	3.73 (0.000)	Women (vs. Men)	-0.48 (0.126)	0.000	0.61 (0.482-0.788)
Blood pressure	0.76 ± 0.64	0.87 ± 0.65	0.84 ± 0.65	-2.78 (0.005)	Women (vs. Men)	0.38 (0.175)	0.027	1.47 (1.044-2.070)
Plasma glucose	1.14 ± 0.76	1.08 ± 0.77	1.10 ± 0.77	1.29 (0.196)	Women (vs. Men)	-0.10 (0.119)	0.369	0.89 (0.711-1.135)

Factors	LS7	Smoking	Body mass index	Physical activity	Diet	Cholesterol	Blood pressure	Plasma glucose
Women	0.99, 0.68-1.46	58.41, 30.69-111.15	0.49, 0.37-0.64	0.76, 0.58-0.98	1.45, 1.01-2.09	0.59, 0.42-0.83	1.34, 0.94-1.93	1.091, 0.821-1.449
Age ≥ 65 years	1.61, 1.05-2.44	1.40, 0.89-2.21	3.22, 2.46-4.21	0.95, 0.72-1.25	1.02, 0.72-1.45	1.02, 0.71-1.49	0.91, 0.64-1.28	1.308, 0.970-1.762
Spousal	1.13, 0.76-1.68	1.34, 0.80-2.23	0.79, 0.61-1.02	1.44, 1.08-1.91	1.14, 0.81-1.61	0.78, 0.54-1.12	0.96, 0.68-1.34	1.145, 0.855-1.533
Secondary school or higher	1.72, 1.03-2.88	0.92, 0.56-1.53	0.67, 0.43-1.02	1.19, 0.82-1.74	1.54, 0.97-2.46	1.43, 0.89-2.29	0.57, 0.30-0.98	0.834, 0.549-1.269
Employed	0.77, 0.52-1.14	0.82, 0.51-1.31	0.59, 0.45-0.77	0.91, 0.70-1.19	0.68, 0.49-0.96	0.96, 0.67-1.37	0.99, 0.71-1.39	1.232, 0.922-1.647
Sufficient income	1.03, 0.70-1.52	1.14, 0.72-1.81	0.99, 0.77-1.28	1.11, 0.85-1.43	1.07, 0.76-1.49	1.14, 0.80-1.62	0.70, 0.51-0.96	1.172, 0.881-1.559
Diabetes, known	0.39, 0.24-0.63	1.17, 0.75-1.82	0.88, 0.68-1.14	1.17, 0.85-1.43	1.29, 0.94-1.79	1.85, 1.13-2.77	1.29, 0.93-1.79	0.000, 0.000-0.000
Hyperlipidemia, known	0.34, 0.23-0.49	1.03, 0.69-1.53	0.82, 0.64-1.04	0.92, 0.72-1.18	0.78, 0.57-1.06	0.00, 0.00-0.00	0.63, 0.46-0.86	0.739, 0.573-0.953
HDL-C ≥ 60 mg/dl	0.65, 0.46-0.92	0.61, 0.38-0.96	0.57, 0.44-0.72	0.92, 0.71-1.18	1.02, 0.74-1.41	1.67, 1.19-2.35	0.95, 0.69-1.31	0.912, 0.698-1.192
Constant OR (% Predicted)	0.23 (88.7%)	1.56 (88.3%)	1.39 (68.4%)	0.36 (72.9%)	0.13 (85.6%)	1.07 (73.4%)	0.24 (85.4%)	0.77 (68.4%)

Note: LS7 = Life's Simple 7 (LS7) by the American Heart Association; ICVH = ideal cardiovascular health

PP-19

Regional Inequities in the Cost of Hypertension and Comorbidities: Lessons for Indonesia's Health Policy

Pisi Bethania Titalessy¹, Audio Bhaskara Titalessy², Julius Ary Mollet¹

¹*Economics, Universitas Cenderawasih, Jayapura/Papua, Indonesia*

²*Bhayangkara Hospital, Ministry of Health, Papua, Indonesia*

Introduction

Hypertension is one of the most prevalent non-communicable diseases in Indonesia, affecting more than one-third of the adult population, and it is strongly associated with comorbidities such as diabetes mellitus, chronic kidney disease, and cardiovascular disease. These conditions significantly elevate healthcare utilization and costs, creating a growing economic burden for households, health facilities, and the national insurance system. This study estimates the economic burden of hypertension and its comorbidities at the national level and highlights disparities between Jakarta in Western Indonesia and Papua in Eastern Indonesia.

Methods

A cost-of-illness analysis was conducted using Riskesdas 2018 prevalence data, BPJS Kesehatan claims from 2020 to 2022, and facility-level studies. Direct medical costs included outpatient consultations, medication, laboratory tests, and hospitalization, while indirect costs encompassed transportation, productivity losses, and caregiver time. The analysis compared patients with hypertension alone and those with comorbid conditions such as diabetes and cardiovascular disease across urban and remote contexts.

Results

Nationally, hypertension affects approximately 34.1% of adults, with comorbid diabetes affecting 6.2% and cardiovascular conditions 3.4%. In Jakarta, outpatient hypertension care averaged around IDR 2.1 million per patient annually, rising to between IDR 3.5 and 4.0 million when combined with diabetes. Inpatient treatment costs averaged IDR 6.5 million per admission, but escalated to IDR 10 to 12.5 million when patients also suffered from heart failure or ischemic heart disease. Although BPJS Kesehatan provided substantial financial protection, reimbursement shortfalls of IDR 2 to 4 million per case remained for complex comorbid conditions. In contrast, outpatient hypertension care in Papua cost between IDR 1.3 and 1.7 million annually, rising to IDR 2.5 to 3.2 million with comorbid diabetes. Inpatient treatment in referral hospitals in Jayapura and Merauke averaged IDR 7.2 million per case for hypertension alone and reached IDR 11 to 13 million when comorbidities were present. Importantly, indirect costs were disproportionately higher in Papua, accounting for 30–35% of the total burden compared to 20–25% in Jakarta, largely due to geographic barriers, longer travel distances, and reduced workforce participation.

Conclusion

These findings demonstrate that while absolute treatment costs are higher in Jakarta due to advanced hospital-based care, the proportional burden of hypertension and comorbidities is heavier in Papua, where indirect and non-medical expenses remain substantial despite BPJS coverage. At the national level, the total economic burden of hypertension and its comorbidities is estimated at IDR 25–30 trillion annually. Addressing this challenge requires not only strengthening preventive and integrated disease management but also tailoring policies to regional contexts: in Western Indonesia, updating BPJS reimbursement to align with the costs of complex cases is critical, while in Eastern Indonesia, expanding primary care capacity, mobile clinics, and telemedicine can reduce indirect costs. Incorporating regional equity into NCD financing is essential to reduce disparities and improve health outcomes across Indonesia.

Ideal Cardiovascular Health, Person and Clinical Factors, and Their Association with Microalbuminuria in Patients with Hypertension: A Cross-Sectional Study in Thai Primary Care

Jom Suwanno

Graduate Nursing Studies, Walailak University School of Nursing, Nakhon Si Thammarat, Thailand

Introduction

Microalbuminuria (MAU) is an early marker of renal and cardiovascular risk in hypertension. The relationship between ideal cardiovascular health (CVH), defined by the American Heart Association's Life's Simple 7 (LS7), and MAU remains unclear, especially in Asian populations. This study examined associations between LS7 metrics, person and clinical factors, and MAU in Thai patients with hypertension.

Methods

A cross-sectional, multi-center study was conducted among 954 hypertensive patients from 15 primary care centers in Thailand. MAU was defined as an albumin-to-creatinine ratio (ACR) of 30–299 mg/dL from a morning spot urine sample. LS7 CVH metrics, person factors (e.g., age, sex, living arrangement, education), and clinical factors (e.g., diabetes, dyslipidemia, LDL-C, antihypertensive drug class) were analyzed using univariate and multivariate logistic regression.

Results

Univariate analyses showed inverse associations between MAU and overall LS7 score, as well as individual metrics including body mass index, physical activity, diet, total cholesterol, and fasting plasma glucose. Person (living arrangement, education) and clinical factors (diabetes, dyslipidemia, LDL-C, antihypertensive regimen) were also significant. In multivariate analyses, ideal CVH metrics—healthy diet (OR: 0.598; 95% CI: 0.394–0.909), total cholesterol (OR: 0.509; 95% CI: 0.297–0.870), and plasma glucose (OR: 0.701; 95% CI: 0.488–1.008)—remained independently protective against MAU. Living with a large family (OR: 0.716; 95% CI: 0.502–1.020), secondary education or higher (OR: 0.491; 95% CI: 0.305–0.791), higher LDL-C (OR: 0.598; 95% CI: 0.429–0.835), and use of ≥ 3 antihypertensive classes (OR: 0.463; 95% CI: 0.339–0.632) were also linked with reduced risk. After adjusting for covariates, overall LS7 remained independently associated with lower MAU (intermediate: OR: 0.566; 95% CI: 0.379–0.845; ideal: OR: 0.452; 95% CI: 0.259–0.787).

Conclusion

Ideal CVH—particularly diet, cholesterol, and glucose control—was associated with lower prevalence of MAU in Thai hypertensive patients. Person and clinical factors also played protective roles. Unexpectedly, higher LDL-C levels correlated with lower MAU, a finding that challenges conventional understanding and warrants further research to elucidate underlying mechanisms and potential clinical implications.

Table

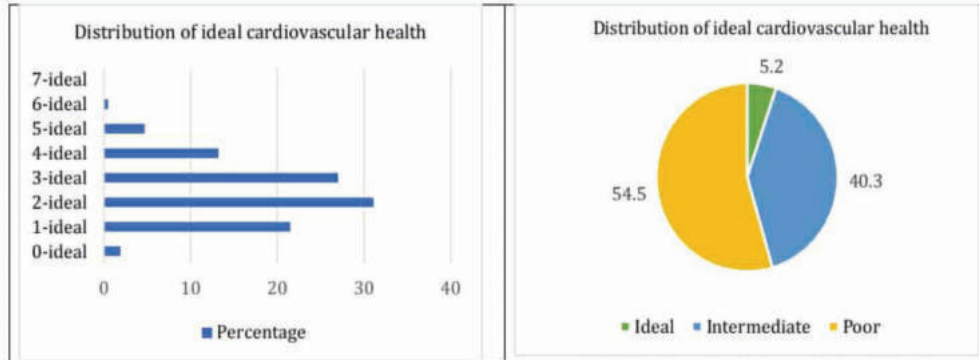


TABLE. Multivariate analysis of ideal cardiovascular health, person, and clinical factors associated with microalbuminuria

Factors	Indicators	Microalbuminuria		
		β	P	OR (95% CI)
LS7 CVH metric				
Current smoking	Poor	0 (reference)		1
	Intermediate			
	Ideal	-0.230	0.327	0.795 (0.501-1.259)
Body mass index	Poor	0 (reference)	0.232	1
	Intermediate	-0.156	0.412	0.855 (0.589-1.242)
	Ideal	-0.262	0.090	0.770 (0.569-1.042)
Physical activity	Poor	0 (reference)	0.147	1
	Intermediate	0.323	0.070	1.382 (0.975-1.959)
	Ideal	-0.014	0.931	0.986 (0.710-1.369)
Healthy diet	Poor	0 (reference)	0.039	1
	Intermediate	0.082	0.696	1.086 (0.718-1.642)
	Ideal	-0.514	0.016	0.598 (0.394-0.909)
Total cholesterol	Poor	0 (reference)	0.041	1
	Intermediate	-0.338	0.058	0.713 (0.502-1.012)
	Ideal	-0.676	0.014	0.509 (0.297-0.870)
Blood pressure	Poor	0 (reference)	0.710	1
	Intermediate	0.114	0.455	1.121 (0.831-1.513)
	Ideal	0.148	0.515	1.159 (0.743-1.807)
Fasting plasma glucose	Poor	0 (reference)	0.026	1
	Intermediate	0.043	0.818	1.044 (0.724-1.505)
	Ideal	-0.355	0.055	0.701 (0.488-1.008)
Person				
Living arrangement	With couple or alone	0 (reference)		1
	With large family	-0.335	0.064	0.716, 0.502-1.020
Education	Primary or no school	0 (reference)		1
	Secondary school or higher	-0.711	0.003	0.491, 0.305-0.791
Clinical				
High lipidemia, history	No	0 (reference)		1
	Yes, known and treated	-0.067	0.724	0.935, 0.646-1.355
LDL-C, mg/dl	< 100	0 (reference)		1
	≥ 100	-0.513	0.003	0.598, 0.429-0.835
Hypertension drug class	1-2 drug class	0 (reference)		1
	3 or more drug class	-0.770	0.000	0.463 (0.339-0.632)

Investigation of Screening for Primary Aldosteronism in an Adrenalectomy Population: A Multicenter Cross Sectional Study

Wei Song¹, Yang Yu¹, Zuowei Pei³, Minghui Yang¹, Zhi Lu¹, Ying Zhang¹, Yinong Jiang¹, Xue Gao¹, Deyong Yang¹, Lili Wang²

¹Cardiology, The First Affiliated Hospital of Dalian Medical University, Dalian, China

²Cardiology, The Second Affiliated Hospital of Dalian Medical University, Dalian, China

³Cardiology, The Central Hospital of Dalian Affiliated Dalian University of Technology, Dalian, China

Introduction

Primary aldosteronism (PA) is a common secondary hypertension linked to heart failure and chronic kidney disease. However, the screening rate and prevalence of PA vary across countries. We conducted a multicenter cross-sectional study in China to investigate the preoperative screening rate and prevalence of PA in adrenalectomy patients using postoperative immunohistochemical staining.

Methods

A total of 1,014 patients who had adrenalectomy and were diagnosed with adrenocortical adenoma or nodular hyperplasia by hematoxylin-eosin (HE) staining were collected. Immunohistochemical staining for specific aldosterone synthase (CYP11B2) monoclonal antibodies was performed on postoperative tissue sections. Analysis of staining results according to the consensus on the histopathology of PA.

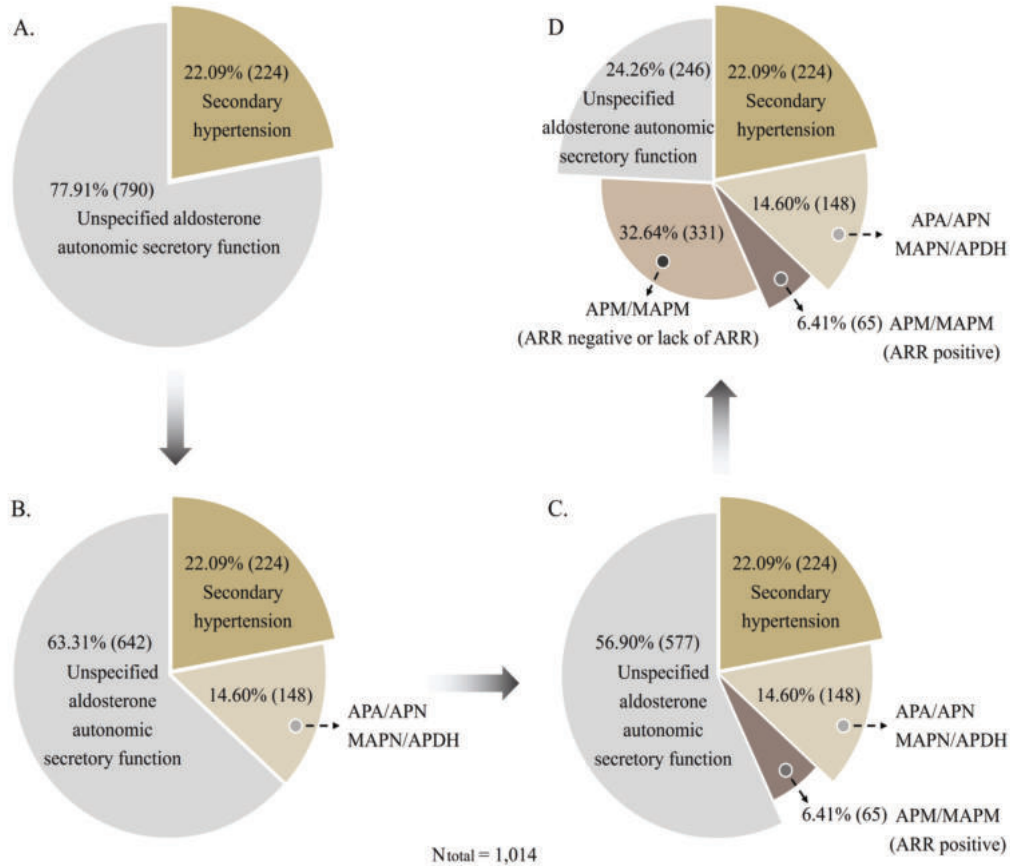
Results

There were 224 patients (22.09%) who were screened and diagnosed with secondary hypertension preoperatively, including 170 (16.77%) patients with PA, 51 (5.03%) patients with adrenocorticotrophic hormone (ACTH) independent Cushing's syndrome (CS) or subclinical CS, and 3 patients (0.30%) with aldosterone and cortisol co-secretion. The positive rate of CYP11B2 was 94.22% in PA patients. Of the remaining 790 (77.91%) patients, based on CYP11B2 immunohistochemical staining results, histopathology identified 129 patients (12.72%) with classical lesions (aldosterone-producing adenoma and aldosterone-producing nodule) and 415 (40.93%) with non-classical lesions (multiple aldosterone-producing nodules, aldosterone-producing micronodule, multiple aldosterone-producing micronodules and aldosterone-producing diffuse hyperplasia) of unilateral PA. There were still 24.26% of patients who underwent adrenalectomy lacking aldosterone autonomous secretion lesions confirmed by postoperative immunohistochemical staining. The proportion of patients with aldosterone autonomous secretion lesions decreased with age, and the proportion of aldosterone-producing micronodule and multiple aldosterone-producing micronodules in aldosterone autonomous secretion lesions increased with age.

Conclusion

The screening rate for PA is inadequate, and improving the preoperative screening rate for PA is crucial. CYP11B2 is a powerful tool for diagnosing aldosterone autonomous secretion function in adrenocortical lesions and should be routinely used in postoperative pathological examination.

Figure



APA, aldosterone-producing adenoma; APN, aldosterone-producing nodule; MAPN, multiple aldosterone-producing nodules; APDH, aldosterone-producing diffuse hyperplasia; APM, aldosterone-producing micronodule; MAPM, multiple aldosterone-producing micronodules; ARR, aldosterone to renin ratio.

Triple Antihypertensive in a Single Pill Therapy: A Multi-Center Study in Western Part of India

Jeegnesh Bholabhai Satanee¹, Jatinkumar Dhanani², Shweta Dhanani¹

¹Family Medicine, Nanduba Medical Center, Surat, India

²Pharmacology, GMERS Medical College, Navsari, India

Introduction

Hypertension (HT) is the preventable and modifiable cardiovascular risk factor. Recent international guidelines recommend single-pill, low-dose combinations as initial treatment strategy in new cases of HT. The aim of the study was to investigate whether this approach is feasible in developing countries like India.

Methods

In this prospective observational study total 98 patients could be enrolled after diagnosis of hypertension was established with three sets of blood pressure measurements. They were given, a once-daily, single-pill combination of olmesartan, amlodipine, and hydrochlorothiazide was prescribed at an appropriate dose. Patients were instructed on its administration and potential side effects and encouraged towards lifestyle modifications. The treatment regimen was adjusted, if needed, at each outpatient clinic scheduled after 4, 8, 12, and 16 weeks.

Results

Total 79 patients, that adhered the treatment strictly till the end, were taken for statistical analysis. Blood pressure was decreased to 140/90 mmHg after 4 weeks in 44 (56%), after 8 weeks in 62 (78%), after 12 weeks in 69 (87%), and after 16 weeks in 74 (94%) participants. Moreover, 55 patients (70%) achieved a target blood pressure of <130/80 mmHg. Similarly, dropouts also showed a clinically significant decrease in blood pressure. Medication tolerance was excellent in most of both completers and dropouts.

Conclusion

These results suggest that once-daily, single-pill combination of triple drug olmesartan, amlodipine, and hydrochlorothiazide is effective and more feasible even at remote and peripheral area where resources are very less. And can be tried in rural and remote areas in low- and middle- income countries as a reliable first-line treatment strategy.

Table

	Before treatment	Treatment (weeks)				<i>P</i> value
		4	8	12	16	
Completers (<i>N</i> = 79)						
Attenders, <i>N</i>	79	79	79	79	79	
Blood pressure, mmHg						
Systolic	164 [156–173]	135 [123–147]	124 [113–136]	120 [111–130]	120 [110–131]	< 0.0001
Diastolic	96 [88–102]	80 [80–88]	78 [73–84]	75 [70–80]	76 [71–82]	< 0.0001
Blood pressure < 140/ 90 mmHg, <i>N</i> (%)		44 (56)	62 (78)	69 (87)	74 (94)	< 0.0001
Resting heart rate, beats/min	78 [69–87]	76 [66–86]	73 [66–81]	67 [63–74]	70 [62–81]	< 0.0001
Medication (OLM/AML/ HCTZ), mg						
10/2.5/6.2		40 (51)	33 (42)	36 (46)	39 (49)	
20/5/12.5		33 (42)	31 (39)	27 (34)	24 (30)	
40/10/12.5		6 (7)	15 (19)	16 (20)	16 (20)	
Excellent tolerance, <i>N</i> (%)		76 (96)	74 (94)	78 (99)	79 (100)	
Dropouts (<i>N</i> = 19)						
Attenders, <i>N</i>	19	14	9	6	0	
Blood pressure, mmHg						
Systolic	154 [150–166]	131 [122–138]	117 [110–121]	128 [117–137]		
Diastolic	90 [87–97]	80 [77–85]	72 [66–80]	81 [69–91]		
Blood pressure < 140/ 90 mmHg, <i>N</i> (%)		12 (86)	8 (89)	5 (83)		
Resting heart rate, beats/min	77 [67–85]	73 [66–82]	73 [62–85]	73 [67–79]		
Medication (OLM/AML/ HCTZ), mg						
10/2.5/6.2		9 (64)	6 (66)	3 (50)		
20/5/12.5		5 (36)	2 (22)	2 (33)		
40/10/12.5		0	1 (11)	1 (17)		
Excellent tolerance, <i>N</i> (%)		14 (100)	8 (89)	6 (100)		

Table

	Before treatment	Treatment (weeks)				<i>P</i> value
		4	8	12	16	
Completers (<i>N</i> = 79)						
Attenders, <i>N</i>	79	79	79	79	79	
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Systolic	164 [156–173]	135 [123–147]	124 [113–136]	120 [111–130]	120 [110–131]	< 0.0001
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10/2.5/6.2		40 (51)	33 (42)	36 (46)	39 (49)	
20/5/12.5		33 (42)	31 (39)	27 (34)	24 (30)	
40/10/12.5		6 (7)	15 (19)	16 (20)	16 (20)	
Excellent tolerance, <i>N</i> (%)		76 (96)	74 (94)	78 (99)	79 (100)	
Dropouts (<i>N</i> = 19)						
Attenders, <i>N</i>	19	14	9	6	0	
Blood pressure, mmHg						
Systolic	154 [150–166]	131 [122–138]	117 [110–121]	128 [117–137]		
Diastolic	90 [87–97]	80 [77–85]	72 [66–80]	81 [69–91]		
Blood pressure < 140/ 90 mmHg, <i>N</i> (%)		12 (86)	8 (89)	5 (83)		
Resting heart rate, beats/min	77 [67–85]	73 [66–82]	73 [62–85]	73 [67–79]		
Medication (OLM/AML/ HCTZ), mg						
10/2.5/6.2		9 (64)	6 (66)	3 (50)		
20/5/12.5		5 (36)	2 (22)	2 (33)		
40/10/12.5		0	1 (11)	1 (17)		
Excellent tolerance, <i>N</i> (%)		14 (100)	8 (89)	6 (100)		



HYPERTENSION SEOUL 2025

2025. 11. 06 (Thu.) - 08 (Sat.)

Conrad Hotel, Seoul, Korea

Healthy BP, Healthier Life

Poster Presentation

Day 3_November 8 (Sat.)

PP-A3 10:25-11:40

Zone A, Studio 8+9+10

PP-23 Anthropometric Muscle and Obesity Indices and Their Associations with Hypertension: Sex Specific Analyses

Chaeyeon Ahn (Korea University)

PP-24 Effects of the Weekend Warrior Exercise Pattern on Health-Related Fitness among Adults with Hypertension

Putra Rizki (Indonesia)

PP-25 Hypertension as a Predictor of Five-Year Survival in End-Stage Renal Disease Patients on Continuous Ambulatory Peritoneal Dialysis: An Indonesian Cohort Study

Tohari Tohari (Indonesia)

PP-26 Mining Antihypertensive Treatment-Response Phenotypes from Perioperative Waveforms with Pharmacovigilance Validation: A Big Data Study

Rifaldy Fajar (Indonesia)

PP-B3 10:25-11:40

Zone B, Studio 8+9+10

PP-27 Adherence to 24-Hour Movement Guidelines and Its Association with Hypertension Prevalence of Korean Adults

Sun Jung Kim (University of Seoul)

PP-28 Diabetes Phenotypes, Coastal Groundwater Salinity, and Hypertension in Middle-Aged Type 2 Diabetes Population in Bangladesh: A Latent Class Analysis

Rajib Mondal (Japan)

PP-29 Impact of Nighttime Toothbrushing on Hypertension Risk across Age Groups

Minseo Kim (Korea University)

PP-30 A Randomised Controlled Trial to Evaluate the Effectiveness of Gut Microbiome Modulation in Lowering Blood Pressure in Pre-Hypertensive Patients

Aashal Bhavesh Shah (India)

PP-31 Association between Weekend Catch-up Sleep and Hypertension: Differences by Physical Activity Patterns

Nawon Lee (Korea University)

PP-32 **Withdrawal**

PP-A3_ 10:25-11:40

PP-23

Anthropometric Muscle and Obesity Indices and Their Associations with Hypertension: Sex Specific Analyses

Chaeyeon Ahn¹, Donghyeok Cho¹¹Cardiology, Korea University, Korea University, Seoul, Korea, Republic of

Introduction

Sarcopenia and obesity are both closely linked to hypertension, and their coexistence may amplify cardiovascular risk. However, the strength and direction of these associations depend on how muscle mass and adiposity are defined. Conventional measures such as BMI and waist circumference have well-established roles, but novel indices—including the weight-adjusted waist index (WWI) and BMI-adjusted appendicular skeletal muscle mass (ASMB)—may offer additional insight. Evidence in elderly Asian populations, particularly regarding sex differences, remains limited. We therefore examined the associations of multiple anthropometric muscle and obesity indices with hypertension in a nationally representative Korean population.

Methods

We analyzed data from the 2008–2010 Korea National Health and Nutrition Examination Survey (KNHANES), including 17,391 adults (representing ≈38.5 million individuals) under a complex survey design. Hypertension was defined as systolic blood pressure ≥140 mmHg, diastolic blood pressure ≥90 mmHg, or current use of antihypertensive medication. Sarcopenia was assessed using the appendicular skeletal muscle mass index (ASMI = ASM/height², kg/m²) and BMI-adjusted ASM (ASM/BMI, ASMB), both analyzed as continuous variables. Obesity was evaluated using BMI, waist-to-height ratio (WtHR), and the weight-adjusted waist index (WWI).

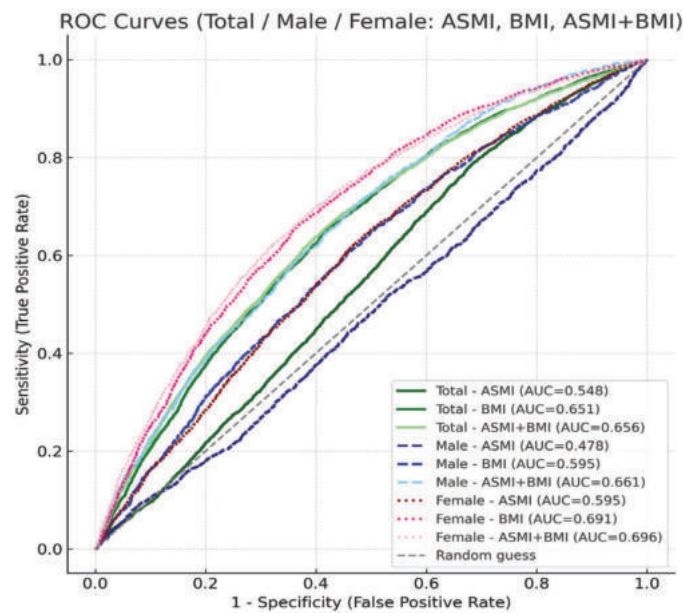
Results

Among 29,235 adults included in the survey, 16,328 had complete data on appendicular skeletal muscle mass by DXA and blood pressure measurements. The mean age of this population was 49.06 years (SD=16.26), and women accounted for 57.0% of participants. The prevalence of hypertension was 27.15% (4,433/16,328) in the overall adult group, 57.78% (2,037/3,526) among older adults aged ≥65 years, 52.20% (782/1,498) in older men, and 61.88% (1,255/2,028) in older women. For single indices, WC/ht (AUC=0.737) and WWI (AUC=0.744) showed the strongest associations with hypertension in the overall adult population, while WC (AUC=0.692) and BMI (AUC=0.651) were weaker. Sarcopenia-related indices alone were not suitable: ASMI showed only a very weak protective association (AUC=0.548). When obesity indices were added, the explanatory value of ASMI modestly improved. ASMI+BMI (0.657) and ASMI+WC (0.705) outperformed BMI or WC alone, and ASMI+WC/ht (0.737) performed similarly to WC/ht alone. The combination of ASMI with WWI yielded the highest AUC (0.751), but the improvement over WWI alone (0.744) was marginal. In men, ASMI alone had minimal explanatory value (AUC=0.479). Obesity indices showed moderate associations (BMI 0.596, WC 0.637, WC/ht 0.678, WWI 0.695), and their associations with hypertension were strengthened when combined with muscle measures—for example, ASMI+BMI (0.662) and ASMI+WC/ht (0.706). In women, ASMI also demonstrated only a weak protective signal (AUC=0.595), while ASMB (AUC≈0.27) suggested a stronger protective association. Obesity indices were dominant (BMI 0.691, WC 0.735, WC/ht 0.783, WWI 0.795), and the addition of muscle measures provided only marginal improvements (e.g., ASMI+WC/ht 0.789 vs WC/ht 0.783).

Conclusion

Hypertension clustered in obesity-related phenotypes, but the relative contributions of muscle and obesity indices differed by sex. In men, both sarcopenia and obesity were independently associated with hypertension, whereas in women, sarcopenia indices contributed little and adiposity measures dominated. These findings underscore that the role of body composition in hypertension is strongly sex-specific, highlighting the need for sex-tailored approaches in risk assessment and prevention.

Figure



PP-24

Effects of the Weekend Warrior Exercise Pattern on Health-Related Fitness among Adults with Hypertension

Putra Rizki^{1,2}, Ayu Sekarsari³, Tasia Ma'abud⁴

¹Sports Medicine, Hasan Sadikin Hospital, Bandung, Indonesia

²Sports Medicine, Edelweiss Hospital, Bandung, Indonesia

³Internal Medicine, Edelweiss Hospital, Bandung, Indonesia

⁴Clinical Science, Chulalongkorn University, Bangkok, Thailand

Introduction

Evidence highlights the protective role of physical activity in reducing the risk of hypertension. Adherence to the recommended total volume of moderate-intensity physical activity is considered essential. However, for individuals with limited free time during the workweek, meeting these guidelines may be challenging; thus, the "weekend warrior" exercise approach has been suggested as an alternative strategy.

Methods

This study analyzed data from 338 adults aged 25–65 years with hypertension who underwent an exercise program at the Sports Medicine Center, Hasan Sadikin Hospital, between 2018 and 2024. Participants were divided into three groups: the first group performed three aerobic and two resistance exercise sessions per week; the second group engaged exclusively in aerobic exercise; and the third group followed the weekend warrior approach, completing a maximum of two combined exercise sessions weekly. To assess the relationships between exercise patterns, waist circumference, blood pressure, and aerobic capacity, univariate and multivariate stepwise linear regression analyses were applied.

Results

Group one and group three demonstrated significant reductions in waist circumference compared to group two, with β values of .307 (95% CI –0.611 to –0.003) and .354 (95% CI –0.467 to –0.241), respectively. However, no significant difference was observed between group one and group three (β = .047, 95% CI –0.258 to 0.352). In terms of blood pressure, no differences were found among the three groups. Additionally, group three exhibited a smaller improvement in aerobic capacity compared to the other groups.

Conclusion

The weekend warrior model offers meaningful health advantages and may be recommended as an effective option for hypertension control, particularly for those unable to engage in regular exercise sessions.

Figure

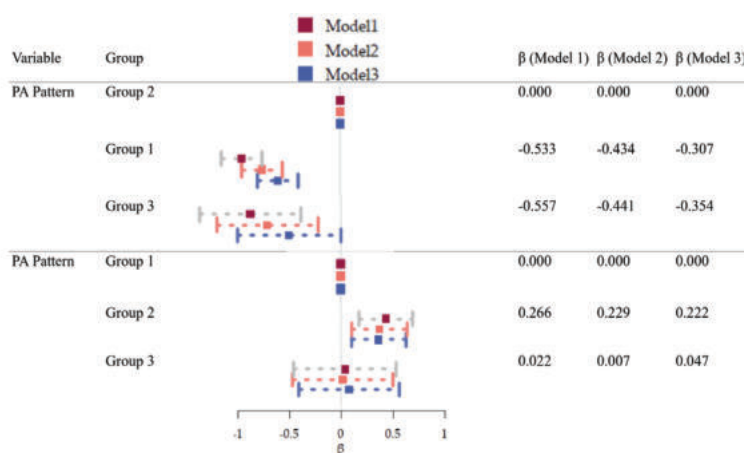


Figure1. PA pattern and the Health related fitness in adults. PA: physical activity

Table

Table 1. Demographic and clinical profiles of the participants.

Characteristics	n	%
Sex		
Female	233	68.9
Male	105	31.1
Age, year		
25-45	82	24.3
46-55	109	32.3
56-65	147	43.4
Comorbidity		
None	125	36.9
Diabetes mellitus	86	25.4
Hyperlipidaemia	58	17.2
Hyperuricaemia	28	8.3
Cerebrovascular accident	5	1.5
Coronary heart disease	14	4.1
Kidney disease	1	0.3
Hypertensive heart disease	2	0.6
Congestive heart failure	5	1.5
Medication		
Antihypertensive drug	234	69.2

PP-25

Hypertension as a Predictor of Five-Year Survival in End-Stage Renal Disease Patients on Continuous Ambulatory Peritoneal Dialysis: An Indonesian Cohort Study

Tohari Tohari

Department of Internal Medicine, Abu Hanifah General Hospital, Bangka Belitung, Indonesia

Introduction

Continuous Ambulatory Peritoneal Dialysis (CAPD) is a renal replacement therapy alternative for patients with kidney failure, particularly in developing countries such as Indonesia. The CAPD program in Malang has been operational since 2010; however, limited studies have evaluated its survival outcomes. This study aimed to assess the 5-year survival rate of end-stage renal disease (ESRD) patients on CAPD, with a focus on those with comorbid hypertension.

Methods

We conducted a retrospective cohort study involving 674 ESRD patients who underwent CAPD therapy at the CAPD Center of Abu Hanifah General Hospital, Bangka Belitung, from August 2019 to July 2024. Survival was analyzed using the Kaplan–Meier method, while hazard ratios were assessed using Cox regression.

Results

Of the 674 patients, the 5-year survival rate was 63.2%, with overall survival at 1, 3, and 5 years of 80%, 60%, and 52%, respectively. The 3-year survival rate was 80% in patients with hypertension alone, but only 10% in those with both hypertension and type II diabetes mellitus. The hazard ratio for ESRD patients with comorbid hypertension and type II diabetes mellitus was 8.4 (95% CI: 6.36–11.21).

Conclusion

Patients undergoing CAPD therapy demonstrated a favorable 5-year survival rate. However, the presence of comorbid hypertension combined with type II diabetes mellitus significantly reduced survival compared to patients with hypertension alone.

Figure

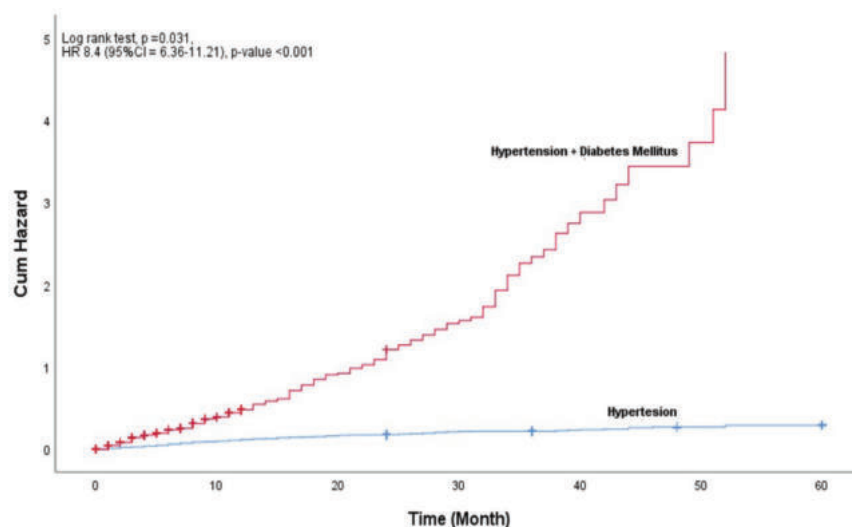


Figure 2. Kaplan-Meier survival curve comparison of CAPD patients with end-stage renal disease who had comorbid hypertension and those who had hypertension and type II diabetes mellitus.

Table

Table 1. Characteristics of CAPD Patients

Characteristic	N=674 n (%)
Gender	
Men	389 (58.8)
Women	285 (41.2)
Age	
12-25 years	61 (9.1)
26-45 years	195 (28.9)
46-59 years	287 (42.6)
>60 years	120 (17.8)
Marital status	
Single	61 (9.1)
Married	613 (90.9)
Smoker	
Yes	287 (42.6)
No	287 (57.4)
History of Hypertension	
Medication	
Calcium channel blocker	195 (28.9)
Angiotensin-converting enzyme inhibitor	287 (42.6)
Angiotensin receptor blocker	192 (28.48)
Comorbidity	
Hypertension	381 (57.7)
Hypertension and Diabetes Mellitus	278 (42.3)
Cause of Mortality	
Cardiovascular Disease	198 (79.8)
Cerebrovascular Disease	8 (3.2)
Sepsis (peritonitis)	40 (16.1)
Other	2 (0.8)

Mining Antihypertensive Treatment-Response Phenotypes from Perioperative Waveforms with Pharmacovigilance Validation: A Big Data Study

Rifaldy Fajar¹, Rini Winarti², Sahnaz Vivinda Putri³, Prihantini Prihantini¹

¹*AI-BioMedicine Research Group, IMCDS-BioMed Research Foundation, Jakarta, Indonesia*

²*Biology, Yogyakarta State University, Sleman, Indonesia*

³*Management, Indonesia Open University, Makassar, Indonesia*

Introduction

Hypertensive crises during surgery are common and potentially harmful, while individualized selection of intravenous antihypertensive therapy remains poorly defined. Most clinical trials lack the resolution to capture continuous blood pressure (BP) dynamics or the scale to assess heterogeneity of drug response. This study aimed to establish a computational framework to quantify treatment effects of perioperative antihypertensives from high-frequency waveforms, to identify response phenotypes using machine learning-based causal inference, and to validate findings against national pharmacovigilance signals.

Methods

We analyzed 6,388 surgical cases from VitalDB containing 62.5–500 Hz arterial BP, PPG, and ECG waveforms with synchronized drug infusion histories. Hypertensive spikes were defined as systolic BP ≥ 160 mmHg or ≥ 30 mmHg above baseline. Infusion initiation was aligned as t0, and changes in systolic BP area-under-curve (Δ SBP AUC) and time-to-normotension (≤ 140 mmHg) were calculated over $[-5, +15]$ min. Confounding was controlled using marginal structural models with inverse probability of treatment weighting and doubly robust estimators. Heterogeneous treatment effects were estimated with X-learners and causal forests trained on pre-drug waveform embeddings that incorporated heart rate variability, PPG morphology, anesthetic depth, and patient comorbidities. External validation was conducted in PulseDB (5.2 million 10-second BP segments from 5,361 subjects) to assess model generalizability. Validation of safety signals used FAERS (2010–2023, ~2.1 million reports), applying disproportionality analyses (reporting odds ratio [ROR], proportional reporting ratio [PRR]) for hypotension, hypertensive crisis, and bradycardia, stratified by drug and co-medications. All preprocessing, modeling, and statistical analyses were executed locally in Python (Jupyter environment) using libraries (numpy, pandas, scikit-learn, econml, statsmodels). OpenAI's GPT-based models were employed in a limited capacity to support code generation and debugging during analysis development.

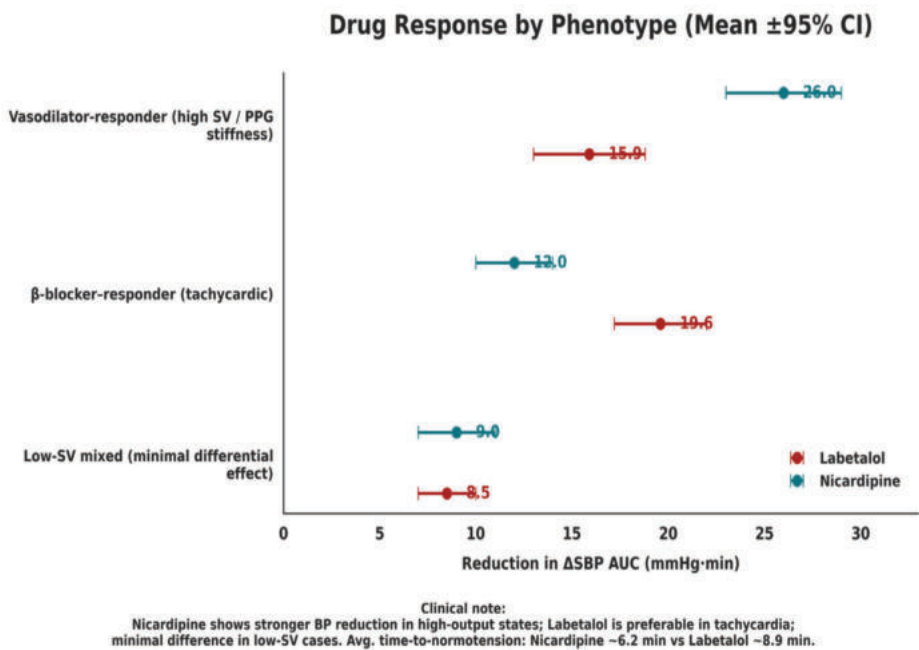
Results

Nicardipine had the strongest average treatment effect on Δ SBP AUC (-22.4 mmHg-min; 95% CI -24.7 to -20.1 ; $p < 0.001$), with mean time-to-normotension of 6.2 ± 2.8 minutes. Labetalol had a smaller effect (-14.7 mmHg-min; 95% CI -16.9 to -12.5 ; $p < 0.001$) and longer normotension times (8.9 ± 3.4 minutes). Causal forests identified three reproducible subphenotypes: vasodilator responders with high stroke-volume and PPG stiffness, β -blocker responders with hyperadrenergic tachycardia, and low-stroke-volume patients with minimal differential effect. Uplift AUC for phenotype separation was 0.84. PulseDB validation confirmed external reproducibility (≤ 11 mmHg SBP MAE, calibration error < 0.05). FAERS analyses indicated increased hypotension risk for nicardipine (ROR 1.42, 95% CI 1.31–1.53) and labetalol (ROR 1.36, 95% CI 1.28–1.45), while polypharmacy motifs such as nicardipine combined with propofol amplified risk further (ROR 1.71, 95% CI 1.52–1.92), consistent with subgroup findings in VitalDB. Clinically, these results suggest that nicardipine provides faster and stronger BP control in high-output states, while labetalol may be more effective in tachycardic patients, offering practical guidance for drug choice during acute perioperative hypertension management.

Conclusion

This big data mining study shows that antihypertensive drug-response phenotypes can be derived from perioperative waveforms and validated through pharmacovigilance. The framework identifies subgroups that benefit differently from vasodilators or β -blockers and provides consistent safety signals at the population scale. These findings indicate the potential of computational phenotyping to guide precision antihypertensive therapy in perioperative and critical care practice.

Figure



PP-B3_10:25-11:40**PP-27**

Adherence to 24-Hour Movement Guidelines and Its Association with Hypertension Prevalence of Korean Adults

Sun Jung Kim, Hyun Jeong Kim, Tae Gu Choi, Ho Jeong Min, Seung Won Jung, Hyun Soo Song, Sae Young Jae

Sports Science, University of Seoul, Seoul, Korea, Republic of

Introduction

Regular physical activity is well known to reduce blood pressure. However, emerging evidence suggests that an integrated approach considering 24-hour movement behaviors, including physical activity, sedentary behavior, and sleep, has been proposed as a more comprehensive framework for cardiovascular health promotion. Therefore, we aimed to examine the relationship between adherence to the 24-hour movement guidelines and hypertension prevalence among Korean adults.

Methods

We analyzed data from 5,351 adults aged ≥ 19 years who participated in the 2023 Korea National Health and Nutrition Examination Survey (KNHANES). Adherence to the 24-hour movement guidelines, assessed using self-reported questionnaires including the Global Physical Activity Questionnaire, was categorized according to the number of components met (0, 1, 2, or 3): (1) physical activity, defined as meeting the WHO recommendation of ≥ 150 min/week of leisure-time moderate-to-vigorous physical activity (MVPA); (2) sedentary behavior, defined as < 8 hours/day of sitting time; and (3) sleep, defined as 7–9 hours/day of sleep duration. Hypertension was defined as systolic blood pressure ≥ 140 mmHg, diastolic blood pressure ≥ 90 mmHg, physician-diagnosed hypertension, or current use of antihypertensive medication.

Results

Overall, 25.3% of participants met none of the guidelines, 45.5% met one, 25.2% met two, and 3.9% met all three. The prevalence of hypertension decreased progressively with greater adherence: 37.1% (0 guidelines), 33.0% (1), 31.3% (2), and 28.9% (3) ($p=0.004$). Mean systolic blood pressure, diastolic blood pressure, mean arterial pressure, and pulse pressure decreased significantly with increasing adherence (all $p \leq 0.05$). Favorable associations were also observed for waist circumference, triglycerides, and HDL cholesterol (all $p \leq 0.05$), whereas total and LDL cholesterol did not differ significantly across adherence categories.

Conclusion

Adherence to the 24-hour movement guidelines was generally low in Korean adults. Nevertheless, greater adherence was associated with lower hypertension prevalence and more favorable cardiometabolic profiles. These findings highlight the potential importance of integrated movement behaviors in hypertension prevention and management.

Diabetes Phenotypes, Coastal Groundwater Salinity, and Hypertension in Middle-Aged Type 2 Diabetes Population in Bangladesh: A Latent Class Analysis

Rajib Mondal^{1,2}, Katsuyuki Miura¹

¹Department of Preventive Medicine, NCD Epidemiology Research Center, Shiga University of Medical Science, Shiga, Japan, Japan

²Department of Noncommunicable Diseases, Bangladesh University of Health Sciences, Dhaka, Bangladesh, Bangladesh

Introduction

Hypertension is prevalent in type 2 diabetes. However, the synergistic influences of age at diagnosis, duration, glycemic control, geographical groundwater salinity, and other traditional risk factors on hypertension are hardly examined as phenotypes, particularly in the Asian population. Our aims were to investigate the associations of age at diagnosis, duration, and control of diabetes with hypertension, and to identify latent phenotypes integrating the geographical groundwater salinity issue.

Methods

We cross-sectionally analyzed data from 356 adults aged 40 - 60 years. Six binary exposures, i.e., sex, current smoking, overweight-obesity (body mass index, ≥ 25 kg/m²), age at diagnosis (<45 vs ≥ 45 years), diabetes duration (≤ 5 vs >5 years), uncontrolled diabetes, and high groundwater salinity (coastal vs inland), were fitted in latent class analysis (LCA), as class predictors. A two-class model ($K = 2$, $nrep = 80$, and $maxiter = 10,000$) was employed. Hypertension was defined by a blood pressure level of $\geq 140/90$ mmHg, or the use of antihypertensive medicine, or a prior history. Modified Poisson regression was used to assess factors and their phenotypes associated with hypertension, computing risk ratio (RR) and 95% confidence interval (CI).

Results

Hypertension was prevalent in 54.5% of the participants (mean $\pm$ SD age, 51.0 ± 6.9 years; women, 51.1%). In the multivariable model, diabetes duration >5 years and high salinity were significantly associated with higher risk of hypertension (RR [95% CI], 1.55 [1.26 - 1.90] and 1.34 [1.11 - 1.63], respectively). LCA identified two phenotypes: 1) Class 1 (37.6%) – early-onset, long-duration, often-uncontrolled, and high-salinity phenotype; and 2) Class 2 (62.4%) – short-duration, lifestyle, obesity, and low-salinity phenotype. The risk of hypertension was significantly higher (RR [95% CI], 1.27 [1.05 - 1.52]) in individuals belonging to Class 1, compared to those of Class 2.

Conclusion

Longer diabetes duration and coastal high-salinity exposure were independently associated with hypertension in this Bangladeshi diabetes population. Individuals with early-onset, long-duration, and often-uncontrolled diabetes, and high-salinity exposure phenotype had a higher risk of hypertension, suggesting the targeted blood pressure screening and individualized interventions.

Table

Table. Item-response predicted probabilities within the latent classes derived from latent class analysis among the study participants with type 2 diabetes in Bangladesh (n = 356)

Class predictors	Latent classes	
	Class 1 (n = 134; 37.6%)	Class 2 (n = 222; 62.4%)
Early diabetes onset	67.8	37.7
Longer diabetes duration	88.0	27.0
Uncontrolled diabetes	73.4	59.2
Current smoking	9.4	17.3
Overweight and obese	25.2	40.3
High salinity exposure	73.5	23.3

The table shows the probability of the presence of risk ('Yes') for each indicator within each class (class predictors).

Latent class phenotypes: 1) Class 1 – early-onset, long-duration, often-uncontrolled, and high-salinity phenotype; 2) Class 2 – short-duration, lifestyle, obesity, and low-salinity phenotype.

Early onset of diabetes was defined by an age at diabetes diagnosis of <45 years.

Longer duration of diabetes was defined as the duration of diabetes of >5 years.

Uncontrolled diabetes was defined either by a fasting blood glucose level of <80 or >130 mg/dL (<4.4 or >7.2 mmol/L), or a random blood glucose level of ≥180 mg/dL (≥10.0 mmol/L).

Overweight and obesity were defined by a body mass index of ≥25 kg/m².

High salinity exposure was defined as the exposure to high water salinity in the southern coastal part of Bangladesh.

Latent class analysis was conducted on the binary ('Yes' and 'No') class predictors to identify underlying subgroups (latent class phenotypes) among the participants.

Impact of Nighttime Toothbrushing on Hypertension Risk across Age Groups

Minseo Kim¹, Dong-Hyuk Cho²

¹College of Medicine, Korea University, Seoul, Korea, Republic of

²Division of Cardiology, Korea University College of Medicine, Anam Hospital, Seoul, Korea, Republic of

Introduction

Lifestyle management is essential for the prevention of hypertension, and strategies may need to differ by age. While toothbrushing frequency has been associated with increased hypertension risk, the impact of toothbrushing timing is unclear. Nighttime brushing is particularly important, as reduced salivary flow during sleep diminishes the mouth's natural cleansing effect and allows bacterial growth to accelerate. Thus, this study aimed to evaluate the association between toothbrushing time and hypertension in Korean adults and assessed age-specific differences.

Methods

This cross-sectional study analyzed oral health behavior data from the 7th Korea National Health and Nutrition Examination Survey (2016–2018), including 12,063 adults aged ≥ 19 years with available oral hygiene behavior information. Toothbrushing time was classified into four groups: morning only (AM), night only (PM), both morning and night (AM+PM), and none. Associations between toothbrushing time and hypertension were examined using multivariate complex-sample logistic regression, and interaction terms with age were tested to assess effect modification.

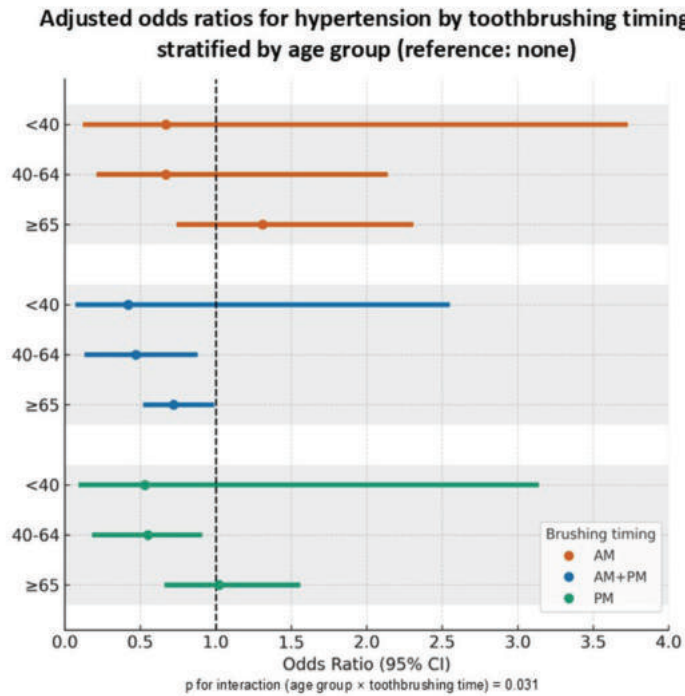
Results

The prevalence of hypertension was 26.1%, with a mean age of 51.2 ± 0.15 years, and 55.2% of participants were women. In multivariate logistic regression, each additional year of age was associated with higher odds of hypertension (adjusted OR per year, 1.066; 95% CI, 1.051–1.080; $p < 0.001$). Compared with the None group, the PM group showed significantly lower odds (adjusted OR 0.354; 95% CI, 0.131–0.954; $p = 0.04$), while the AM+PM group showed a borderline protective effect (adjusted OR 0.387; 95% CI, 0.138–1.088; $p = 0.071$); the AM group did not differ significantly (adjusted OR 0.512; 95% CI, 0.138–1.908; $p = 0.317$). Age-stratified analyses showed that the protective effect of nighttime brushing was most evident in middle-aged adults (40–64 years): PM (OR 0.55; 95% CI, 0.18–0.91; $p = 0.021$) and AM+PM (OR 0.47; 95% CI, 0.13–0.88; $p = 0.015$). Among older adults (≥ 65 years), the effect persisted only in the AM+PM group (OR 0.72; 95% CI, 0.52–0.99; $p = 0.042$). (FIGURE) The protective effect of PM brushing was particularly pronounced in middle-aged adults (p for interaction = 0.046), whereas the AM+PM group showed consistent benefits across ages.

Conclusion

This study demonstrated that nighttime toothbrushing plays an important role in the prevention of hypertension, with the effect being particularly pronounced in middle-aged adults. Given that hypertension risk increases with aging, adopting healthy nighttime oral hygiene habits from midlife may serve as an effective lifestyle strategy to prevent chronic hypertension.

Figure



PP-30

A Randomised Controlled Trial to Evaluate the Effectiveness of Gut Microbiome Modulation in Lowering Blood Pressure in Pre-Hypertensive Patients

Aashal Bhavesh Shah

Pharmacology, GMERS Medical College and Hospital, Valsad/Gujarat, India

Introduction

Recently, evidence has emerged which links gut microbiome with blood pressure (BP) regulation. Short chain fatty acids (SCFA) produced by microbiomes regulate the BP. This study was conducted with an aim to evaluate the effectiveness of gut microbiome modulation in lowering BP in pre-hypertensive patients.

Methods

This was a randomised, double-blind, placebo-controlled trial conducted at a tertiary care hospital for a duration of one year. Adult patients with pre-hypertension, defined as systolic BP of 130-139 mmHg and diastolic BP of 80-89 mmHg. The patients were randomly allocated to either intervention group or control group. Intervention group received a probiotic capsule which contained strains of *Lactobacillus* and *Bifidobacterium* and 10 g/day prebiotic fibre for six months. A similar looking placebo was administered to control group. Follow up was done at 3 and 6 months. The primary outcome was defined as change in office BP. Secondary outcomes were changes in ambulatory BP, composition of gut microbiome, levels of SCFA and adverse events. Relevant statistical analysis was conducted and $P < 0.05$ was considered significant.

Results

Total 300 patients were enrolled in the study. There was a significant reduction in the systolic BP in the intervention group as compared to control group (-8 mmHg vs -3 mmHg, $P = 0.001$). There was a significant improvement in ambulatory BP ($P = 0.01$). There was a 23.4% increase in the microbial diversity with an increase in SCFA-producing bacteria. Mild gastrointestinal discomfort was seen in 7.4% patients. No serious adverse events were observed.

Conclusion

Modulating the gut microbiota may lower the BP and also improves microbial diversity in gut. Further studies must be conducted in larger sample size studies to identify appropriate doses of gut microbiota and mechanisms elucidating the lowering of BP.

Association between Weekend Catch-up Sleep and Hypertension: Differences by Physical Activity Patterns

Nawon Lee¹, Cho Dong-Hyuk²

¹College of medicine, Korea University, Seoul, Korea, Republic of

²Department of Cardiology, Korea University Anam Hospital, Seoul, Korea, Republic of

Introduction

Both physical activity and sufficient sleep are important lifestyle factors for preventing hypertension. Weekend catch-up sleep (WCS) has been suggested to mitigate health risks of insufficient sleep, while physical activity is a well-established protective factor that may interact with sleep in influencing blood pressure. However, little is known about their combined effects. This study aimed to examine the association between WCS and hypertension and to evaluate whether physical activity modifies this relationship.

Methods

We conducted a cross-sectional analysis using data from the 2019–2023 Korea National Health and Nutrition Examination Survey (KNHANES). After excluding individuals <19 years and those with missing data, 26,663 adults were included. WCS time was defined as weekend minus weekday sleep duration and initially categorized into WCS (>0 h) and non-WCS (≤0 h), and further classified into six groups using 1-hour intervals. Physical activity was classified as active (≥600 MET-min/week) or inactive (<600 MET-min/week) based on WHO guidelines. Weighted logistic regression estimated odds ratios (ORs) and 95% CIs for hypertension, and interaction terms tested effect modification by physical activity.

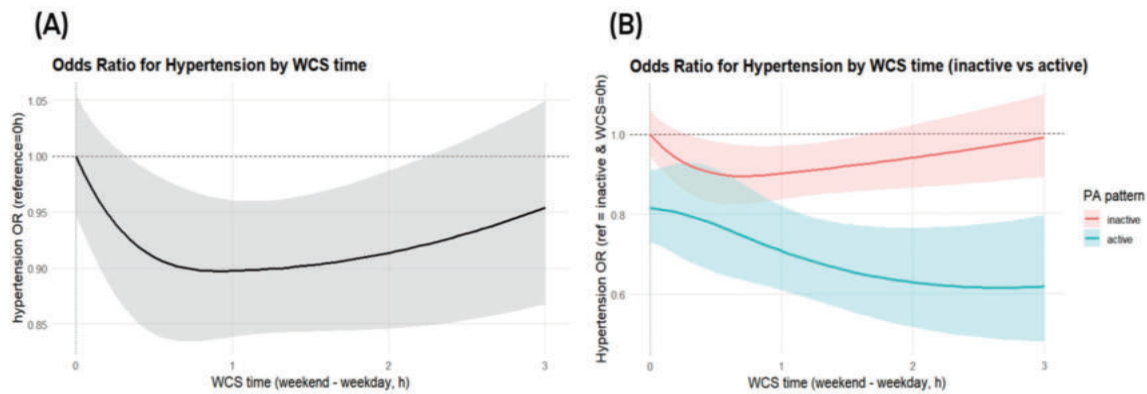
Results

Among 26,663 participants, the weighted prevalence of hypertension was 28.3% (95% CI: 27.5–29.2). The mean age was 48.2 ± 16.7 years, and 50.3% (95% CI: 49.8–50.9) were women. When categorized by WCS duration, crude models showed lower odds of hypertension across all WCS groups independent of total sleep time, but after adjustment of baseline characteristics, only the 0–1 h group remained significant (OR = 0.80, 95% CI: 0.71–0.90, $p < 0.001$). Restricted cubic spline analyses revealed a non-linear association, with risk decreasing up to about 2 h of WCS but diminishing thereafter (Figure A). Physical activity was independently associated with lower hypertension odds. Compared with the inactive group, the active group had lower odds both before (OR = 0.54, 95% CI: 0.49–0.59, $p < 0.001$) and after adjustment (OR = 0.78, 95% CI: 0.71–0.86, $p < 0.001$). In the joint analysis of physical activity and WCS, using inactive non-WCS as the reference, both active non-WCS (OR = 0.80, 95% CI: 0.71–0.90, $p < 0.001$) and active WCS (OR = 0.66, 95% CI: 0.55–0.78, $p < 0.001$) were significantly associated with lower odds of hypertension. Inactive WCS also showed a significant protective association (OR = 0.89, 95% CI: 0.82–0.97, $p = 0.011$). Spline analyses suggested that hypertension odds decreased with longer WCS in the active group but not clearly in the inactive group, although the interaction was not statistically significant ($p = 0.22$) (Figure B).

Conclusion

This study demonstrated that even a modest addition of weekend catch-up sleep (~0–1 h) was associated with lower odds of hypertension, while physical activity provided a consistent protective effect. Together, these findings highlight the potential of simple lifestyle strategies—regular activity and modest weekend sleep recovery—to reduce the population burden of hypertension.

Figure





PP-32

Withdrawn Abstract

This abstract has been withdrawn by the authors and is therefore not included in the presentation program of *Hypertension Seoul 2025*.

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Elfiany Syafruddin (Indonesia)

EP-01

Female-Specific Cardiovascular Risk Literacy and Its Association with Risk Perception and INTERHEART Scores among Aging Women in Malaysia

**Siew-Keah Lee¹, Chai Nien Foo¹, Shi Xiang Loh¹, Sin Jiun Yeoh¹, Priscilla Zi Yee Loh¹,
Wen Jia Ooi¹, Zhi Xuan Toh¹, Ang-Lim Chua²**

¹*M.Kandiah Faculty of Medicine and Health Sciences, Universiti Tunku Abdul Rahman, Kajang/Selangor, Malaysia*

²*Faculty of Medicine, Universiti Teknologi MARA, Malaysia, Sungai Buloh/Selangor, Malaysia*

Introduction

Cardiovascular disease (CVD) is the leading cause of death among aging women worldwide, yet its severity is frequently underestimated—particularly in low- and middle-income countries. In Malaysia, limited research has explored women's awareness of CVD, especially female-specific risk factors, and how this influences their risk perception and actual cardiovascular risk. This study aimed to assess knowledge of both traditional and female-specific CVD risk factors, self-perceived CVD risk, and actual risk based on INTERHEART risk stratification, and to explore the interrelationships among these variables in middle-aged and elderly Malaysian women

Methods

A cross-sectional survey was conducted between April and June 2024 among 288 women aged 40 years and above residing in Selangor, Malaysia. Participants were recruited via convenience and snowball sampling. Data were collected using a validated, self-administered questionnaire covering sociodemographics, CVD risk knowledge (traditional and female-specific), self-perceived risk, and INTERHEART-based risk assessment. Descriptive and inferential statistical analyses were used to identify trends and associations.

Results

Results showed that knowledge of female-specific CVD risk factors was significantly lower (mean score: 39.3%) compared to traditional risk factors (80.2%). Major gaps were observed in awareness of menopause- and pregnancy-related risks, and fewer than half of participants recognized CVD as the leading cause of death among women. Only 3.5% perceived themselves at high risk, despite 14.6% being classified as high risk by INTERHEART criteria. Higher actual CVD risk was significantly associated with elevated BMI, being a healthcare worker, lack of regular medical check-ups, and a history of adverse pregnancy outcomes. Notably, both low knowledge and inaccurate risk perception were significant predictors of higher CVD risk.

Conclusion

These findings underscore a critical need to address knowledge deficits and misperceptions through targeted, culturally sensitive education and preventive strategies aimed at improving cardiovascular health outcomes in Malaysian women.

Systolic Blood Pressure Ratio and Pulse Pressure as Predictors of Clinically Relevant Inter-Arm Difference in Blood Pressure in Non-Hypertensive Malaysian Adults

Wan Fatein Nabeila Wan Omar¹, Siti Hanie Izzati Hasanbasri², Nurul Qistyna Emir Emir Nazrul²

¹Dept. of Basic Medical Sciences, Kulliyyah of Medicine, International Islamic University Malaysia, Kuantan, Pahang, Malaysia

²Year 5 Medical Student, Kulliyyah of Medicine, International Islamic University Malaysia, Kuantan, Pahang, Malaysia

Introduction

Inter-arm systolic blood pressure difference (IAD) ≥ 10 mmHg has been associated with increased cardiovascular risk and arterial disease. However, most studies have focused on Western populations or hypertensive patients, with limited data in non-hypertensive adults from Southeast Asia. Furthermore, while inter-arm differences in systolic blood pressure (SBP) are well documented, the role of pulse pressure (PP) asymmetry remains underexplored. Understanding these patterns in non-hypertensive adults is important, as early detection of subtle inter-arm asymmetry may have implications for cardiovascular screening. This study determines the prevalence of clinically relevant IAD in non-hypertensive Malaysian adults and to evaluate simple hemodynamic indices; SBP ratio and inter-arm pulse pressure difference (Δ PP), as potential predictors of IAD ≥ 10 mmHg.

Methods

A cross-sectional study was conducted among 109 non-hypertensive adults aged 18–60 years. Bilateral blood pressures were measured three times with a validated automated blood pressure monitor (OMRON HEM-7120). Inter-arm systolic BP difference (IAD_SBP), SBP ratio (SBP dominant arm / SBP non-dominant arm), and Δ PP were calculated. Logistic regression and Receiver operating characteristic (ROC) curve analyses were used to identify predictors of IAD ≥ 10 mmHg. A paired-samples t-test was performed to compare PP between dominant and non-dominant arms.

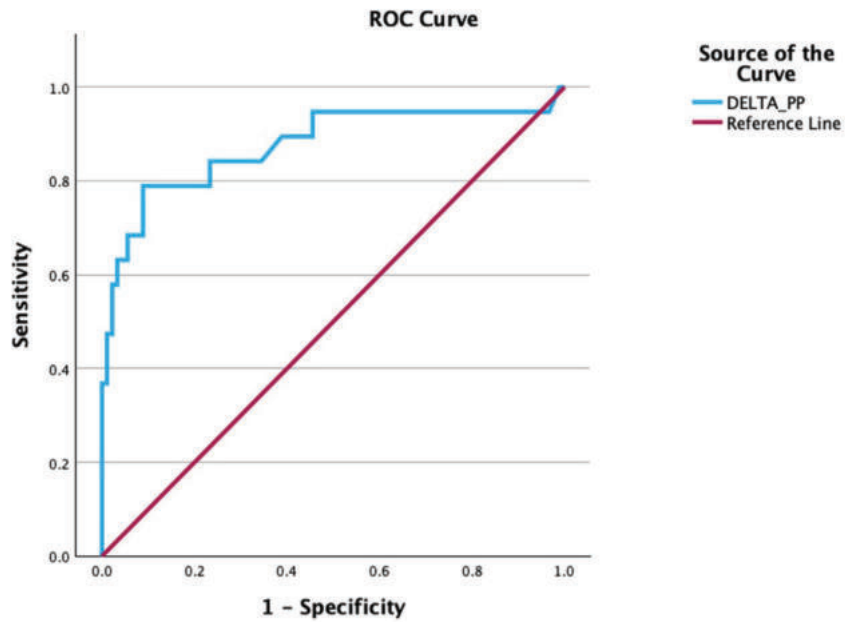
Results

The prevalence of IAD ≥ 10 mmHg was 17.4%. Logistic regression showed male sex was independently associated with higher IAD ($B=3.11$, $p=0.003$). ROC analysis revealed that SBP ratio significantly predicted IAD ≥ 10 mmHg (AUC 0.788, 95% CI 0.605–0.971, $p=0.002$), with an optimal cutoff of ≥ 1.05 (sensitivity 78.9%, specificity 86.7%). Δ PP demonstrated the strongest predictive performance (AUC 0.875, 95% CI 0.765–0.985, $p<0.001$), with an optimal cutoff of ≥ 7 mmHg (sensitivity 78.9%, specificity 90.0%). In paired-samples analysis, dominant arm PP was significantly higher than non-dominant PP (mean difference = 1.95 mmHg, 95% CI 0.81–3.10, $p=0.001$, Cohen's $d=0.32$), suggesting a systematic asymmetry.

Conclusion

Clinically relevant IAD was present in nearly one in six non-hypertensive adults. Both SBP_ratio ≥ 1.05 and Δ PP ≥ 7 mmHg were robust predictors of IAD, with Δ PP showing excellent diagnostic accuracy. These findings support the importance of bilateral BP measurement even in non-hypertensive adults and suggest that pulse pressure asymmetry may represent a novel marker for inter-arm vascular differences.

Figure



EP-03

Preeclampsia Programs Sex-Specific Hypertension and Heart Mitochondrial OXPHOS Activity in Offspring

Ling Li, Yin Hua Zhang

Department of Physiology & Biomedical Sciences, Seoul National University College of Medicine, Seoul, Korea, Republic of

Introduction

Preeclampsia predisposes offspring to hypertension, with cardiovascular phenotypes showing sex-specific differences. The mechanisms, however, remain revealed.

Methods

Preeclampsia was induced in pregnant Sprague-Dawley rats by angiotensin II (Ang II) infusion (GD 8–20) for 2 weeks. Offspring blood pressure (BP) was measured by a Noninvasive Blood Pressure Measurement Device (CODA), and mitochondrial function was assessed in the myocardium.

Results

Maternal BP was increased with Ang II infusion (peak at GD17, sham vs. PE: SBP 121.7 ± 2.9 and 153.3 ± 4.5 , $p=0.0003$; DBP 87.7 ± 2.4 and 117.0 ± 9.5 , $p=0.01$; $n=5$). Body weight was reduced in PE rats (GD17, $p=0.04$, $n=5$). BP of offsprings were measured (sham vs. PE: female SBP 123.6 ± 2.7 and 136.3 ± 2.2 , $p=0.0007$, female DBP 87.3 ± 2.4 and 106.3 ± 2.5 , $p<0.0001$, $n=4$; male SBP $p=0.8$, male DBP $p=0.37$, $n=4$). Body weight of offsprings were reduced in PE (female: $p=0.004$, $n=6$; male: $p=0.04$, $n=6$). Mitochondrial function in cardiac tissue was assessed in offspring of sham and PE. Oxygen consumption rate was increased in PE (sham vs. PE: female, $p=0.04$, $n=8$; male, $p=0.5$, $n=6$). Similar elevation was observed in membrane potential (female, $p=0.1$; male, $p=0.6$, $n=5$). The activities of complex II and III, ATP synthase or reactive oxygen species were increased in PE in both groups, with effects more pronounced in females.

Conclusion

Preeclampsia predisposes hypertension in offsprings, females demonstrate increased susceptibility. Mitochondrial OXPHOS activities in the heart were improved in female offsprings of PE.

EP-04

Prevalence of Arterial Hypertension and Its Risk Factors among Nurses

Davaakhuu Vandannyam¹, Amarsaikhan Dashtseren²

¹*Adult nursing, School of Nursing, MNUMS, Ulaanbaatar, Mongolia*

²*Public Health, School of Public Health, MNUMS, Ulaanbaatar, Mongolia*

Introduction

Study aims to survey a spread and risk factors of HTN among shift working nurses.

Methods

Prevalence of arterial hypertension among nurses, its influencing risk factors were determined by case-study method from 264 nurses working in day shift and some indicators of health risks arose from shift work were questioned by cross-sectional model from 634 nurses involved in the research. We have used tests of international standards, physical measurement method and laboratory test methods in the questionnaire of the research. Statistical processing of research work was performed by SPSS 21.0 software.

Results

Participants' mean age 39.6 ± 9.6 years. Overall, 8% of participants who work for shift and 7.2% of day working nurses are smokers ($p < 0.0001$). Prevalence of arterial hypertension among nurses was 22.7% including 13.3% exists in day-time nurses (table 1). The day working nurses and the shift working nurses and compared their BMI to measured normal (42.1% and 36.4%) overweight (39.7% and 43.9%), obesity (18.2% and 19.7%) ($p < 0.02$), central obesity normal (39.4% and 34.5). Blood cholesterol level of mean 4.3 ± 0.48 mmol/l. Blood glucose level of mean 5.5 ± 0.9 mmol/l. Nurses are divided into two groups as shift working and day working show that normal (54.9% and 48.1%) $p < 0.12$, glucose abnormal before breakfast (30.7% and 34.5%) $p < 0.12$, diabetes (4.4% and 17.4%) ($p < 0.12$). Having fruits and vegetables less than 5 units (OR=1.1 [95% CI 1.0-1.1]), BMI (OR=1.1 [95% CI 1.1-1.2]), BMI (OR=1.1 [95% CI 1.1-1.2]), visceral obesity (OR=1.1 [95% CI 1.1-1.2]), central obesity (OR=1.0 [95% CI 1.0-1.1]), blood glucose level (OR=1.4 [95% CI 1.1-1.8]), and blood cholesterol level (OR=2.2 [95% CI 1.5-3.4]) increased the risk of arterial hypertension (Table 2).

Conclusion

One in four shift working nurses had Arterial HTN, this higher than day working nurses. Hypertension is directly related such as overweight, obesity, pernicious habits and blood sugar and cholesterol level increase.

Table

Table 1. Spread of HTN of Day working and shift working nurses

HTN classification	Day work nurses				Shiftwork nurses			
	n	Spread (mean age)	95%CI		n	Spread (mean age)	95%CI	
			Highest	Lowest			Highest	Lowest
Normal	187	70.8(37.5)	65.3	76.3	167	63.3(37.1)	57.4	69.1
Increased BP	42	15.9(44.2)	11.5	20.3	37	14(43.9)	9.8	18.2
HTN	35	13.3(45.1)	9.2	17.3	60	22.7(44.8)	17.7	27.8

Table 2. Logistic regression analysis to determine the risk factors for arterial hypertension

Үзүүлэлтүүд	OR	95% ИИ		p утга
		Доод утга	Дээд утга	
Alcohol	1.021	0.644	1.620	0.928
Having fruits and vegetables less than 5 units	1.054	1.035	1.074	0.0001
Overweight and obesity	1.141	1.086	1.199	0.0001
Visceral obesity	1.163	1.113	1.215	0.0001
Central obesity	1.078	1.050	1.106	0.0001
Blood sugar level (before breakfast)	1.454	1.143	1.848	0.002
Blood cholesterol level (before breakfast)	2.285	1.504	3.471	0.0001
Smoking	1.406	0.644	3.068	0.392

Table

Table 1. Spread of HTN of Day working and shift working nurses

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HTN	35	13.3(45.1)	9.2	17.3	60	22.7(44.8)	17.7	27.8

Table 2. Logistic regression analysis to determine the risk factors for arterial hypertension

Үзүүлэлтүүд	OR	95% ИИ		p утга
		Доод утга	Дээд утга	
Alcohol	1.021	0.644	1.620	0.928
Having fruits and vegetables less than 5 units	1.054	1.035	1.074	0.0001
Overweight and obesity	1.141	1.086	1.199	0.0001
Visceral obesity	1.163	1.113	1.215	0.0001
Central obesity	1.078	1.050	1.106	0.0001
Blood sugar level (before breakfast)	1.454	1.143	1.848	0.002
Blood cholesterol level (before breakfast)	2.285	1.504	3.471	0.0001
Smoking	1.406	0.644	3.068	0.392

EP-05

Repetitive Renal Artery Occlusion and Recanalization in Patient with a Single Kidney

Cherie Im, Sanghoon Kim

Cardiology, Bundang CHA Medical Center, Seongnam, Korea, Republic of

Introduction

Renal artery occlusion is defined as the complete cessation of blood flow through the renal artery, most commonly resulting from thromboembolic events, atherosclerotic disease, or fibromuscular dysplasia (FMD). This condition can lead to significant renal impairment, and bilateral occlusions are frequently associated with the need for dialysis. Despite its clinical importance, the optimal management of chronic total renal artery occlusion remains controversial, with limited data available on the efficacy of recanalization procedures. We report a case of a single kidney patient with chronic total renal artery occlusion who showed partial renal function recovery after repeated endovascular interventions.

Methods

A 55-year-old male visited the nephrology with complaints of dyspnea. Laboratory evaluation revealed an elevated serum creatinine level of 2.3 mg/dL. Three months later, he revisited the emergency room with complaints of severe nausea and vomiting. Laboratory testing revealed a markedly elevated serum creatinine level of 10.9 mg/dL. He reported anuria for the preceding three days, so he started hemodialysis. During hospitalization, the patient continued to experience refractory uncontrolled hypertension despite the volume control by hemodialysis and the use of 4 types of antihypertensive medications. Further laboratory tests and an abdomen computed tomography was performed and CT revealed an atrophied right kidney and enlarged left kidney with left renal artery obstruction. As CT showed some contrast enhancement in the left renal cortex, we postulated the existence of a collateral arterial supply, thereby suggesting a potential opportunity to preserve left renal function with interventional treatment.

Results

The initial procedure was performed via a right femoral artery approach. Renal angiography demonstrated a total occlusion of the left renal artery with a small stump, while the origin of the right renal artery was not visualized. The procedure failed at first attempt, but 3 days later was successfully recanalized by right brachial approach with high support. Finally, percutaneous transluminal angioplasty with a 2.0 × 40 mm balloon was done, and a bare metal stent (Palmaz Blue, 5.0 × 24 mm) was deployed. Post-procedurally, the patient's urine output recovered, and hemodialysis could be discontinued. During the evaluation of the etiology for renal artery stenosis, polyarteritis nodosa (PAN) was diagnosed based on the laboratory findings, imaging studies, and clinical presentation through a consultation with the rheumatology department. The patient was subsequently initiated on immunosuppressive therapy, including azathioprine, mycophenolic acid and systemic corticosteroids. Dual antiplatelet agents and high intensity statin were also started. Three years later, the patient experienced oliguria and worsening of renal function on routine follow-up, and received re-intervention with a cutting balloon followed by a drug-eluting balloon. The second restenosis occurred one year later and was treated with a drug-eluting balloon. The third restenosis occurred three years later and was treated with a drug-eluting balloon. Each time, renal function and urine output recovered after the procedure. He is now on 6 years of follow-up after the first procedure without dialysis.

Conclusion

This case demonstrates that repeated endovascular interventions can be an effective therapeutic option for patients with chronic total renal artery occlusion and a single functioning kidney, particularly in the presence of collateral perfusion. Timely revascularization may lead to recovery of renal function and discontinuation of dialysis. A multidisciplinary approach is critical in the diagnosis, intervention, and follow-up of complex renovascular disease.

Figure



Figure 1: Before and after repetitive recanalization of renal artery

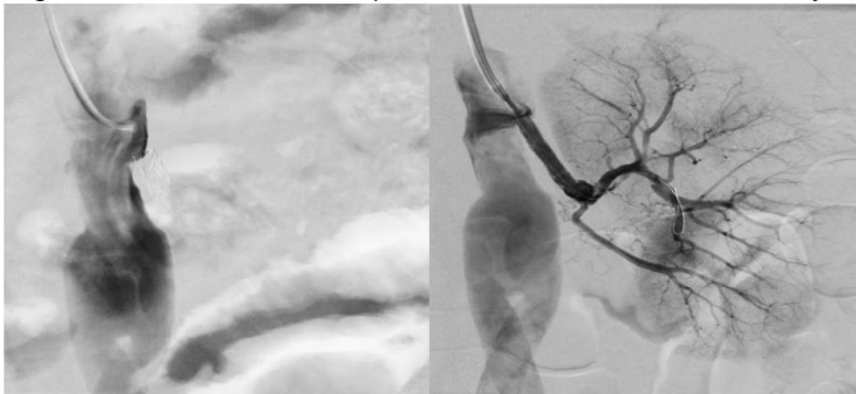


Figure 2: Before and after recanalization of the In-stent restenosis

EP-06

Health Budget Priorities and Hypertension Risk: An Analysis of the Role of Domestic General Government Health Expenditure, External Health Expenditure, and Out-of-Pocket in an Adult Population of ASEAN-5

Putri Ayu¹, Roland Helmizar²

¹Economics, Andalas University, Padang/Indonesia, Indonesia

²Internal medicine, Baiturrahmah University, Padang/Indonesia, Indonesia

Introduction

According to 2023 WHO data and referenced reports, nearly one-third of the world's adult population, or approximately 33%, suffers from hypertension. This figure represents approximately 1 in 3 adults worldwide. This study aims to identify the interrelationships between government, the private sector, and individual awareness of hypertension risk among adults in ASEAN-5.

Methods

The methods used in this study are fixed effects and random effects models. The data used are panel data, combining data series from 2000 to 2018 with cross-sectional data from ASEAN-5 (Indonesia, Malaysia, Thailand, Singapore, and the Philippines). The data are sourced from the World Health Organization. The independent variables used were Domestic General Government Health Expenditure (DGGH-E), External Health Expenditure, and Out-of-Pocket Expenditure, with the dependent variable being the prevalence of hypertension in adults aged 20-79 years.

Results

The results showed that the best model from the Hausman test was the fixed effect model, as the sig value was less than 0.005. The fixed effect model showed that the variables DGGH-E, External Health Expenditure, and Out-of-Pocket significantly and negatively reduced the risk of hypertension, as indicated by $p < 0.1$, $* p < 0.05$, and $*** p < 0.01$. The result that significantly reduced the risk of hypertension was external expenditure, marked by the largest coefficient value among the other independent variables at -1.283%, followed by DGGH-E at -0.278%, and finally, out-of-pocket expenditure as a percentage of current health expenditure at -0.0687%. When viewed simultaneously, all independent variables collectively influence the prevalence of hypertension among those aged 20-79 in the ASEAN-5.

Conclusion

Therefore, government efforts are needed to collaborate with external parties to provide health insurance to support public health, increase government spending through the state budget (APBN), and increase community income to increase out-of-pocket expenditure and reduce the risk of hypertension.

Table

	(Random effect) hypertension	(Fixed effect) hypertension
GGHE-D	-0.278* (0.149)	-0.266* (0.145)
External expenditure	-1.283*** (0.278)	-1.363*** (0.268)
Out of pocket	-0.0687* (0.0411)	-0.0895** (0.0408)
cons	39.94*** (2.951)	40.24*** (2.799)
N	86	86

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Analyzing the Interplay of Lifestyle, Psychology, and Heredity in Hypertension: A Study of Smoking, Mental Well-being, Demographic Factors, and Family History among Indonesian Adults Using the Indonesia Family Life Survey (IFLS) Data

Derizal Derizal¹, Roland Helmizar², Putri Ayu³

¹Tourism, IP Trisakti, South Jakarta/Indonesia, Indonesia

²Internal Medicine, Baiturrahmah University, Padang/Indonesia, Indonesia

³Economics, Andalas University, Padang/Indonesia, Indonesia

Introduction

Hypertension is one of the diseases that is quite common in Indonesia. This study aims to identify smoking habits, mental health, demographic status and parental habits in hypertension patients in Indonesia.

Methods

The method used is tabulation analysis. The data source is the Indonesia Family Life Survey with a total of 1,078 respondents. Identification of variables suspected of influencing hypertension are smoking habits, mental health problems, demographic variables such as age, gender, education, employment status, parental habit variables when children are under 12 years old in the form of smoking habits, drinking habits, and mental health problems.

Results

The study revealed that a significant majority of hypertension sufferers in Indonesia are active smokers (72.26%), while those experiencing mental health problems were recorded as lower (6.03%). Demographically, patients were predominantly male (87.93%), married (80.97%), and most had a junior high school education (36.92%), followed by a bachelor's degree (28.57%), with the majority being workers (73.56%). In terms of parental habits, a strong intergenerational correlation was seen where the majority of patients (72.35%) came from parents who smoked when they were under 12 years old, while parental alcohol consumption habits and parental mental health problems were less common (5.20% and only 4 people, respectively).

Conclusion

So, someone who smokes, is stressed, a worker, and whose parents have a habit of smoking and drinking alcohol has a high chance of getting hypertension which is marked by a value greater than 70%. It is expected that individuals do not smoke, maintain mental health, work by paying attention to time and health, and parents do not have bad habits.



EP-08

Family History as a Determinant of Hypertension Risk: A Population-Based Study Using Python-Based Statistical Analysis

Devi Yulia Rahmi

Management, Universitas Andalas, Agam, Indonesia

Introduction

Hypertension is a significant risk factor for cardiovascular disease, with a steadily increasing prevalence globally. In addition to lifestyle factors, family history is an important determinant, reflecting a genetic predisposition to hypertension. Individuals with a family history of hypertension have a higher risk than those without a similar history. Python-based analysis can help comprehensively evaluate this relationship through a statistical and data-driven approach.

Methods

Using a population-based study approach, this study used secondary data from a hypertension dataset. The analysis focused on the influence of family history on hypertension risk, compared to lifestyle factors. Data were processed and analysed using Python in Google Colab, using descriptive statistics and logistic regression techniques to identify influential factors.

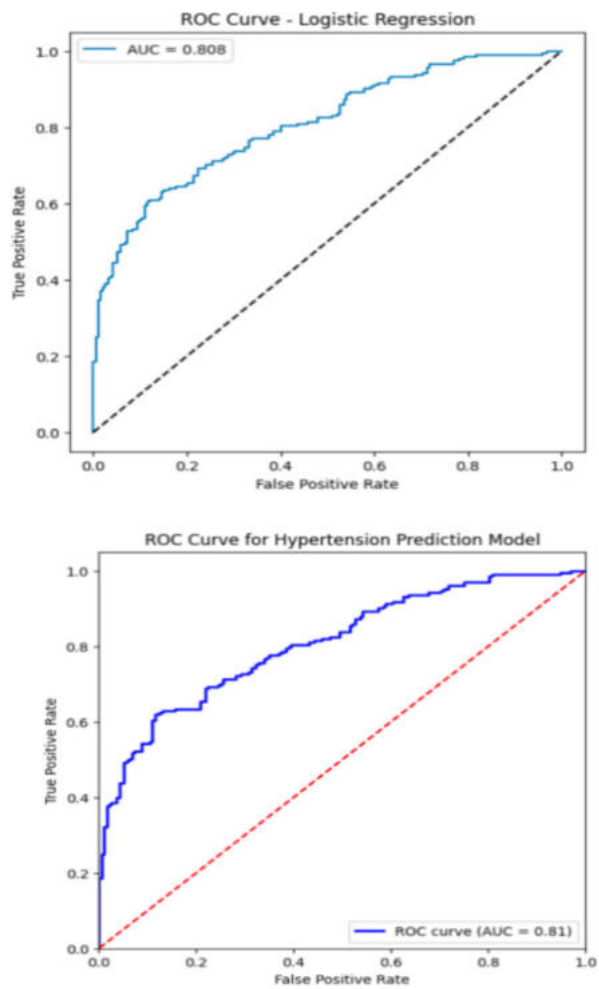
Results

The analysis showed a higher prevalence of hypertension in individuals with a positive family history than in those without. The logistic regression model performed well with an AUC of 0.808. Significant risk factors included family history, smoking, and high salt intake. Family history remained a strong predictor, confirming the contribution of genetic factors to the incidence of hypertension.

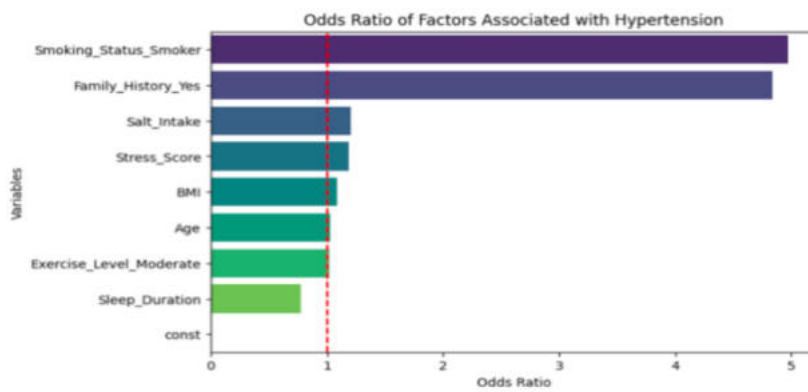
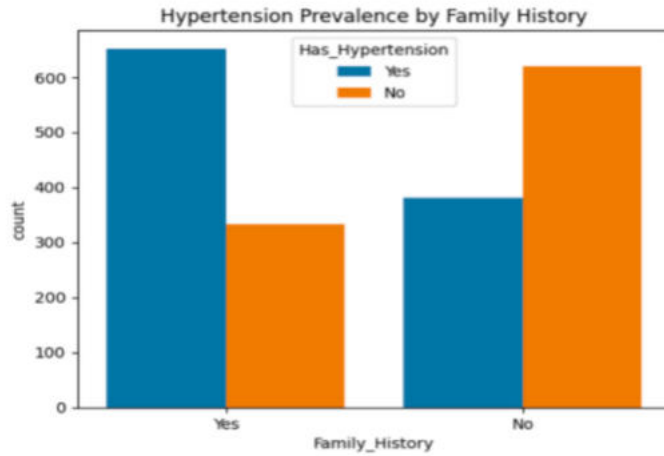
Conclusion

Family history has been shown to play a significant role as a risk factor for hypertension, even when compared with lifestyle factors. These findings emphasise the importance of genetic factors in hypertension prevention and management efforts.

Figure



Figure



EP-09

Association between Sleep Duration and Hypertension: A Python-Driven Analysis of Lifestyle and Demographic Risk Factors

Muhammad Irzaq

Language and Art, Alumnus Padang State University, Padang- West Sumatera, Indonesia

Introduction

Hypertension is a global health problem with increasing prevalence and is a significant risk factor for cardiovascular disease. Lifestyle factors, including sleep duration, influence blood pressure regulation significantly. However, the relationship between sleep quality and hypertension remains a relevant research topic, mainly when analyzed in conjunction with other risk factors such as age, body mass index, salt intake, stress, and family history.

Methods

This study used secondary data from 1,985 respondents. The main variables analyzed included hypertension status, sleep duration, age, body mass index (BMI), salt consumption, stress levels, lifestyle factors, and family history. The analysis was performed in Python using a difference-of-means test to assess differences in sleep duration between the hypertensive and non-hypertensive groups. Furthermore, multivariate logistic regression was applied to evaluate the association between sleep duration and hypertension after adjusting for covariate factors. Model performance was assessed using an ROC curve with AUC calculation.

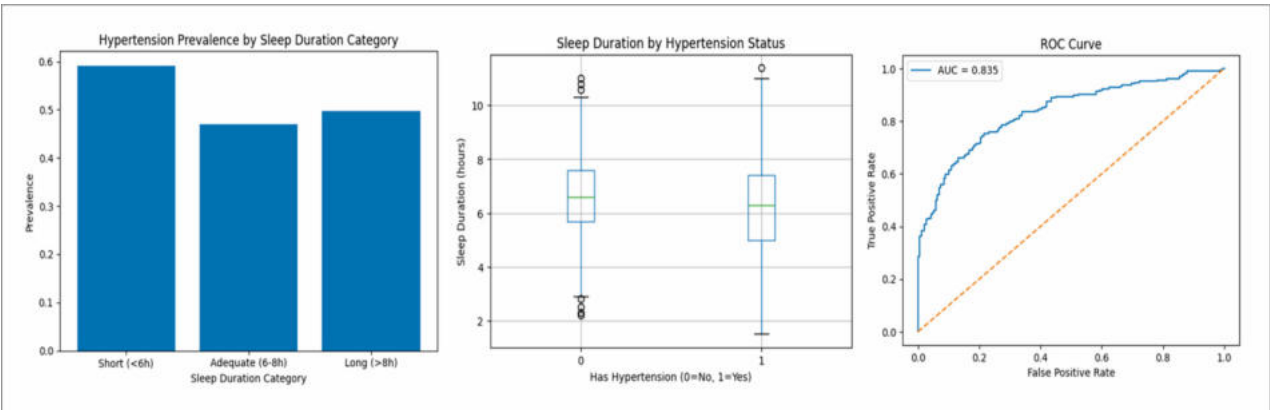
Results

The analysis was conducted on 1,985 respondents with a hypertension prevalence of 51.99%. The average sleep duration in the hypertension group was 6.28 hours, lower than that of the non-hypertension group (6.64 hours). Logistic regression analysis showed that each additional hour of sleep was associated with a reduced risk of hypertension (OR = 0.78; 95% CI: 0.73–0.84; $p < 0.001$). The developed prediction model performed well with an AUC value of 0.835, indicating intense discrimination.

Conclusion

Shorter sleep duration was significantly associated with an increased risk of hypertension, even after controlling for lifestyle and demographic factors. These findings underscore the importance of maintaining adequate sleep patterns as part of a population-level hypertension prevention strategy.

Figure



EP-10

Impact Evaluation of Policy Interventions on Hypertension Disease Prevalence: Assessing the Smoking and Alcohol Regulation in Indonesia

Rosinta Hotmaida Pebrianti Purba¹, Yesika Simbolon^{2,1}

¹Health Economics, The Pranala Institute, Yogyakarta, Indonesia

²Accounting, Atmajaya University, Yogyakarta, Indonesia

Introduction

The prevalence of hypertension in Indonesia is 34.1%, showing an increase compared to the 2013 National Basic Health Survey (Riskesdas), which reported a prevalence of 25.8%. Hypertension is a leading risk factor for cardiovascular diseases, exacerbated by smoking and alcohol consumption. In Indonesia, cigarette excise taxes and alcohol restriction aim to reduce these behaviors. However, their effectiveness particularly across different age groups, remains underexplored. This study leverages Indonesia Family Life Survey (IFLS) data to evaluate the impact of these policies while considering demographic, socioeconomic, and social capital factors.

Methods

Using Indonesia Family Life Survey (IFLS), sample is adults aged ≥ 18 divided into three age groups 18–39 years (young adults), 40–59 years (middle-aged), and 60+ (elderly). Variables include cigarette excise (price), alcohol ban and restriction (purchase frequency), migration status (rural to urban, urban to rural, or inter-island), and control variables (demographics, SES, and social capital). Fixed-effects regression and interaction effects will analyze the relationship.

Results

Cigarette excise taxes reduced hypertension prevalence by 11.2%, with the strongest effects among middle-aged adults ($p < 0.001$). Alcohol bans contributed to an 8.5% reduction, particularly benefiting elderly populations ($p < 0.01$). Combined policies resulted in an overall 19.7% decrease in hypertension prevalence. Social capital reduced prevalence by 6.4% across all age groups, emphasizing the role of community engagement. However, higher income increased prevalence (+4.0%), reflecting access to alternative sources of cigarettes and alcohol. Middle-aged adults showed the highest responsiveness to cigarette excise taxes, while elderly individuals benefited most from alcohol bans. Young adults exhibited smaller reductions, highlighting the need for age-specific strategies. High education further amplified policy effectiveness, reducing prevalence by 5.8%.

Conclusion

Cigarette excise taxes and alcohol bans significantly reduce hypertension prevalence, particularly among middle-aged and elderly groups. Strengthening social capital and educational outreach can enhance policy outcomes, addressing age-specific and socioeconomic disparities to mitigate hypertension risks.

Table

Predictor	Δ Cigarette Consumption	Δ Alcohol Consumption	Δ Hypertension Prevalence	Interaction Effect (Age Group)	p-value
Cigarette Excise Tax	-7.5%	-	-10.8%	Strongest in middle-aged adults	< 0.001
Alcohol Ban	-	-9.2%	-7.3%	Most effective in elderly	< 0.01
Social Capital (High)	-3.8%	-4.5%	-6.0%	Beneficial across all groups	< 0.05
Income (High)	+2.5%	+3.1%	+4.0%	Consistent across groups	< 0.05

Table

Predictor	Combined Effect on Hypertension Prevalence (ΔCases)	Interaction Effect (Age Group)	p-value
Cigarette Excise Tax	-11.2%	Strongest in middle-aged adults	< 0.001
Alcohol Ban	-8.5%	Strongest in elderly populations	< 0.01
Education Level (High)	-5.8%	Consistent across groups	< 0.01
Social Capital (High)	-6.4%	Beneficial across all ages	< 0.01

EP-11

Decoding the Structural Exposome: Integrating Incarceration, Eviction, Built Environment, and Pollution to Model Hypertension Risk

Sahnaz Vivinda Putri¹, Rini Winarti², Prihantini Prihantini³, Rifaldy Fajar¹

¹*Management, Indonesia Open University, Makassar, Indonesia*

²*Biology, Yogyakarta State University, Sleman, Indonesia*

³*AI-BioMedicine Research Group, IMCDS-BioMed Research Foundation, Jakarta, Indonesia*

Introduction

Hypertension is the leading modifiable driver of cardiovascular morbidity and mortality, while conventional models largely neglect the contribution of structural and environmental stressors. Incarceration, eviction, food deserts, walkability, and air pollution represent underexplored dimensions of the “structural exposome” that may jointly shape population-level hypertension risk. This study integrated these determinants into a single analytic framework using multi-source open datasets and machine learning.

Methods

We assembled a nationwide dataset by linking the Centers for Disease Control and Prevention (CDC) PLACES Project 2024 tract- and county-level estimates of high blood pressure prevalence with indicators of structural stressors, including the Vera Institute of Justice Incarceration Trends Dataset (jail and prison incarceration rates, 1970–2024) and the Eviction Lab National Database (eviction filings and judgments, 2000–2018), supplemented by the Eviction Lab Eviction Tracking System (ETS) for selected jurisdictions (2020–present). Built environment features were extracted from the United States Department of Agriculture (USDA) Food Access Research Atlas (food desert indicators, census tract) and the United States Environmental Protection Agency (EPA) National Walkability Index (block group scores, aggregated to tract), while environmental exposures were captured from the Open Air Quality (OpenAQ) Platform (PM_{2.5}, NO₂, O₃, 2015–2022 averages). Sociodemographic covariates were derived from the American Community Survey (ACS) 5-year estimates. Datasets were harmonized through spatial joins and population weighting, yielding approximately 70,000 census tracts nationwide. Predictive models included gradient boosting, random forest, and graph neural networks with adjacency matrices based on tract contiguity. OpenAI’s GPT-based tools were used to assist in drafting code documentation and preprocessing workflows, with all procedures refined and finalized by the authors. Model interpretability was assessed using SHAP values, and counterfactual analyses simulated reductions in structural stressors.

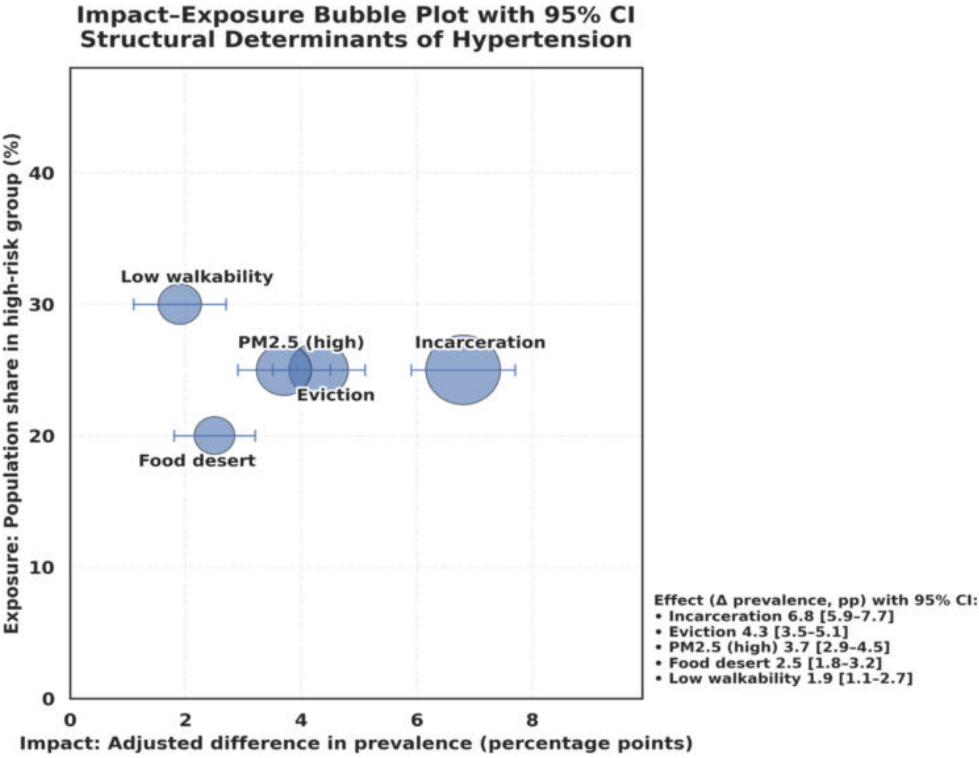
Results

Mean tract-level hypertension prevalence was 31.4% (95% CI, 31.2–31.6), with wide geographic variation (17.1–52.6%). Models integrating structural and environmental exposures improved out-of-sample prediction ($R^2 = 0.41$, RMSE = 3.7%) compared to sociodemographic-only models ($R^2 = 0.26$, RMSE = 5.1%). Incarceration was among the strongest predictors: tracts in the top incarceration quintile showed 6.8% higher hypertension prevalence (95% CI, 5.9–7.7%) than those in the lowest quintile. Eviction was also significant, with tracts in the top quartile of filings showing 4.3% higher prevalence (95% CI, 3.5–5.1%). Food deserts and low walkability contributed additional risk, with absolute increases of 2.5% (95% CI, 1.8–3.2%) and 1.9% (95% CI, 1.1–2.7%), respectively. Environmental exposures remained independent predictors: tracts in the highest PM_{2.5} quartile (>12 µg/m³) exhibited 3.7% higher prevalence (95% CI, 2.9–4.5%). Counterfactual simulations projected that reducing eviction rates by 20% could lower hypertension prevalence by 1.7% (95% CI, 1.2–2.2%), while reducing PM_{2.5} by 5 µg/m³ corresponded to a 1.5% relative decline, magnitudes comparable to improvements in educational attainment.

Conclusion

This study shows that incorporating incarceration, eviction, food access, walkability, and pollution substantially improves prediction of community hypertension burden. Structural and environmental stressors are critical, policy-relevant levers for cardiovascular prevention, with potential for interventions directed at housing stability, justice reform, and urban design.

Figure



EP-12**Beyond Clinical Metrics: Satisfaction of Care, Psychological Well-being, and Nutritional Status among Elderly Hypertensive Patients in Indonesia**

Hepri Ardianson¹, Lintong Simbolon¹, Rosinta Purba¹, Ester Marnita^{2,1}, Yesika Simbolon^{3,1}

¹Health Economics, The Pranala Institute, Yogyakarta, Indonesia

²Hospitality and Care, Raff Tindal NT, Darwin, Australia

³Accounting, Atmajaya University, Yogyakarta, Indonesia

Introduction

The management of hypertension in elderly populations within low- and middle-income countries requires a holistic focus on patient-centered outcomes beyond clinical metrics. Understanding the interplay between healthcare satisfaction, psychological well-being, and nutritional status is critical for developing effective public health strategies for Indonesia's aging demographic which reach 30 million older adults aged 60+.

Methods

We analyzed a propensity score-matched cohort of 3,488 elderly hypertensive patients from the Indonesia Family Life Survey. Regular treatment was defined as having a usual care source and antihypertensive medication use. Outcomes included care satisfaction (0-10 scale), psychological distress (CES-D-10), and nutritional status (objectively measured BMI). A subgroup analysis compared patients with and without access to regular treatment—defined as having both a usual care source and using prescribed antihypertensive medication. We employed multivariate regression, heterogeneity analysis, and causal mediation modeling to delineate direct and indirect pathways.

Results

After matching, groups were balanced on socio-demographic and clinical covariates (all standardized differences <0.1). Regular treatment was associated with higher care satisfaction ($\beta=0.52$, $p=0.003$) and reduced psychological distress ($\beta=-0.72$, $p=0.004$) but increased BMI ($\beta=1.21$, $p<0.001$). Heterogeneity analysis revealed treatment benefits on satisfaction were concentrated in the lowest wealth quintile ($\beta=0.91$, $p<0.001$; p -interaction=0.01). Causal mediation analysis demonstrated that 12.4% of the treatment effect on BMI was mediated through reduced psychological distress (ACME=0.15, $p<0.001$), while the majority represented a direct effect (ADE=1.06, $p<0.001$) potentially reflecting medication effects or behavioral pathways.

Conclusion

Hypertension treatment in Indonesia improves mental health and care satisfaction, particularly among the most disadvantaged, but is associated with excess weight gain. This trade-off, partially explained by the alleviation of depressive symptoms, underscores a critical gap in care quality. Public health strategies must integrate nutritional guidance into chronic disease management to avoid substituting metabolic for mental health burdens.

Table

Characteristic	No Regular Tx (n=2,221)	Regular Tx (n=2,394)	Standardized Difference	No Regular Tx (n=1,744)	Regular Tx (n=1,744)	Standardized Difference
Age, mean (SD)	67.5 (6.5)	69.3 (7.3)	0.27	68.9 (7.1)	69.1 (7.2)	0.03
Female, %	57.1%	62.9%	0.12	61.8%	62.2%	0.01
Urban Residence, %	44.2%	51.5%	0.15	49.1%	50.3%	0.02
Wealth Quintile, %			0.31			0.04
- Q1 (Lowest)	31.2%	18.5%		21.8%	20.1%	
- Q2	25.8%	20.1%		22.3%	21.5%	
- Q3	19.1%	21.3%		20.5%	21.0%	
- Q4	15.3%	21.8%		19.1%	19.8%	
- Q5 (Highest)	8.6%	18.3%		16.3%	17.6%	
Has Insurance, %	66.2%	80.1%	0.32	78.3%	79.5%	0.03
Comorbidity Count, mean (SD)	1.4 (1.2)	2.0 (1.3)	0.48	1.8 (1.3)	1.9 (1.3)	0.08
ADL Difficulty, mean (SD)	0.6 (1.1)	1.0 (1.4)	0.33	0.9 (1.3)	0.9 (1.3)	0.00

Table

Outcome	Full Matched Cohort Adjusted Effect (95% CI); p-value	Q1 (Lowest)	Q2	Q3	Q4	Q5 (Highest)	p-Int
Satisfaction (β)	0.52 (0.18 to 0.86); 0.003	0.91 (0.42 to 1.40)	0.63 (0.11 to 1.15)	0.41 (-0.10 to 0.92)	0.22 (-0.35 to 0.79)	0.11 (-0.33 to 0.55)	0.01
CES-D-10 Score (β)	-0.72 (-1.21 to -0.23); 0.004	-0.81 (-1.62 to 0.00)	-0.78 (-1.55 to -0.01)	-0.95 (-1.70 to -0.20)	-0.52 (-1.40 to 0.36)	-0.45 (-1.25 to 0.35)	0.42
High Distress (OR)	0.72 (0.53 to 0.98); 0.038	0.65 (0.38 to 1.11)	0.70 (0.41 to 1.20)	0.57 (0.35 to 0.94)	0.81 (0.47 to 1.40)	0.88 (0.51 to 1.52)	0.31
BMI (β)	1.21 (0.83 to 1.59); <0.001	1.05 (0.42 to 1.68)	1.18 (0.61 to 1.75)	1.25 (0.68 to 1.82)	1.30 (0.65 to 1.95)	1.45 (0.85 to 2.05)	0.58
Overweight (OR)	1.38 (1.12 to 1.70); 0.002	1.25 (0.85 to 1.84)	1.32 (0.92 to 1.90)	1.41 (0.98 to 2.03)	1.47 (0.97 to 2.22)	1.65 (1.10 to 2.47)	0.21

EP-13

Umbelliferone Liposomes Ameliorate NG Nitro L Arginine Methyl Ester (I NAME) Induced Hypertension in Rats via Alteration of PI3K/Akt Signaling Pathway

V Kumar¹, D Chauhan², P Bhatt³

¹Pharmacy, AAI-DU, Allahabad, India

²Applied Physics, RK Institute of Management, Uttarakhand, India

³Biotechnology, Fermentis Life Sciences, Gurugram, India

Introduction

Hypertension is a progressive cardiovascular syndrome characterized by sustained elevations in blood pressure. It arises from complex and interrelated etiologies. In this study we fabricate the liposomes of umbelliferone (UF-PEGL) and scrutinized against the NG Nitro L Arginine Methyl Ester (I NAME) Induced Hypertension in Rats via alteration of PI3K/Akt Signaling Pathway.

Methods

Swiss Wistar rats were used in this study and I-NAME (40 mg/kg body weight) was used for the administration of hypertension in the rats and rats were orally received the oral administration of UF-PEGL. The blood pressure parameters and direct cannulation model was used for estimation of hemodynamic parameters. The antioxidant, cytokines and inflammatory parameters were estimated. The mRNA expression of PI3K and Akt were estimated.

Results

UF-PEGL significantly ($P < 0.001$) suppressed the diastolic and systolic blood pressure. UF-PEGL significantly ($P < 0.001$) modulated the heart rate, plasma norepinephrine, epinephrine and mean arterial pressure. UF-PEGL significantly ($P < 0.001$) altered the level of oxidative stress parameters like SOD (45%), MDA (56%), GSH (43%), CAT (61%); cytokines like TNF- α (32%), IL-1 β (45%), IL-6 (43%); inflammatory parameters include TGF- β (34%), NF- κ B (43%), CRP (34%). UF-PEGL significantly ($P < 0.001$) altered the mRNA expression of PI3K, Akt.

Conclusion

The result clearly showed that UF-PEGL exhibited the antihypertensive effect against NG Nitro L Arginine Methyl Ester Induced Hypertension in Rats via alteration of PI3K/Akt Signaling Pathway.

Geographic Information System (GIS) Mapping of Hypertension Vulnerability in Kalimantan Island in Indonesia: Using Open Government Data

Derizal Derizal¹, Putri Ayu², Siska Azizah³

¹Pariwisata, IP Trisakti, South Jakarta/Indonesia, Indonesia

²Economics, Andalas University, Padang/Indonesia, Indonesia

³Health, Baiturrahmah University, Padang/Indonesia, Indonesia

Introduction

Hypertension in Indonesia is quite high, with the incidence reaching 36% according to the Indonesian Basic Health Research (Ministry of Health, 2023). This study aims to identify and map the prevalence of hypertension in 34 provinces in Indonesia, particularly Kalimantan Island, which has the highest prevalence in Indonesia.

Methods

The method used was Geographic Information System (GIS) analysis using QGIS software and data processing techniques to transform spatial and geographic data into meaningful information. The analysis was conducted using descriptive regional analysis, taking five provinces on Kalimantan Island, Indonesia. Data identified included inadequate service availability, smoking rates, per capita income, National Health Insurance (JKN) coverage, and happiness levels, all of which were compared with the number of hypertension sufferers sourced from the Indonesian Central Statistics Agency (BPS) and the WHO.

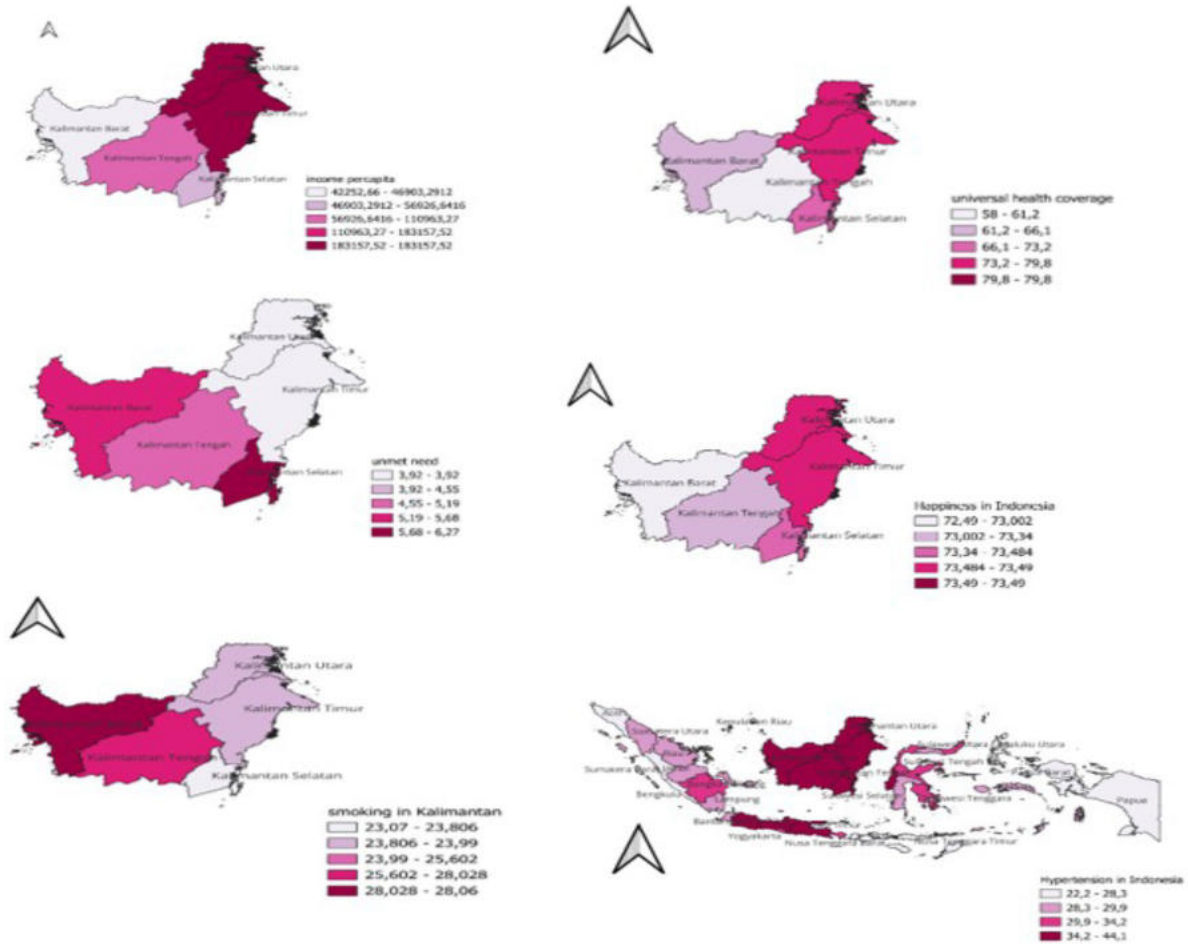
Results

The results showed that Kalimantan Island, where the five provinces have the highest hypertension rates, all of which fall within the 4th quartile, with a range of 34.2-44.1%. In Indonesia, hypertension in quartile 4 is also experienced by all provinces on the island of Java except Banten province, and West Sulawesi province of Sulawesi island. When compared to socio-economic factors affecting hypertension, it is mapped that North Kalimantan and East Kalimantan are in Quartile 4 (183157.52-183157.52 USD) in per capita income, this shows that the higher the income, the higher the incidence of hypertension, but not in all provinces. When viewed from the unmet need for services, it is seen that South Kalimantan is in quartile 4 (5.68-6.27%), indicating that the services are not met, thus increasing hypertension, while other provinces do not show a positive pattern. West Kalimantan shows a high smoking rate (Quartile 4 (28.02-28.06%)), indicating a positive association with hypertension. Central Kalimantan is in Quartile 3, North and East Kalimantan in Quartile 2, and South Kalimantan in Quartile 1. West, Central, and South Kalimantan (Quartiles 1-2) show a negative association between JKN and happiness with hypertension, while North and East Kalimantan have a positive association in Quartile 4.

Conclusion

Therefore, special attention is needed for each region, given the different risk factors across provinces, including smoking rates, per capita income, universal health coverage, unmet need for services, and happiness levels.

Figure



EP-15

Effect of Nutritional Intervention at an Elderly Home Care on Glycaemic Control and Blood Pressure in Individuals with Type 2 Diabetes: Quasi-Experimental Study

Atika Anif Prameswari

Nutrition, Universitas Airlangga, Surabaya, Indonesia

Introduction

This study aimed to investigate the effect of a nutritional intervention on glycaemic control, risk factor status, and dietary adherence in institutionalized elderly with type 2 diabetes.

Methods

A quasi-experimental study with pre and post-tests was designed in this study. Thirty-two elderly with type 2 diabetes took part in the study. The intervention comprised nutrition education (class counseling on balanced nutrition guidelines) and improved nutrition and food provision for 3 months. The primary outcomes were serum levels of HbA1c, HDL, LDL, total cholesterol, triglyceride, blood pressure, and dietary consumption. Diabetes mellitus was defined as having HbA1c >6.5%. Outcome measures were assessed at baseline and 3-month. Data analysis was done using paired t-test and Wilcoxon signed-rank test with $p < 0.05$ considered as significant. Data were entered and analyzed using STATA software version 15.

Results

All 32 (100%) type-2 diabetes patients (men: 18 (56.25%); aged 60-80 years old) attended all educational sessions and completed the intervention period. There was a significant improvement in HbA1c (from 7.55 ± 1.57 mg/dL to 6.57 ± 1.44 mg/dL; $p = 0.005$), SBP (from 141.78 ± 27.87 mmHg to 130.43 ± 21.32 mmHg; $p = 0.036$), and DBP (from 86.31 ± 26.71 mmHg to 76.21 ± 13.42 mmHg; $p = 0.03$), however, there was no significant improvement in HDL, LDL, total cholesterol, and triglycerides ($p > 0.05$). This study also found the effect of a nutritional intervention in increasing protein intake (baseline: 35.43 ± 12.42 g vs 3-months: 46.47 ± 19.02 g; $p < 0.05$). However, there was an increase but not statistically significant in intakes of energy, carbohydrate, and fat before and after the intervention.

Conclusion

Our study showed an effect of an institution-based nutritional intervention in improving HbA1c, blood pressure (systolic blood pressure and diastolic blood pressure), and protein intake among individuals with type 2 diabetes. Improved food provision combined with nutritional education in geriatric home care can be a strategy to enhance their health status.

Table

Table 1. Comparison of mean (95% CI) for health parameters at baseline and at 3 months

Variable	Baseline	After 3 months follow up	Mean difference (comparing 3 months with baseline)	Statistical significance
	Mean±SD	Mean±SD	Mean±SD	p-value
HbA1C (%)	7.55 ± 1.57	6.57 ± 1.44	10.09 ± 21.58	0.005
Systolic blood pressure (mmHg)	141.78 ± 27.87	130.43 ± 21.32	11.34 ± 25.27	0.036
Diastolic blood pressure (mmHg)	86.31 ± 26.71	76.21 ± 13.42	0.98 ± 1.57	0.030
HDL (mmol/L)	42.75 ± 11.60	41.31 ± 13.30	1.43 ± 12.40	0.323
LDL (mmol/L)	113.08 ± 32.98	125.94 ± 27.59	-12.86 ± 30.85	0.952
Cholesterol (mmol/L)	188.78 ± 40.28	200.71 ± 36.75	-11.93 ± 38.72	0.889
Triglyceride (mmol/L)	174.96 ± 135.16	179.03 ± 109.25	-4.06 ± 121.93	0.552

Values in bold are statistically significant ($P < 0.05$). CI, Confidence Interval; HDL, High Density Lipoprotein; LDL, Low Density Lipoprotein

EP-16

The Intertwining of Rotating Night Shifts and the Practice of Consuming Light Meals Late at Night Can Heighten the Likelihood of Developing Hypertension, Obesity and Cardiovascular Diseases

Qulsoom Naz¹, B Anjum², Narsingh Verma²

¹Medicine, King George's Medical University, Lucknow, India

²Physiology, King George's Medical University, Lucknow, India

Introduction

The aim of this study was to investigate the effects of rotating night shift and late night feeding behaviour on 24 hrs chronomics of BP/HR, Insulin level and lipid profile in rotating night shift nursing professionals.

Methods

Here we have presented the findings of two different case control studies on night shift nursing professionals performed day and night shift duties (aged 20-40 year) and age sex matched controls. For study I, we have tested Fasting blood glucose level, Insulin resistance and lipid profile and for study II, 24 hours chronomics of BP/HR (ABPM) in terms of Acrophase and Hyperbaric index and its relation with circadian rhythm of salivary cortisol were studied.

Results

Fasting insulin level was increased in night workers (4.05 ± 2.45) than controls (2.75 ± 2.53) and was statistically significant ($p < 0.05$). Insulin resistance was slightly increased among night workers (0.80 ± 0.50) as compare to controls (0.53 ± 0.51). In night shift, hyperbaric index (HBI) of mean SBP was found to be increased at 00-03 am (midnight) while during day shift, peak was found at 06-09 am. HBI of mean HR was found to be increased at 18-21 pm during night shift while in controls, peak was found at 09-12 am & again 15-18 pm. Alterations in Acrophase of BP/HR were very common among night shift workers. Significant difference was found in night cortisol levels among night (4.08 ± 3.28) vs day shift (2.62 ± 2.37), ($p < 0.005$).

Conclusion

Indulging in late-night meals during night shifts heightens their risk of developing cardiovascular diseases later on. Consequently, they may encounter a greater likelihood of heart issues in the future.

Factors Associated with Good Dietary Salt Intake Practices among Medical Students at Universiti Putra Malaysia

Siew Mooi Ching¹, Sangeetha Murugapergasam¹, Muhammad Aizra Putra Sany Putra¹, Hannah Maihani Nor Azhar¹, Dhashani Sivaratnam², Salwana Ahmad³

¹Family Medicine, FPSK, UPM, 43400 Serdang Selangor, Malaysia, Serdang/ Selangor, Malaysia

²Ophthalmology, FPSK, UPM, 43400 Serdang Selangor, Malaysia, Serdang/Selangor, Malaysia

³Clinical Research Unit, Clinical Research Unit, Hospital Sultan Abdul Aziz Shah, Serdang/ Selangor, Malaysia

Introduction

Excessive dietary salt intake is a major public health concern linked to various health risks, including hypertension and cardiovascular diseases. As future healthcare professionals, medical students must adopt and promote good dietary salt intake practices. This study aimed to identify factors associated with good dietary salt intake practices among medical students at a public university.

Methods

A cross-sectional study was conducted among first- to fifth-year medical students at UPM from February 2024 to June 2024 using universal sampling. Data were collected using a validated online questionnaire on knowledge, attitude and practice towards low salt consumption, adapted from the Ministry of Health's guidelines. Dietary Salt Intake Practice was classified as "good" (score ≥ 8) or "poor" (score < 8) based on a median cut-off. Pilot study was conducted with Cronbach's Alpha value of 0.732. Ethical approval was obtained before study commencement. Multiple logistic regression was used to determine factors associated with good dietary salt intake practices.

Results

Response Rate was 68.7% (364 out of 530 UPM medical students participated). Median age was 22 year-old, 54.2% Malay, 66.2% female. Knowledge on Salt Intake: 70.1% aware of Malaysian salt guidelines, but only 29.3% knew the recommended 5g/day limit. 82.3% identified "Sodium/Natrium" on nutrition labels. Attitude: 61.4% believed they consumed "just the right amount" of salt. 45.5% considered lowering salt "very important". Based on multiple logistic regression analysis, Non-Malay individuals showing higher odds of good practice compared to Malay individuals (aOR 1.93, $p=0.005$). Students in their Clinical years had significantly higher odds of good practice than those in Pre-clinical years (aOR=1.30, $p=0.002$). Those with a higher total attitude score was significantly and positively associated with good practice of dietary salt intake (aOR 1.52, $p<0.001$).

Conclusion

In conclusion, more than half of UPM medical students practiced good dietary salt intake. Targeted educational interventions are needed for Malay students, pre-clinical students, and those with less favorable attitudes towards salt management.

EP-18

Determinants of Ideal Cardiovascular Health among Older Adults with Hypertension in Thai Primary Care: A Cross-Sectional Study

Jom Suwanno

Graduate Nursing Studies, Walailak University School of Nursing, Nakhon Si Thammarat, Thailand

Introduction

Ideal cardiovascular health (CVH), defined by the American Heart Association's Life's Simple 7 (LS7), is a central framework for promoting cardiovascular prevention. However, little is known about its determinants among older adults with hypertension, especially in Asian primary care settings. In this study, we investigated person and clinical factors associated with overall and individual LS7 metrics in older Thai adults with hypertension.

Methods

A cross-sectional study was conducted among hypertensive patients aged ≥ 65 years recruited from 15 primary health care centers in Thailand. Determinant factors included person (age group, gender, marital status, education, living arrangement, employment, income) and clinical variables (history of diabetes, history of hyperlipidemia, HDL-C, LDL-C, triglycerides, antihypertensive drug classes, duration of hypertension). Multivariate logistic regression identified factors associated with achieving overall LS7 ideal status and individual LS7 metrics.

Results

Among 834 participants (mean age 75.05 ± 7.02 years; 71.9% women), 13.3% achieved overall ideal CVH, while the proportion meeting individual LS7 metrics ranged from 14.5% for blood pressure to 90.2% for smoking. In the final multivariate model, several factors were significantly associated with achieving CVH, with patterns of association varying across individual metrics. Age ≥ 75 years was associated with greater likelihood of achieving ideal smoking (OR 2.35, 95%CI 1.32-4.18) and BMI (OR 2.07, 95%CI 1.53-2.78). Women were more likely to achieve ideal smoking (OR 57.92, 95%CI 23.26-144.24) and blood pressure (OR 1.82, 95%CI 1.12-2.97), but less likely to meet ideal BMI (OR 0.65, 95%CI 0.46-0.90), cholesterol (OR 0.57, 95%CI 0.39-0.81), and plasma glucose (OR 0.74, 95%CI 0.54-1.02). Having spousal support was positively associated with physical activity (OR 1.53, 95%CI 1.08-2.15) and smoking (OR 2.10, 95%CI 1.06-4.15). Employment reduced the likelihood of achieving ideal BMI (OR 0.69, 95%CI 0.50-0.94) and diet (OR 0.48, 95%CI 0.30-0.76). Living with a large family was negatively associated with ideal blood pressure (OR 0.58, 95%CI 0.37-0.91). Clinically, history of diabetes was associated with non-ideal cholesterol (OR 0.32, 95%CI 0.21-0.48). History of hyperlipidemia increased odds of ideal smoking (OR 1.82, 95%CI 1.02-3.27) but reduced ideal plasma glucose (OR 0.40, 95%CI 0.29-0.53). Higher HDL-C ≥ 60 mg/dL (OR 2.12, 95%CI 1.44-3.12) was significantly linked with ideal cholesterol. Higher LDL-C ≥ 100 mg/dL reduced the odds of ideal cholesterol (OR 0.28, 95%CI 0.20-0.39). Elevated triglycerides (≥ 150 mg/dL) reduced the odds of ideal BMI (OR 0.62, 95%CI 0.46-0.85). Use of ≥ 3 antihypertensive drug classes was positively associated with ideal physical activity (OR 1.41, 95%CI 1.01-1.97) and diet (OR 1.51, 95%CI 1.01-2.26), but negatively with ideal cholesterol (OR 0.66, 95%CI 0.44-0.97). Finally, only two factors, clinical history of diabetes (OR 0.30, 95%CI 0.16-0.58) and hyperlipidemia (OR 0.49, 95%CI 0.31-0.77) reduced the overall ideal cardiovascular health.

Conclusion

Determinants of ideal CVH in older Thai adults with hypertension varied substantially across LS7 metrics, reflecting both sociodemographic and clinical influences. Female sex, advanced age, spousal support, and lipid profiles played important but sometimes paradoxical roles in predicting health behaviors and risk factors. These findings underscore the need for tailored, context-specific strategies to improve cardiovascular health in aging hypertensive populations.

Table

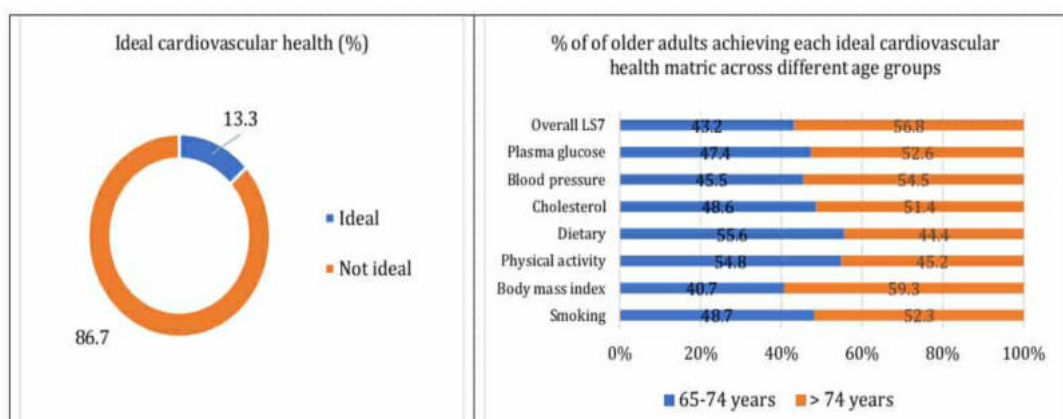
TABLE 1. Multivariate analysis of determinant factors associated with achieving overall ideal cardiovascular health.

Determinant factors	Indicators	β	P	OR (95% CI)
Diabetes, history	No	0 (reference)		1
	Yes, known and treated	-1.189	0.000	0.305 (0.161-0.578)
Hyperlipidemia, history	No	0 (reference)		1
	Yes, known and treated	-0.708	0.000	0.493 (0.315-0.770)

None of the other factors showed significant associated in either the univariate or multivariate models.

TABLE 2. Multivariate analysis of factors associated with achieving individual metrics of ideal cardiovascular health.

Determinant factors	Statistics	Smoking	BMI	Physical activity	Dietary	Cholesterol	Blood pressure	Plasma glucose
Person factors								
Age ≥ 75 years	β	0.855	0.726	—	—	—	—	—
	P-value	0.004	<0.001	—	—	—	—	—
	OR	2.352	2.067	—	—	—	—	—
Women	β	4.059	-0.437	—	—	-0.563	0.601	-0.297
	P-value	<0.001	0.011	—	—	0.002	0.016	0.066
	OR	57.924	0.646	—	—	0.569	1.824	0.743
Spousal	β	0.742	—	0.422	—	—	—	—
	P-value	0.033	—	0.016	—	—	—	—
	OR	2.100	—	1.525	—	—	—	—
Living with large family	β	—	—	—	—	—	-0.545	—
	P-value	—	—	—	—	—	0.019	—
	OR	—	—	—	—	—	0.580	—
Employed	β	—	-0.377	—	-0.737	—	—	—
	P-value	—	0.019	—	0.002	—	—	—
	OR	—	0.686	—	0.478	—	—	—
Sufficient income	β	—	—	—	—	—	-0.442	—
	P-value	—	—	—	—	—	0.035	—
	OR	—	—	—	—	—	0.643	—
Clinical factors								
Diabetes, history	β	—	—	—	—	-1.145	—	—
	P-value	—	—	—	—	0.000	—	—
	OR	—	—	—	—	0.318	—	—
Hyperlipidemia, history	β	0.601	—	—	—	—	—	-0.921
	P-value	0.043	—	—	—	—	—	0.000
	OR	1.824	—	—	—	—	—	0.398
HDL-C ≥ 60 mg/dl	β	—	—	—	—	0.751	—	—
	P-value	—	—	—	—	0.000	—	—
	OR	—	—	—	—	2.119	—	—
LDL-C ≥ 100 mg/dl	β	—	—	—	—	-1.273	—	—
	P-value	—	—	—	—	0.000	—	—
	OR	—	—	—	—	0.280	—	—
Triglycerides ≥ 150 mg/dl	β	—	-0.472	—	—	—	—	—
	P-value	—	0.003	—	—	—	—	—
	OR	—	0.624	—	—	—	—	—
Antihypertensive ≥ 3 classes	β	—	—	0.347	0.412	-0.423	—	—
	P-value	—	—	0.042	0.045	0.036	—	—
	OR	—	—	1.414	1.509	0.655	—	—



EP-19

Evaluating the Blood Pressure and Glycemic Modulation Potential of Cucurbita (Pumpkin) Seed Supplementation in Type 2 Diabetes Mellitus Patients

Poonam Sahu¹, Dileep Kumar Verma¹, Narsingh Verma², Shyam Chand Chaudhary¹, Ranjana Singh¹

¹Physiology, King George's Medical University, Lucknow/ Uttar Pradesh, India

²Dean, Hind Institute of Medical Sciences, Sitapur/ Uttar Pradesh, India

Introduction

To evaluate the impact of Cucurbita (pumpkin) seed powder supplementation on clinical and biochemical parameters including BMI, blood pressure (BP), fasting blood sugar (FBS), postprandial glucose (PPG) and glycated hemoglobin (HbA1c) in patients with type 2 diabetes mellitus (T2DM).

Methods

A randomized controlled trial was conducted among 156 T2DM patients aged 30-65 years, recruited from the Outpatient Department of Medicine, King George's Medical University (KGMU), Lucknow. Participants were randomly assigned to either the intervention group (n=78), receiving 10 g/day of pumpkin seed powder along with standard diabetes treatment, or the control group (n=78), continuing standard treatment alone. Parameters were assessed at baseline and after 6 months of intervention.

Results

The mean age of participants was 48 $\pm$ 7 years. Baseline characteristics were similar across groups. The intervention group BMI and BP showed slight decreases (BMI: 27.02 $\pm$ 3.38 to 25.84 $\pm$ 5.59; SBP: 131.71 $\pm$ 0.71 to 129.73 $\pm$ 15.92 mmHg; DBP: 83.25 $\pm$ 11.31 to 81.81 $\pm$ 12.83 mmHg), but without statistical significance. While a significant reduction in HbA1c ($P < 0.05$), with a notable decline in FBS (150.75 $\pm$ 61.8 to 114.85 $\pm$ 29.96 mg/dL) and PPG (225.25 $\pm$ 81.21 to 166.09 $\pm$ 39.60 mg/dL). No significant changes were observed in the control group across parameters.

Conclusion

Pumpkin seed supplementation resulted in a significant reduction in HbA1c levels. Although changes in FBS, PPG, BMI and BP showed favorable trends, they were not statistically significant. These results suggest the potential of Cucurbita seeds as a functional dietary adjunct in the management of T2DM.

Prognostic Role of Hypertension and Admission Blood Pressure in Acute Heart Failure: A Multicenter Malaysian Cohort

Siew Yap Chai¹, Bui Khiong Chung², Winda Chaw³, Khai Vern Poon⁴, Pey Woei Ting⁴, Zhi Yuan Lee⁵, Alex Zhi Yang Koh⁵, Hwei Sung Ling⁶, Rong Yao Pang⁷, Dhivakaran Mogan⁷

¹Cardiology, Sultanah Bahiyah Hospital, Alor Setar, Kedah, Malaysia

²Cardiology, Sarawak Heart Center, Sarawak, Malaysia

³Pharmacy, Kapit Hospital, Sarawak, Malaysia

⁴Internal Medicine, Bintulu Hospital, Sarawak, Malaysia

⁵Internal Medicine, Sarawak General Hospital, Sarawak, Malaysia

⁶Internal Medicine, University of Malaysia, Sarawak, Sarawak, Malaysia

⁷Internal Medicine, Kapit Hospital, Sarawak, Malaysia

Introduction

Hypertension and heart failure are closely linked. While chronic hypertension drives the development of heart failure, paradoxically, patients with acute heart failure (AHF) who present with higher systolic blood pressure (SBP) tend to survive better in the short term, as shown in large registries like OPTIMIZE-HF and ADHERE. In this study, we evaluate the prognostic impact of both a history of hypertension and admission SBP on short-term outcomes in AHF patients

Methods

Retrospective multicenter study of 403 AHF admissions across four Malaysian hospitals (Jan 2023–Jun 2024). Collected data included admission SBP/DBP, labs (eGFR, albumin) and outcomes: in-hospital mortality, ICU admission, intubation, AKI, and length of stay. Multivariate logistic regression identified independent mortality predictors. The authors acknowledge the assistance of ChatGPT (OpenAI) in refining the language and structure of the abstract.

Results

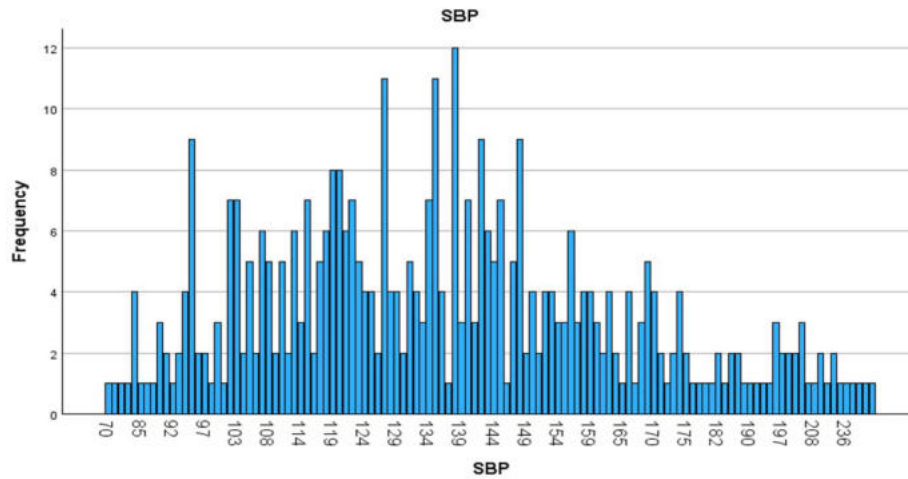
Mean age 60±15 years; 71% male; 69% had known hypertension. Known hypertension was common and associated with higher admission SBP (141 vs 127 mmHg, $p<0.001$) but did not predict mortality ($p=0.152$), ICU admission ($p=0.747$), AKI ($p=0.778$) or length of stay ($p=0.450$). Hypertensive patients more often required intubation (7.5% vs 2.4%, $p=0.046$). By contrast, lower admission SBP was a strong, independent predictor of in-hospital death (mean 120 vs 138 mmHg in non-survivors; $p=0.009$). On multivariate analysis SBP remained significant (OR per 1 mmHg 0.962; 95% CI 0.931–0.994; $p=0.019$), equivalent to 38% lower odds of death for every 10 mmHg higher SBP. Other independent mortality predictors were lower eGFR ($p=0.006$), need for renal replacement therapy ($p=0.012$), hypoalbuminemia ($p=0.022$) and intubation ($p<0.001$). The model explained 71% of variance (Nagelkerke R^2) and correctly classified 96.7% of cases.

Conclusion

In this multicenter cohort, nearly 70% of patients admitted with acute heart failure had a history of hypertension, reinforcing its role as a key driver in the development of HF. However, once decompensation occurs, it is not the history of hypertension but the admission blood pressure that determines short-term outcomes, with lower SBP emerging as a strong independent predictor of in-hospital mortality. These findings carry a dual message for clinical practice: effective control of chronic hypertension remains crucial to prevent HF, while in the acute setting, admission SBP should serve as a frontline tool for risk stratification, prognosis, and guiding management.

Figure

Figure 1 : Systolic blood pressure of on admission



Table

Table 1: Logistic Regression Analysis on In-Hospital Mortality

Predictor	B	SE (B)	Wald	Exp(B)	95% CI for Exp(B)	p-Value
eGFR Admission	-.068	0.025	7.464	0.935	.890 - .981	.006
Renal replacement therapy(1)	3.259	1.300	6.281	26.016	2.035 - 332.678	.012
Inotrope/Vasopressor(1)	2.079	1.242	2.803	7.998	.701 - 91.208	.094
SBP	-.039	.016	5.536	0.962	.931 - .994	.019
Albumin	-.159	.069	5.265	0.853	.745 - .977	.022
Intubation(1)	4.698	1.163	16.323	109.691	11.232 - 1071.276	<.001
Constant	6.719	3.149	4.553	827.938		

The model explained 71.0% of the variance (Nagelkerke R^2) and correctly classified 96.7% of cases (sensitivity 56.3%, specificity 98.5%).

Exp(B) = Odds Ratio; CI = Confidence Interval; SBP = Systolic Blood Pressure.

Deep Learning Based Multimodal Prediction of Coronary Artery Disease Using Clinical and Imaging Data from the MESA Cohort

Rao Faizan

Computer Science and Engineering, Kyung Hee University, Yongin, Korea, Republic of

Introduction

Coronary artery disease (CAD) remains the leading cause of global mortality. Conventional risk assessment tools, such as the Framingham score, often fail to fully capture the interplay between traditional risk factors and imaging biomarkers. This study aims to develop and evaluate a multimodal deep learning framework that integrates clinical, laboratory, and coronary CT imaging data from the Multi-Ethnic Study of Atherosclerosis (MESA) to enhance CAD prediction.

Methods

We used data from the MESA cohort, which includes over 6,800 participants with detailed cardiovascular phenotyping, clinical records, and coronary CT imaging. Our framework consists of two branches: Clinical Data Branch – A transformer-based encoder processes demographic, laboratory (lipid profile, HbA1c, hs-CRP), and lifestyle risk factors. Imaging Data Branch – A 3D convolutional neural network extracts quantitative features from CT scans, focusing on coronary artery calcium (CAC) score, plaque burden, and stenosis severity. The outputs are fused through an attention-based mechanism to capture correlations between clinical and imaging features. The model was trained with a 70:15:15 train-validation-test split. Interpretability was ensured using SHAP (clinical features) and Grad-CAM (imaging features).

Results

The proposed AI model achieved an AUC of 0.88, significantly outperforming baseline models. Table 1. Comparison of Model Performance (AUC values)

Conclusion

By integrating clinical and imaging data, the proposed deep learning model provides superior prediction of CAD risk compared to conventional models. This approach highlights the value of multimodal AI for precision cardiology.

Table

Model	AUC
Framingham Risk Score	0.78
SCORE2 Risk Model	0.81
Clinical Data Only (DL)	0.85
Imaging Data Only (DL)	0.86
Proposed Multimodal AI	0.88

EP-22

Comparison of Antihypertensive Efficacy and Safety of the Combination of Efonidipine+Chlorthalidone with Combination Cilnidipine+ Chlorthalidone

Jatinkumar Veljibhai Dhanani¹, Jeegnesh B Satanee², Shweta Dhanani¹, Usha Satanee²

¹Pharmacology, GMERS Medical College, Navsari, India

²Medicine, Nanduba Medical Center, Surat, India

Introduction

The aim of the study was to compare efficacy and safety of combination Efonidipine+Chlorthalidone with combination Cilnidipine+ Chlorthalidone.

Methods

In this prospective, randomized control research, 240 hypertension patients were randomly assigned (1:1) to receive either Cilnidipine 10 mg + Chlorthalidone 12.5 mg (C+C group) or Efonidipine 40 mg + Chlorthalidone 12.5 mg (E+C group) once daily for 90 days. Blood pressure (BP) variations from baseline to Days 30, 60, and 90 were assessed for each patient. The average of three consecutive readings taken while seated was used to calculate blood pressure. The safety and tolerability were assessed based on the incidences of adverse events (AEs) reported.

Results

The baseline mean ($\pm$ SD) diastolic blood pressure (DBP) and systolic blood pressure (SBP) for the E+C group was 159.10 $\pm$ 11.43/101.19 $\pm$ 10.03 mmHg. The mean ($\pm$ SD) decrease in SBP/DBP after 30 days of E+Cgroup therapy was 25.13 $\pm$ 16.23/16.11 $\pm$ 10.35 mmHg, while the baseline reduction at Day 60 was 32.51 $\pm$ 19.73/17.91 $\pm$ 11.06 mmHg. At day 90, the E+C group's blood pressure dropped from 159.10 $\pm$ 11.43/101.19 $\pm$ 10.03 mmHg to 118.95 $\pm$ 15.31/81.59 $\pm$ 3.78 mmHg, with a mean decrease of 40.15/19.60 mmHg. 90.99% of the patients who received the E+C group regimen were able to achieve a target blood pressure of less than 140/90 mmHg. 88% of patients with Stage II hypertension and 94% of those with Stage I hypertension met the desired blood pressure level. Minor adverse events were recorded by 2.54% of patients in the E+C group overall.

Conclusion

Efonidipine and Chlorthalidone combination was efficacious as well as safe and well tolerated by the patients in the management of hypertension in both Stage I and Stage II hypertensive patients with minimum side effects.

Table

Blood Pressure	Baseline	Day 90	Mean difference	P Value
Stage I (N=39)				
SBP (mmHg)	147.01 $\pm$ 4.32	125.77 $\pm$ 6.06	21.24 $\pm$ 7.50	<.0001
DBP (mmHg)	94.09 $\pm$ 3.33	82.17 $\pm$ 4.98	11.91 $\pm$ 4.57	<.0001
Stage II (N=72)				
SBP (mmHg)	165.64 $\pm$ 8.28	115.25 $\pm$ 17.44	50.39 $\pm$ 18.56	<.0001
DBP (mmHg)	105.04 $\pm$ 10.36	81.28 $\pm$ 2.93	23.76 $\pm$ 11.54	<.0001

Risk of Developing Hypertension in the Asian Americans Residing in the United States

Ekamol Tantisattamo^{1,2}, Nongnapas Assawamasbunlue¹, Panchanit Yongkiatkan¹, Napat Wongmat¹, Sorawis Ngaohirunpat¹, Nicha Wareesawetsuwan¹, Natanon Chamnarnphol¹, Weerinth Puyati¹, Rabhas Boonyawairote¹, Wanprapit Noree¹, Kanita Mankan^{1,3}, Nopavit Mohpichai^{1,2}, Thanin Asawaroekwisoot¹, Kaninart Chartpattananan¹, Possawat Vutthikraivit^{1,4}, Voramol Rochanaroon^{1,5}, Chutawat Kookanok^{1,6}, Narathorn Kulthamrongsri^{1,7}, Phuuwadith Wattanachayakul^{1,8}, Issaree Boonyawannukul^{1,9}, Kyunghee Lee^{1,10}

¹American Heart Association Comprehensive Hypertension Center at the University of California Irvine Medical Center, Division of Nephrology, Hypertension and Kidney Transplantation, Department of Medicine, University of California Irvine School of Medicine, Orange, California, United States

²Excellent Center for Organ Transplantation, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

³Department of Biochemistry, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand

⁴Department of Medicine, MedPark Hospital, Bangkok, Thailand

⁵Department of Medicine, Police General Hospital, Bangkok, Thailand

⁶Department of Medicine, Interfaith Medical Center, Brooklyn, New York, United States

⁷University of Hawaii Internal Medicine Residency Program, University of Hawaii John A. Burns School of Medicine, Honolulu, Hawaii, United States

⁸Department of Medicine, Albert Einstein Medical Center, Philadelphia, Pennsylvania, United States

⁹Faculty of Medicine Srinakarin Hospital, Khon Kaen University, Khon Kaen, Thailand

¹⁰Division of Nephrology, Department of Internal Medicine, Daegu Veterans Health Service Medical Center, Daegu, Korea, Republic of

Introduction

While Asians have unique characteristics that increase the risk of premature hypertension, the risk is unclear in Asian Americans (AA) living in the United States since environmental factors may contribute to the risk of hypertension in this population. We aim to examine the risk of developing hypertension in AA compared to non-Asian Americans (NAA) among the representative population in the United States.

Methods

A retrospective cohort study using the 2017-2023 NHANES included adults with known hypertension status, either ever or never diagnosed with hypertension. The study population was divided into 2 groups based on race: AA and NAA. The association of race with time to developing hypertension was examined by multiple Cox proportional hazard regression analyses.

Results

Of 17,846 participants ≥ 18 years old, the mean $\pm$ SD age was 51 $\pm$ 19 years, and 53% were female. AA accounts for 9.05% of the study population. Compared to NAA, AA had significantly lower mean SBP (SBP: AA 122 $\pm$ 18 vs. NAA 124 $\pm$ 19; meandiff (95%CI) -1.5 (-2.5, -0.4; P 0.0084) and lower mean DBP with no significance (DBP: AA 74 $\pm$ 10 vs. NAA 74 $\pm$ 11; meandiff (95%CI) -0.2 (-0.8, 0.5; P 0.5797)) (Figure 1A). During the median follow-up time of 52 years (IQR 35, 66), the incidence rate of developing hypertension was 0.021 person-years, and the median time to develop hypertension was 48 years. AA developed hypertension at a younger age than NAA (Age of hypertension: AA 60 $\pm$ 13 vs. NAA 61 $\pm$ 14; meandiff (95%CI) -1.7 (-3.0, -0.3; P 0.0161)). Compared to NAA, AA had 7% lower risk of developing hypertension, but no statistical significance (HR 0.93; 95%CI 0.82, 1.04; P 0.197; Figure 1B). After adjusting for age, gender, ethnicity (Hispanics vs non-Hispanics), history of diabetes mellitus, and hyperlipidemia, body mass index, mean SBP, DBP, hemoglobin A1c, total cholesterol, estimated glomerular filtration rate, urinary microalbumin:urinary creatinine ratio, serum albumin, ferritin, high-sensitivity C-reactive protein, level of education, and ratio of family income to poverty, AA had 17% significantly lower risk of developing hypertension (HR 0.83; 95% CI 0.71, 0.97; P 0.020). There was no effect measure modification of the race-hypertension association among all covariates.

Conclusion

Although the risk of hypertension involves the interplay between genetic and environmental factors, the lower risk of developing hypertension in AA suggests genetic factors as one of the main contributing factors of hypertension. While prevention and treatment for hypertension are universal, some racial groups, such as NAA, should be screened early and intervened to mitigate the risk of hypertension.

Figure

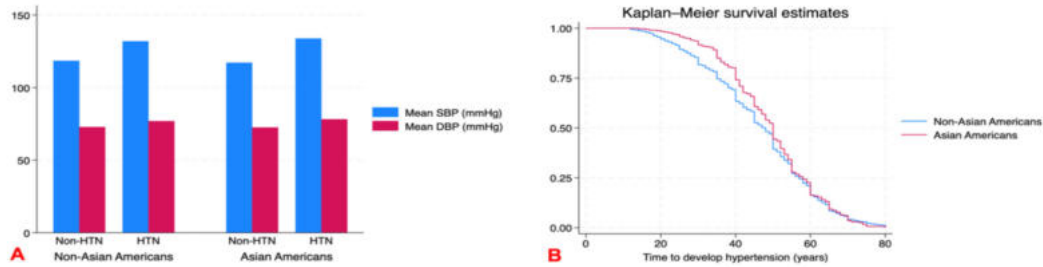


Figure 1: A: Distribution of mean systolic and diastolic blood pressure stratified by race (Asian Americans vs. non-Asian Americans) and history of hypertension. **B:** Kaplan-Meier curve comparing time to developing hypertension between Asian Americans and non-Asian Americans.

Tight Systolic Blood Pressure Control (<120 mmHg) and Its Impact on Cardiovascular Events: Insights from a Systematic Review and Meta-Analysis

Lutfi Hafiz Zunardi^{1,2}, Elen Putri Cintya³

¹Department of Cardiology and Vascular Medicine,, Sunan Kalijaga General Hospital, Demak, Indonesia, Semarang, Indonesia

²Department of Cardiology and Vascular Medicine, PKU Muhammadiyah Gubug Hospital, Grobogan, Indonesia

³Department of Cardiology and Vascular Medicine, Universitas Brawijaya, Malang, Indonesia

Introduction

Hypertension is widespread, yet global BP control remains poor due to its asymptomatic nature, delayed diagnosis, and poor adherence. Debate persists on optimal thresholds, as guidelines typically recommend SBP <140 mmHg, while growing evidence indicates that stricter control (<120 mmHg) may offer added benefit in high-risk patients. This meta-analysis evaluated randomized trial evidence comparing SBP lowering to <120 mmHg versus <140 mmHg and its impact on all-cause mortality and cardiovascular outcomes such as MACE, stroke, myocardial infarction, and heart failure in adults with hypertension or elevated cardiovascular risk.

Methods

A systematic review and meta-analysis were conducted following PRISMA 2020. We searched PubMed, Embase, Cochrane CENTRAL, ScienceDirect, and Google Scholar for RCTs (2015-present) involving adults (≥ 18 years) with hypertension or elevated cardiovascular risk comparing intensive (<120 mmHg) versus standard (<140 mmHg) SBP control. Non-English studies, non-randomized designs, pediatric populations, and those lacking sufficient data were excluded. Screening and data extraction were performed independently, risk of bias assessed with Cochrane RoB 2, and dichotomous outcomes pooled using Mantel–Haenszel random-effects models, reported as risk ratios (RRs) with 95% CIs. Heterogeneity was evaluated with Cochran's Q and I^2 .

Results

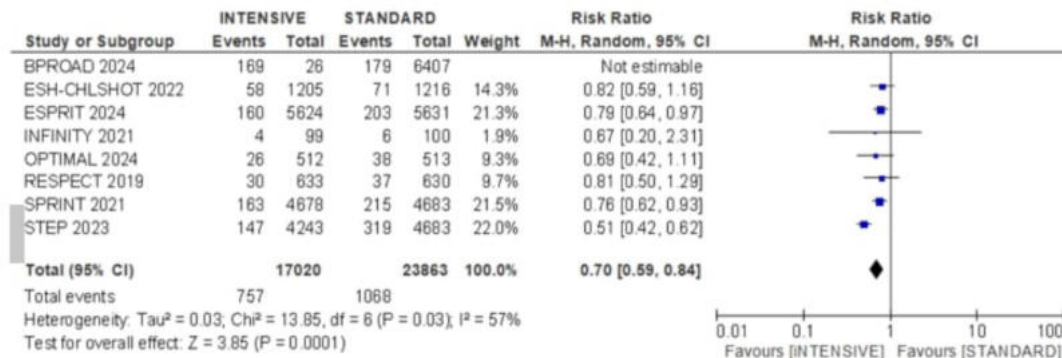
Eight RCTs with a total of 40,883 participants met the eligibility criteria. Intensive SBP control (<120 mmHg) was associated with significant reductions in risk ratios (RRs) for all-cause mortality (0.70, 95% CI 0.59-0.84), MACE (0.82, 95% CI 0.76-0.88), stroke (0.83, 95% CI 0.75-0.92), myocardial infarction (0.81, 95% CI 0.69-0.96), and heart failure (0.75, 95% CI 0.63-0.89). Across all outcomes, statistical heterogeneity remained low.

Conclusion

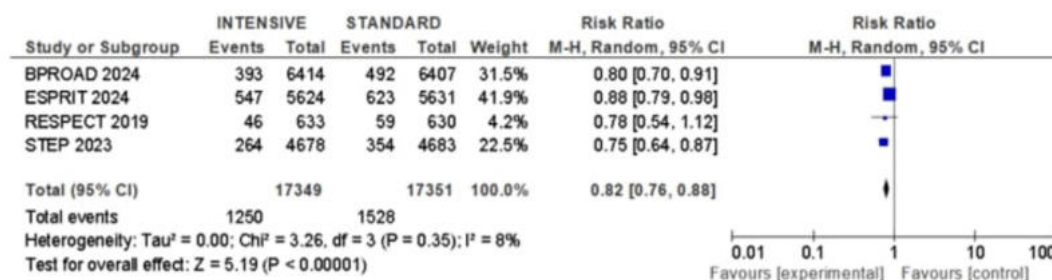
In adults with hypertension or heightened cardiovascular risk, targeting an SBP <120 mmHg confers clinically meaningful reductions in all-cause mortality and major cardiovascular events compared with the standard <140 mmHg goal. These findings reinforce the value of intensive BP targets for appropriately selected patients. Nevertheless, clinical decisions should balance potential benefits with individual patient factors, tolerability, and risk of treatment-related adverse effects.

Figure

1.1 intensive versus standard blood pressure control and all-cause mortality



1.2 mace



1.3 incidence of stroke



The Effectiveness of Polyphenol Supplements for Managing Blood Pressure in Hypertensive Patients

Shweta Jatinkumar Dhanani¹, Usha J Satanee², Jatinkumar Dhanani¹

¹Pharmacology, GMERS Medical College, Navsari, India

²Family Medicine, Nanduba Medical Center, SURAT, India

Introduction

Numerous studies have examined the potential of polyphenols found in grape seed extract, which are well-known for their strong antioxidant qualities, in reducing cardiovascular illnesses. This study aimed to assess the effectiveness of a polyphenol-based supplement, high in polyphenols obtained from grape seed extract, in treating hypertension and its effects on blood pressure management.

Methods

76 patients participated in the study and were observed for 24 weeks. The patients were split into three groups: stage I hypertension (140/90–149/109 mmHg), stage II hypertensive (150 or above/110 or above mmHg), and prehypertensive (120/80–139/89 mmHg). Three separate blood pressure readings were taken while standing and sitting at 5-minute intervals, with the mean of the data being deemed reliable. During the initial visit, the patients were provided a 500 mg once-daily polyphenol-based supplement, with follow-ups scheduled for blood pressure and heart rate monitoring at 12 and 24 weeks.

Results

There were 40 men (52.6%) and 36 women (47.4%) in the study, and their average age was 47.52 ± 12.67 years. The mean diastolic change was -1.73 mmHg (95% CI: -2.47 to -0.38 , $p = 0.007$), while the mean systolic change was -1.98 mmHg (95% CI: -3.50 to -0.64 , $p = 0.005$). Throughout the follow-up time, there was a statistically significant decrease in both the systolic and diastolic blood pressure, with the third visit being especially noteworthy. According to the analysis, obese people may need to take polyphenol-based supplements for a longer period of time than normo-weight patients in order to reach their desired blood pressure values.

Conclusion

The findings suggests that supplementing with polyphenols significantly lowers blood pressure in people with stage I hypertension and prehypertension.

Racial Disparity of Hypertension-Related Mortality in the United States

Nongnapas Assawamasbunlue^{1,2}, Sorawis Ngaohirunpat¹, Napat Wongmat¹, Panchanit Yongkiatkan¹, Weerinth Puyati¹,
Nicha Wareesawetsuwan¹, Natanon Chamnarnphol¹, Wanprapit Noree¹, Rabhas Boonyawairote¹, Kanita Mankan^{1,3},
Nopavit Mohpichai^{1,4}, Kaninart Chartpattananan¹, Thanin Asawaroekwisoot¹, Possawat Vutthikraivit^{1,5},
Voramol Rochanaroon^{1,6}, Chutawat Kookanok^{1,7}, Narathorn Kulthamrongsri^{1,8}, Phuuwadith Wattanachayakul^{1,9},
Issaree Boonyawannukul^{1,10}, Kyunghee Lee^{1,11}, Ekamol Tantisattamo^{1,4}

¹Department of Medicine, University of California Irvine School of Medicine, American Heart Association Comprehensive Hypertension Center at the University of California Irvine Medical Center, Division of Nephrology, Hypertension and Kidney Transplantation, Department of Medicine, University of California Irvine School of Medicine, Orange, California, United States

²Faculty of Medicine, Faculty of Medicine, Chulalongkorn University, Bangkok, Thailand, Bangkok, Thailand

³Department of Biochemistry, Department of Biochemistry, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand, Chiang Mai, Thailand

⁴Excellent Center for Organ Transplantation, Excellent Center for Organ Transplantation, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand, Bangkok, Thailand

⁵Department of Medicine, Department of Medicine, MedPark Hospital, Bangkok, Thailand, Bangkok, Thailand

⁶Department of Medicine, Department of Medicine, Police General Hospital, Bangkok, Thailand, Bangkok, Thailand

⁷Department of Medicine, Department of Medicine, Interfaith Medical Center, Brooklyn, New York, United States, Brooklyn, New York, United States

⁸University of Hawaii Internal Medicine Residency Program, University of Hawaii Internal Medicine Residency Program, University of Hawaii John A. Burns School of Medicine, Honolulu, Hawaii, United States, Honolulu, Hawaii, United States

⁹Department of Medicine, Department of Medicine, Albert Einstein Medical Center, Philadelphia, Pennsylvania, United States, Philadelphia, Pennsylvania, United States

¹⁰Faculty of Medicine Srinakarin Hospital, Faculty of Medicine Srinakarin Hospital, Khon Kaen University, Khon Kaen, Thailand, Khon Kaen, Thailand

¹¹Division of Nephrology, Department of Internal Medicine, Division of Nephrology, Department of Internal Medicine, Daegu Veterans Health Service Medical Center, Daegu, Korea, Daegu, Korea, Republic of

Introduction

While racial disparity in mortality exists, the magnitude of hypertension-related mortality among different races is unclear. We aim to compare hypertension-related mortality among different races of populations in the United States.

Methods

A cross-sectional study utilizing data from the Centers for Disease Control and Prevention Wide-ranging ONline Data for Epidemiologic Research (CDC WONDER) included adults ≥ 25 years old stratified into 5 groups based on race: Asians, American Indian or Alaska Native, Blacks or African Americans, Native Hawaiian or Other Pacific Islander, and Whites. All-cause and hypertension-related mortalities of the incremental 10-year age group (25-34, 35-44, 45-54, 55-64, 65-74, 75-84, and ≥ 85 years old) between 2018 and 2023 was retrieved. Cause of death was classified based on International Classification of Diseases (ICD)-10 code. Age-adjusted all-cause and hypertension-related (excluding pregnancy-related hypertension) mortalities (per 100,000) among different races were examined by one-way analysis of variance (ANOVA).

Results

Of all 1,339,337,338 U.S. population during the study period, the age-adjusted all-cause mortality was 1,185.6 deaths per 100,000 population (95% CI 1,185.0 – 1,186.1). Asians had the lowest age-adjusted all-cause and hypertension-related mortalities compared to other races. Blacks or African Americans had the highest age-adjusted and hypertension-related mortalities (Figure 1A and 1B). In addition, age-adjusted hypertension-related mortality in each age-group stratum was highest in Blacks or African Americans. There were significant difference in age-adjusted all-cause mortality and hypertension-related mortality among group ($p < 0.0001$).

Conclusion

Age-adjusted all-cause and hypertension-related mortalities were highest in Blacks or African Americans and lowest in Asians in the United States.

While genetic factor contributes to the risk for hypertension and hypertension-related mortality, social and environmental risk factors may be involved in the disparity among different races. Further longitudinal studies to explore protective or risk factors of hypertension and hypertension-related mortality, particularly among the high-risk groups, such as Black or African American is warranted.

Figure

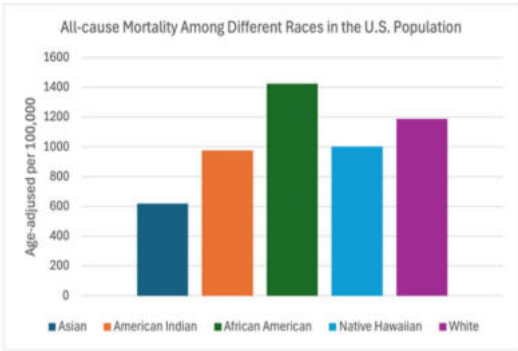


Figure 1A: All-Cause Mortality Among Different Races in the U.S. Population

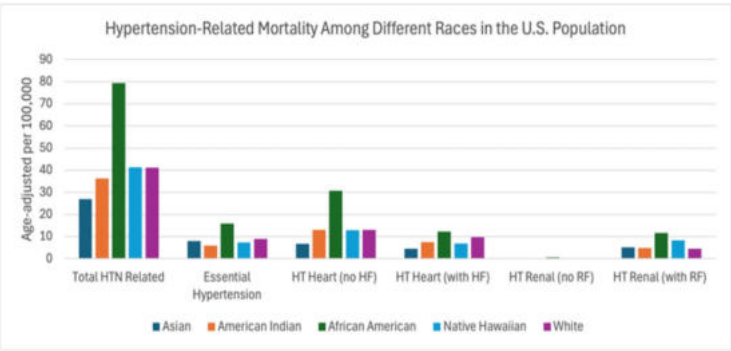


Figure 1B: Hypertension-Related Mortality Among Different Races in the U.S. Population

HTN = Hypertension, HT Heart = Hypertensive Heart Disease, HF = Heart Failure, HT Renal = Hypertensive Renal Disease, RF = Renal Failure

EP-27

Atrial Fibrillation as a Driver of Heart Failure Severity across Socio-Demographic Settings: A Population-Based Study in Adults over 55 Years

Zavia Putri Salsabila, Zulfania Rahmah

Basic Science, Universitas Islam Indonesia, Yogyakarta, Indonesia

Introduction

Atrial fibrillation (AF) is the most common sustained arrhythmia worldwide, which has a strong association with heart failure (HF). AF can be the cause or the consequence of heart failure. When AF is diagnosed in a patient with HF, it has a poor prognosis, leading to more hospitalization and mortality. This research aims to identify the epidemiological data of heart failure caused by atrial fibrillation based on their sociodemographic index.

Methods

This study utilized the Global Burden of Disease database from 2021. The study's inclusion criteria were individuals over 55 years of age, diagnosed with mild or severe heart failure due to atrial fibrillation, and residing in areas with either low or high sociodemographic indices. The population was categorized into two groups: Group A, exhibiting mild heart failure, and Group B, exhibiting severe heart failure. The analyzed data included prevalence and years lived with disability (YLDs).

Results

We identified a total prevalence of 181,188 cases of atrial fibrillation-related heart failure, including 9,133 cases in low SDI and 172,533 cases in high SDI. Group A consisted of 65,916 cases (36.3%), whereas Group B represented 115,750 cases (63.7%). Females constituted approximately 59% of both mild and severe cases, while in low SDI regions, severe cases were nearly evenly distributed between the sexes. Compared to group A's 2,912 YLDs, group B contributed 20,002. Severe heart failure caused nearly four times more disability than mild heart failure (173 vs 44 YLDs per 1,000 cases). Low SDI regions had nearly threefold more disability per case (118 vs 40 per 1,000) for mild heart failure, while severe heart failure had a consistently higher burden across both SDI categories.

Conclusion

Atrial fibrillation-related severe heart failure causes most YLDs in both SDI settings, and mild cases in low SDI populations have higher disability weights than high SDI.

Table

Table. Burden of Atrial Fibrillation–Related Heart Failure in Adults ≥55 Years by SDI and Severity

Group (HF severity)	SDI category	Prevalence (n)	Female (n)	Male (n)	YLDs	Disability weight (YLD ÷ Prevalence)
Mild HF (Group A)	Low SDI	3,149	1,723	1,696	371	0.118
	High SDI	62,767	37,108	25,659	2,541	0.040
Severe HF (Group B)	Low SDI	5,984	3,015	2,968	1,018	0.170
	High SDI	109,766	64,885	44,880	18,984	0.173

Hypertension as a Predictor of Arteriovenous Shunt Stenosis in Chronic Kidney Disease Patients Undergoing Hemodialysis: An Indonesian Cohort Study

Tohari Tohari

Department of Internal Medicine, Abu Hanifah General Hospital, Bangka Belitung, Indonesia

Introduction

Arteriovenous (AV) shunt stenosis is one of the most frequent and serious complications in chronic kidney disease (CKD) patients on hemodialysis, often leading to access failure and increased morbidity. The underlying risk factors, however, remain incompletely defined, particularly in developing countries. This study aimed to identify clinical and demographic risk factors associated with AV shunt stenosis among CKD patients undergoing hemodialysis.

Methods

A cross-sectional study was conducted at Abu Hanifah General Hospital, Bangka Belitung, Indonesia, involving 236 CKD patients receiving hemodialysis via AV shunt access. Potential risk factors analyzed included age, sex, diabetes mellitus, hypertension, obesity, smoking history, and AV shunt location. Bivariate associations were tested using the Chi-square test, and independent predictors were assessed using multivariate logistic regression.

Results

Stenosis was significantly associated with older age ($p=0.020$), male sex ($p=0.001$), diabetes mellitus ($p=0.001$), hypertension ($p=0.031$), and smoking ($p<0.001$). Logistic regression revealed that diabetes mellitus increased the risk of AV shunt stenosis by 2.46-fold (95% CI: 1.42–4.26), hypertension by 2.05-fold (95% CI: 1.06–3.96), and age >60 years by 1.93-fold (95% CI: 1.10–3.37). Obesity and shunt location were not significant predictors.

Conclusion

Diabetes mellitus, hypertension, advanced age, and smoking are key determinants of AV shunt stenosis in CKD patients on hemodialysis. Early identification and targeted risk management may improve vascular access longevity, particularly in resource-limited healthcare settings.

Table

Table 2. Bivariate Analysis of Risk Factors Associated with AV Shunt Stenosis

Risk Factors	Stenosis Cases n (%)	Controls n (%)	P-value	OR	95% CI (Lower–Upper)
Age ≥ 60 years	50 (39.7)	28 (25.5)	0.020	1.93	1.10–3.37
Age < 60 years	76 (60.3)	82 (74.5)		0.52	0.30–0.91
Female	77 (61.1)	44 (40.0)	0.001	2.36	1.40–3.98
Male	49 (38.9)	66 (60.0)		0.42	0.25–0.72
Diabetes mellitus	59 (46.8)	29 (26.4)	0.001	2.46	1.42–4.26
Hypertension	108 (85.7)	82 (74.5)	0.031	2.05	1.06–3.96
Smoking	10 (7.9)	53 (48.2)	0.000	0.09	0.04–0.20
Non-smoking	116 (92.1)	57 (51.8)		10.79	5.11–22.75
Obesity	37 (29.4)	29 (26.4)	0.608	1.16	0.66–2.06
Radiocephalic AV Shunt	65 (51.6)	61 (55.5)	0.552	0.86	0.51–1.43
Brachiocephalic AV Shunt	61 (48.4)	49 (44.5)		1.17	0.70–1.95

Table

Table 3. Multivariate Logistic Regression Analysis of Risk Factors for AV Shunt Stenosis

Risk Factor	P-value	OR	95% CI (Lower–Upper)
Age	0.018	2.22	1.15–4.30
Diabetes mellitus	0.006	2.44	1.29–4.61
Hypertension	0.017	2.59	1.19–5.63
Smoking	0.000	10.30	4.76–22.30

Quality of Life and Psychological State of Patients with Arterial Hypertension Depending on Its Etiology

Valentyna Romanova¹, Mariia Gunko¹, Iryna Gunko¹, Oksana Poberezhets¹, Nataliia Horobets², Nataliia Kuzminova¹, Mykhailo Repetenko³

¹Internal Medicine No. 1, National Pirogov Memorial Medical University, Vinnytsya, Ukraine

²General practice (family medicine), Bogomolets National Medical University, Kyiv, Ukraine

³Marketing, Limited Liability Company, Kyiv, Ukraine

Introduction

To evaluate the quality of life and psychological state of patients with essential and secondary (nephrogenic) hypertension.

Methods

98 patients with arterial hypertension (50 with essential and 48 with secondary due to chronic glomerulonephritis) and 30 practically healthy individuals of appropriate age and sex were examined. Quality of life was assessed using Medical Outcomes Study 36-Item Short-Form Health Survey (the SF-36 questionnaire), psychological state was examined using the Beck Depression Inventory (BDI) and the State-Trait Anxiety Inventory (STAI).

Results

According to SF-36 the level of physical health in patients with essential hypertension was 19.6% lower, and in patients with secondary hypertension 21.4% lower than in the control group ($p < 0.05$), without significant difference between these groups ($p > 0.05$). The level of mental health was 5.6% and 12.1% lower than in the control group ($p < 0.05$), respectively, with a tendency to significance depending on arterial hypertension etiology ($0.05 < p < 0.1$). According to BDI patients with nephrogenic hypertension significantly more often had moderate and severe depression not only compared to the control group, but also patients with essential hypertension ($p < 0.05$). According to STAI patients with essential hypertension had a prevalence of moderate and high state anxiety (S-anxiety), while patients with secondary hypertension had a high one (for both $p < 0.05$ compared to the control group) without a significant difference between these groups ($p > 0.05$). Severe trait anxiety (T-anxiety) was significantly more common in patients with secondary hypertension compared to both the control group and patients with essential hypertension ($p < 0.05$). There was no patient with mild T- and S-anxiety among patients with secondary hypertension ($p < 0.05$ compared to both other groups).

Conclusion

Patients with arterial hypertension, regardless of its etiology, have worse quality of life and psychological status indicators. Patients with secondary hypertension were characterized by worse quality of life, a higher frequency of both severe depression and severe S- and T-anxiety.

Table

Indicator	Control group (n=30)	Essential hypertension (n=50)	Secondary hypertension (n=48)	p
Physical health by SF-36, points	63.2±2.41	50.8±3.42*	49.7±3.15*	ns
Mental health by SF-36, points	98.6±1.56	93.1±2.24*	86.7±2.98*	0.05< p<0.1
No depression by BDI, n (%)	21 (70.0%)	32 (64.0%)	21 (43.8%)*	<0,05
Mild depression by BDI, n (%)	7 (23.3%)	9 (18.0%)	4 (8.3%)	ns
Moderate depression by BDI, n (%)	1 (3.3)	7 (14.0%)	15 (31.3%)*	<0,05
Severe depression by BDI, n (%)	1 (3.3%)	2 (4.0%)	8 (16.7%)*	<0,05
Mild S-anxiety by STAI, n (%)	6 (20.0%)	11 (22.0%)	0 (0.0%)*	<0,05
Moderate S-anxiety by STAI, n (%)	18 (60.0%)	18 (36.0%)*	20 (41.7%)	ns
Severe S-anxiety by STAI, n (%)	6 (20.0%)	21 (42.0%)*	28 (58.3%)*	ns
Mild T-anxiety by STAI, n (%)	6 (20.0%)	5 (10.0%)	0 (0.0%)*	<0,05
Moderate T-anxiety by STAI, n (%)	19 (63.3%)	33 (66.0%)	27 (56.25%)	ns
Severe T-anxiety by STAI, n (%)	5 (16.7%)	12 (24.0%)	21 (43.75%)*	<0,05

Notes: * – significant difference according to the control group (p<0.05);

p – difference between groups with essential and secondary (nephrogenic) hypertension;

ns – the difference is not significant (p>0.05).

The Novel Classifier Based on Non-Targeted Lipidomic Methods for Ischemic Stroke in Hypertensive Individuals

Yicheng Zhu, Wenbin Wang, Yingqing Feng

Cardiology, Guangdong Provincial People's Hospital, affiliated by Southern Medical University, Guangzhou, Guangdong Province, China

Introduction

Traditional clinical risk factors are insufficient to estimate the residual risk of large-vessel ischemic stroke. Non-targeted lipidomic techniques provide an opportunity to discover novel biomarkers and evaluate risks of ischemic stroke.

Methods

Plasma samples were collected from 113 hypertensive individuals, including 55 individuals at high risk of ischemic stroke and 58 matched individuals, in a prospective nested case-control cohort. To identify dysregulated lipid metabolites, we conducted multivariate and univariate analyses. A classifier based on a cross-validated procedure was employed to select the optimal combination of lipid species and their ratios.

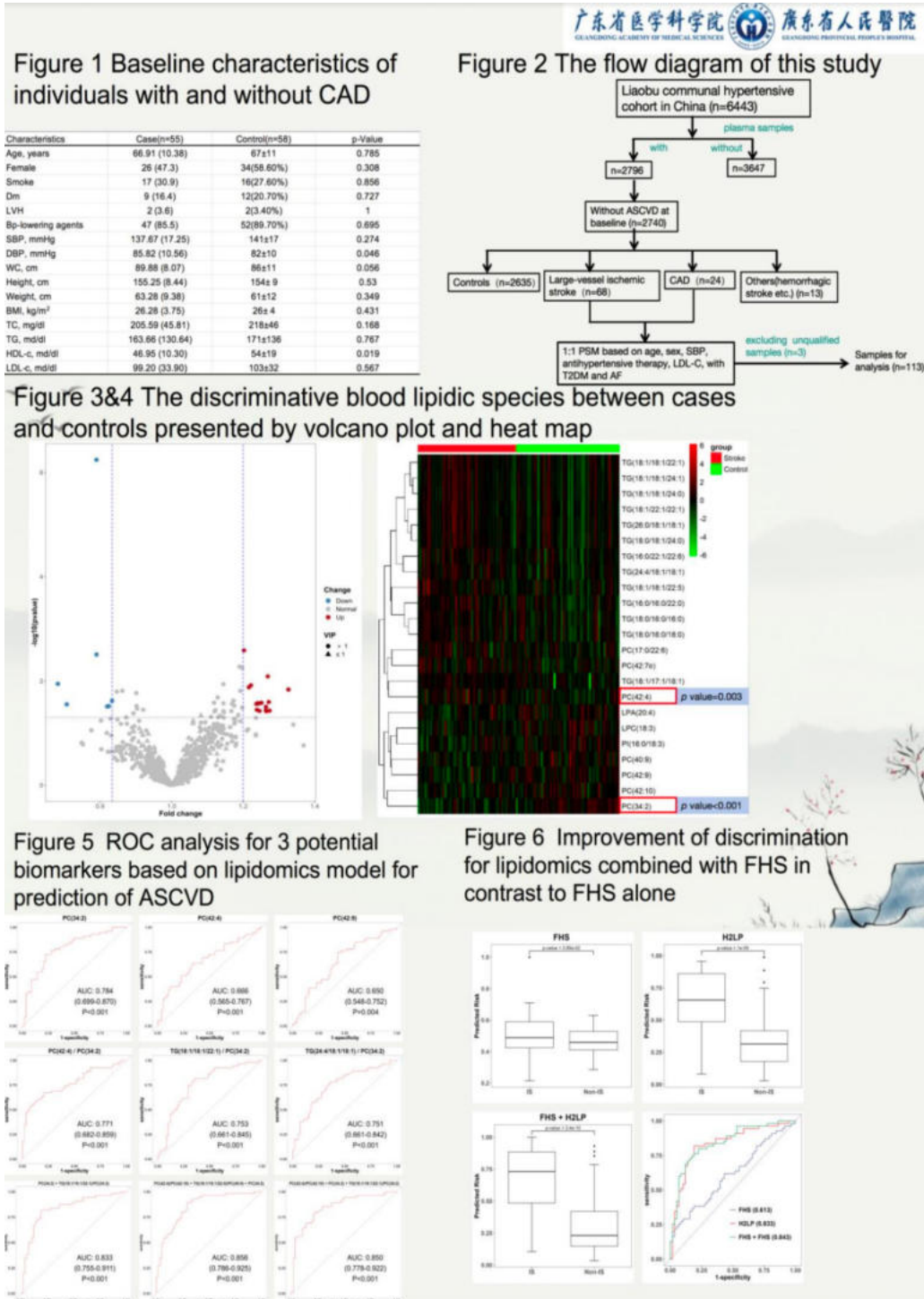
Results

We identified 23 dysregulated lipid species in patients with and without ischemic stroke, including 16 (69.6%) up-regulated and 7 (30.4%) down-regulated lipid species. Through internal cross-validation, the optimal combination of two lipid features (phosphatidylcholine 34:2 and triglyceride 18:1/18:1/22:1 / phosphatidylcholine 34:2, referred to as ischemic stroke-related 2 lipid features - IS2LP) was selected, leading to a more precise prediction probability for ischemic stroke within 3.9 years. In the comparison of different risk factors, the traditional risk score, the IS2LP risk score, and the combination of the traditional risk score with IS2LP yield AUC values of 0.613(95% CI:0.509–0.717), 0.833(95% CI:0.755–0.911), and 0.843(95% CI:0.777–0.916), respectively. The combination of the traditional risk score and IS2LP exhibited significantly improved discriminative performance, with an integrated discrimination improvement (IDI) of 0.31 ($p < 0.001$) and a continuous net reclassification improvement (NRI) of 1.06 ($p < 0.001$) compared to the traditional risk score.

Conclusion

We identified new lipidomic biomarkers associated with the futural event of large-vessel ischemic stroke. These lipid species could serve as potential blood biomarkers for assessing the residual risk of ischemic stroke in hypertensive individuals.

Figure



AI-Driven Circulating miRNA Model for Non-Invasive Lateralization of Primary Aldosteronism and Genotype Inference: Towards Reducing Dependence on Adrenal Vein Sampling

Rifaldy Fajar¹, Prihantini Prihantini¹, Rini Winarti², Sahnaz Vivinda Putri³

¹AI-BioMedicine Research Group, IMCDS-BioMed Research Foundation, Jakarta, Indonesia

²Biology, Yogyakarta State University, Sleman, Indonesia

³Management, Indonesia Open University, Makassar, Indonesia

Introduction

Primary aldosteronism (PA) is the leading cause of secondary hypertension, accounting for up to 10% of hypertensive patients. Its clinical management requires differentiation of unilateral aldosterone-producing adenoma (UPA) from bilateral adrenal hyperplasia (BAH). The gold-standard adrenal vein sampling (AVS) is invasive, operator-dependent, and not widely available. Circulating microRNAs (miRNAs) have emerged as minimally invasive biomarkers reflecting adrenal pathophysiology. We aimed to develop and validate an AI-based circulating miRNA model to lateralize PA and provide probabilistic inference of driver genotypes.

Methods

We integrated two independent circulating miRNA cohorts from the Gene Expression Omnibus (GEO): GSE264578 (n=36, UPA vs BAH) and GSE126386 (n=30, APA vs BAH). Raw sequencing counts were normalized with ComBat-seq, followed by study-stratified nested cross-validation. To incorporate mechanistic priors, we leveraged APA tissue RNA-seq from GSE236437, which identified somatic SLC30A1-driven signatures, and mapped these to validated miRNA–pathway interactions (calcium signaling, CYP11B2-mediated steroidogenesis). Data preprocessing and model implementation were executed locally in Python using scikit-learn and PyTorch frameworks. Coding assistance for debugging and workflow optimization was inspired by an OpenAI language model, with all scripts subsequently reviewed, executed, and validated by the authors. A multi-task graph neural network (GNN) was trained with two outputs: Task 1, lateralization (UPA vs BAH); Task 2, probabilistic classification of APA genotype (KCNJ5, CACNA1D, ATP1A1, CTNNB1, SLC30A1, or other). Interpretability was provided by SHAP applied at the pathway level. Clinical utility was quantified using calibration curves, decision curve analysis (DCA), and net reclassification improvement compared to an “AVS-for-all” policy.

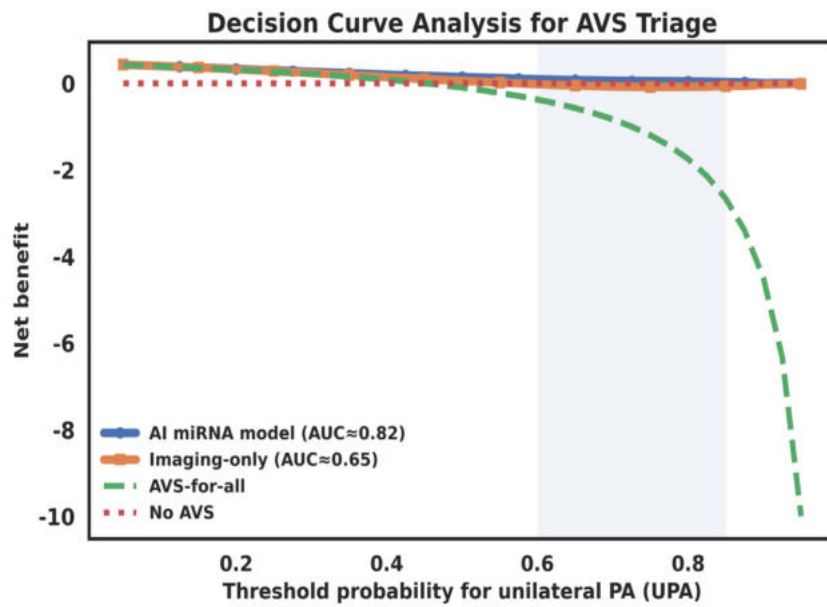
Results

Across leave-one-dataset-out testing, the model achieved an AUC of 0.82 (95% CI 0.74–0.89) for UPA vs BAH discrimination, with calibration slope 0.88. At a prespecified high-specificity threshold (PPV 0.85, NPV 0.78), the model projected a 35% reduction in AVS utilization while capping missed unilateral cases at 5.1%. The genotype inference head yielded macro-F1 of 0.68, correctly identifying KCNJ5-mutant and SLC30A1-mutant subtypes with >75% precision in held-out patients, though classification for rarer drivers showed wider confidence intervals. DCA indicated net clinical benefit over imaging-only strategies across a broad threshold range. SHAP analysis showed enrichment of miR-181 and miR-125 family signals linked to calcium influx and steroidogenic pathways, consistent with APA biology. Sensitivity analyses across both GEO cohorts confirmed consistent predictive performance despite differences in sequencing platforms, and subgroup evaluation indicated higher discrimination in patients with hypokalemia and elevated aldosterone-renin ratios, supporting clinical applicability across patient populations.

Conclusion

We present an externally validated, blood-based AI model that integrates circulating miRNAs with mechanistic priors to lateralize PA and infer driver genotype probability. This approach provides robust accuracy, strong calibration, and clinical net benefit. Prospective validation in larger multi-center cohorts is warranted to translate these findings into routine endocrine hypertension care.

Figure



Machine Learning Framework for Predicting Long-Term Hypertension Risk during Gender-Affirming Hormone Therapy in Transgender Individuals

Rini Winarti¹, Sahnaz Vivinda Putri², Prihantini Prihantini³, Rifaldy Fajar³

¹Biology, Yogyakarta State University, Sleman, Indonesia

²Management, Indonesia Open University, Makassar, Indonesia

³AI-BioMedicine Research Group, IMCDS-BioMed Research Foundation, Jakarta, Indonesia

Introduction

Hypertension is a major cardiovascular burden with high prevalence in transgender individuals, but research in this population remains limited. Gender-affirming hormone therapy (GAHT) is widely prescribed, while its long-term hypertensive effects are poorly defined due to the lack of prospective trials. This study aimed to predict hypertension trajectories under GAHT using a machine learning framework that integrates GAHT-specific methylation, vascular hormone-response biology, and population-level health data.

Methods

GAHT-related DNA methylation changes were extracted from GSE176394, a longitudinal study of 13 transfeminine and 13 transmasculine individuals sampled at baseline, 6 months, and 12 months. Endothelial hormone-response biology was incorporated from GSE168514 (hCMEC/D3 endothelial cells and pericytes $\pm 17\beta$ -estradiol, 48 h) and GSE16683 (primary HUVEC exposed to 1 nM estradiol, 24 h), focusing on nitric oxide and Notch signaling pathways. These molecular priors were integrated into a gradient-boosted survival forest trained on NHANES 2013–2016 (n=8,540 adults with measured blood pressure, antihypertensive use, and sex steroid assays). The model was calibrated by isotonic regression and validated using nested cross-validation. For GAHT exposures, we used the 2022 U.S. Trans Survey (USTS-2022), which included 48,236 respondents aged 18–65 with information on hormone type, route, duration, and sociodemographic covariates. Transportability was addressed using entropy balancing and kernel mean matching. Each USTS respondent was represented as a digital twin, with counterfactual recurrent neural networks simulating GAHT trajectories. Target trial emulation with targeted maximum likelihood estimation (TMLE) quantified 10-year hypertension incidence. Robustness was assessed with 1,000 bootstrap resamples, negative-control outcomes, and E-values. SHAP and decision-curve analysis evaluated interpretability and clinical utility. During implementation, OpenAI ChatGPT supported coding workflows in Python within Jupyter notebooks, including data preprocessing (pandas/NumPy), modeling (scikit-learn, XGBoost), interpretability (SHAP), and decision-curve utilities. ChatGPT assisted with code structuring and debugging, while all analyses were executed, version-controlled, and validated directly in Jupyter.

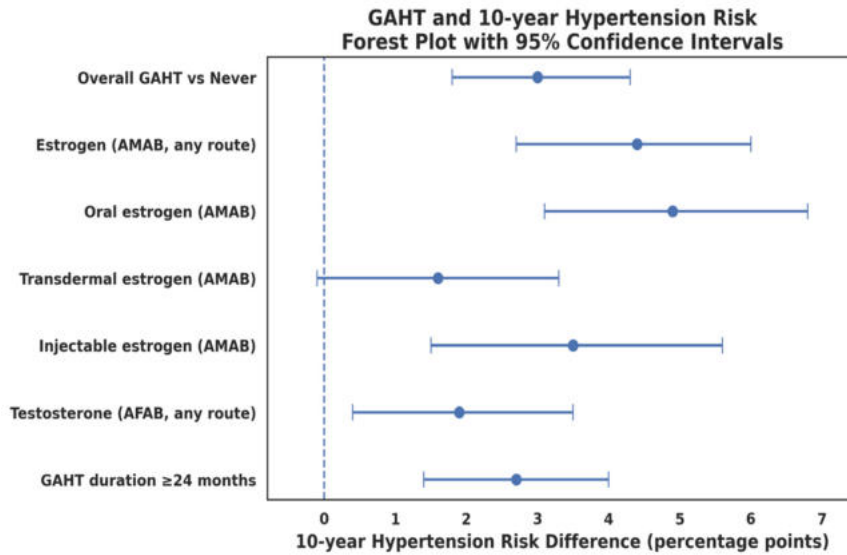
Results

The model achieved AUROC 0.846 (95% CI 0.832–0.861) in NHANES and 0.818 (0.804–0.832) after transport to USTS. Among USTS participants, 68% reported current GAHT. Digital twin simulations estimated a 10-year hypertension risk increase of 3.0 percentage points (95% CI 1.8–4.3; RR 1.11, 1.05–1.18). Transfeminine individuals on estrogen had the largest increase (+4.4 pp, 2.7–6.0), most pronounced with oral formulations (+4.9 pp, 3.1–6.8). Transmasculine individuals on testosterone experienced a smaller but significant increase (+1.9 pp, 0.4–3.5). Longer GAHT duration (≥ 24 months) conferred higher risk than shorter exposure. Incorporating GSE176394 methylation and endothelial signatures from GSE168514/GSE16683 improved calibration (Δ Brier -0.013) and suggested suppression of nitric oxide signaling as a potential pathway. Decision-curve analysis indicated net benefit for risk-guided monitoring at thresholds of 7–12%. Clinically, this means that even modest absolute risk increases become significant at the population level, justifying closer blood pressure surveillance, early lifestyle interventions, and preferential use of safer hormone delivery routes such as transdermal estrogen in higher-risk patients.

Conclusion

This machine learning framework shows that GAHT increases hypertension risk, strongest for oral estrogen and long-term use. Integrating molecular signatures with national survey data provides practical evidence for precision surveillance of endocrine-related secondary hypertension in transgender care.

Figure



Dual-Domain Machine Learning Integrating Renal CTA Anatomy and 24-Hour ABPM to Personalize Renal Denervation Benefit in Resistant Hypertension

Elfiany Syafruddin

Computational Science Research Laboratory, BLK Muhammadiyah University, BLK, Indonesia

Introduction

Following the November 2023 FDA approval of ultrasound renal denervation (RDN), a central gap is identifying patients with clinically meaningful blood-pressure (BP) reduction. We developed a proof-of-concept that integrates renal CT angiography (CTA)-derived anatomy with 24-hour ambulatory BP monitoring (ABPM) phenotypes to estimate patient-specific Expected Treatable BP Reduction (ETBR), calibrated against sham-controlled RDN effect sizes.

Methods

Imaging data came from the Aortic Vessel Tree (AVT) CTA dataset (56 thoracoabdominal CTA scans with labeled aortic branches including the renal origins). ABPM data included one cohort with 270 participants and an external validation set from Oxford with 65 participants. A 3D nnU-Net segmented the aorta and renal arteries; centerline analysis derived ostial/distal diameters at 5, 10, and 20 mm from the ostium, usable segment length within 10–30 mm, take-off angle, curvature, tortuosity, and accessory-artery count. These metrics formed a literature-informed Renal Denervation Anatomical Complexity Index (RACI; 0–10), where smaller diameter, shorter length, greater tortuosity, and accessory branches indicate higher complexity. ABPM features included 24-hour, daytime, and nighttime SBP/DBP, dipping ratio, morning surge, short-term variability (SD, ARV), BP load, and nocturnal-hypertension flags. Gradient-boosting models with nested 5×5-fold cross-validation predicted Δ SBP under therapy intensification as a physiologic proxy of treatability. Bayesian updating aligned predictions to sham-controlled priors (mean daytime SBP reduction 8.0 mmHg, SD 5.0) to yield patient-level ETBR with 95% credible intervals. OpenAI (ChatGPT) was used to assist code prototyping/refactoring and documentation for segmentation, feature engineering, modeling, and Bayesian calibration. Primary endpoints assessed imaging accuracy/reliability, ABPM predictive performance/calibration, and integrated improvement in error, decision-curve net benefit, and risk reclassification into high (ETBR ≥ 10 mmHg), intermediate (5–10), and low (<5) benefit groups.

Results

Renal-artery segmentation achieved Dice 0.88 (95% CI 0.84–0.90). Accessory-artery detection showed sensitivity 0.85 (0.76–0.92) and specificity 0.88 (0.82–0.93). RACI test–retest reliability was ICC 0.87 (0.81–0.91). ABPM-only models predicted Δ SBP with MAE 5.8 mmHg (95% CI 5.2–6.3) and calibration slope 0.88 with intercept 0.6 mmHg; external validation yielded MAE 6.1 mmHg (5.3–7.0). Adding CTA features reduced error to MAE 4.7 mmHg (4.1–5.3) and improved R^2 from 0.38 to 0.52 (Δ MAE -1.1 mmHg; $p=0.002$). Decision-curve analysis showed higher net benefit across 5–15 mmHg thresholds (peak +0.05 at 10 mmHg). Net reclassification improvement for high-benefit candidacy was 0.18 (95% CI 0.06–0.30). Stratification identified high 34% (95% CI 27–41), intermediate 44% (36–51), and low 22% (16–29). Favorable anatomy remained independently associated with higher ETBR: ostial diameter per +1 mm, OR 1.28 (1.06–1.56); usable length per +5 mm, OR 1.18 (1.03–1.36); accessory artery present, OR 0.62 (0.39–0.97).

Conclusion

This machine-learning framework provides trial-anchored ETBR with quantified uncertainty and a transparent anatomic readout to support multidisciplinary selection for RDN. Prospective validation in Asian cohorts is warranted to assess durability, ethnic generalizability, and cost-effectiveness.



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* 2019년 9월 16일 국내 허가 기준

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50세 이상 고혈압 및 심장질환이 있는 환자에서
각각 91.9%, 97.0%의 예방효과⁵

(VE 97.2%, 95% CI 93.7-99.0, p<0.001⁴; VE 91.9%, 95% CI 87.3-95.1⁵; VE 97.0%, 95% CI 82.3-99.9⁵)

✓ 2023년 기준
전 세계 판매 1위(점유율 98%),^{6,†}
국내 판매 1위의 대상포진 백신^{7,‡}

[†]2023 Global IQVIA data [J07E2 VARICELLA VACCINES, MOLECULE: VACCINE, VARICELLA ZOSTER] Herpes zoster vaccine 부문, Value 기준; [‡]2023 국내 IQVIA data [J07E2 VARICELLA VACCINES, MOLECULE: VACCINE, VARICELLA ZOSTER] Herpes zoster vaccine 부문, Value 기준

싱그릭스주
대상포진바이러스백신 (유전자재조합)

CI, confidence interval; VE, vaccine efficacy.

References 1. Marra F, et al. Risk Factors for Herpes Zoster Infection: A Meta-Analysis. Open Forum Infect Dis. 2020;7:ofaa005. 2. American College of Cardiology. How to Talk with Our Heart Patients about Adult Vaccinations. Last Edited December 2023. 3. American College of Cardiology. Vaccination Referral Form. Available at: https://www.cardiosmart.org/assets/worksheets/-vaccination-referral-form?_ga=2.5339893.751868778.1721031319-19472132671720748345. Accessed July 2024. 4. Lal H, et al. Efficacy of an adjuvanted herpes zoster subunit vaccine in older adults. N Engl J Med. 2015;372(22):2087-2096. 5. Oostvogels L, et al. Medical conditions at enrollment do not impact efficacy and safety of the adjuvanted recombinant zoster vaccine: a pooled post-hoc analysis of two parallel randomized trials. Hum Vaccin Immunother. 2019;15(12):2865-2872. 6. 2023 Global IQVIA data [J07E2 VARICELLA VACCINES, MOLECULE: VACCINE, VARICELLA ZOSTER] Herpes zoster vaccine 부문, Value 기준. 7. 2023 국내 IQVIA data [J07E2 VARICELLA VACCINES, MOLECULE: VACCINE, VARICELLA ZOSTER] Herpes zoster vaccine 부문, Value 기준. 8. 싱그릭스 국내 제품설명서.

[Integrated safety information^{*}] 1. 다음 환자에는 투여하지 말 것 이 백신의 구성 성분에 과민반응이 있는 자 2. 다음 환자에는 신중히 투여할 것 1) 급성 중증 열성 질환을 앓고 있는 자(급성 중증 열성질환 또는 급성 감염이 있는 경우, 이 백신의 접종을 연기해야 한다. 감기와 같이 경미한 감염으로 이 백신의 접종을 연기할 필요는 없다.) 2) 열소판 감소증이나 다른 혈액응고장애가 있는 환자(근육주사 시 출혈이 일어날 수 있으므로 주의하여 투여하여야 한다.) 3. 약물이상반응 ① 만 50세 이상의 성인 만 50세 이상 성인 약 17,000명이 17건의 임상시험에서 최소 1회 이 백신을 투여 받았다. 이 백신의 안전성은 만 50세 이상 성인 29,305명을 대상으로 실시한 2건의 주요 3상 위약 대조 임상시험 ZOE-50 (Zoster-006) 및 ZOE-70 (Zoster-022)의 데이터를 통합하여 평가되었다. 시험대상자들은 0, 2개월 접종 일정에서 이 백신 (N = 14,645) 또는 위약 (N = 14,660)을 최소 1회 투여 받았다. 예상된 약물이상반응은 만 70세 이상 시험대상자에 비해 만 50-69세 시험대상자에서 주사부위 통증 및 종창, 피로, 근육통, 두통, 열, 및 위장관증상의 발생률이 더 높았다. 이들 약물 이상반응 대부분은 오래 지속되지 않았다 (지속시간 중앙값 2-3일). 중증 약물이상반응으로 보고된 반응은 1-2일간 지속되었다. ② 만 18세 이상의 질병 혹은 치료로 인한 면역억제 또는 면역억제로 대상포진의 위험이 높거나 높을 것으로 예상되는 자 (이하 "면역억제자 (immunocompromised)"로 지칭함) 예상된 약물이상반응 자기조혈모세포이식 환자를 대상으로 한 연구 Zoster-002에서, 이 백신 투여 후 7일 이내 만 18-49세, 만 50세 이상에서 각각 보고된 예상된 국소 약물이상반응은 통증 (87.5%, 82.7%), 발적 (29.9%, 34.6%) 그리고 종창 (20.5%, 18.0%)이었고, 예상된 전신 약물이상반응은 피로 (64.1%, 53.8%), 근육통 (57.8%, 52.4%), 두통 (43.9%, 30.1%), 위장관증상 (21.1%, 28.2%), 열 (31.4%, 24.6%) 그리고 열 (27.8%, 17.8%)이었다(최소 1회 증상을 보고한 대상자의 백분율 기준). 4. 일반적 주의 1) 이 백신을 팔관내 또는 피내로 투여하지 않는다. 2) 이 백신은 수두의 예방을 적용중으로 하지 않는다. 3) 다른 백신과 마찬가지로, 백신 접종 후 아나필락시스 반응이 일어날 경우에 대비하여 적절한 의학적 치료와 감도가 항상 준비되어 있어야 한다. 4) 만 65세 이상을 대상으로 한 시판 후 관찰 연구(미국, 2017.10.01. ~ 2020.02.29.)에서, 이 백신 접종 후 42일 동안 진행-비례중증군의 발생 위험 증가가 관찰되었다(백신 투여량 1,000,000 dose 당 발생 건수가 약 3건 증가). 이 백신 투여와 인과관계에 판단하기에는 정보가 충분하지 않다. 5. 임부 및 수유부에 대한 투여 1) 임부: 임부에서 이 백신을 사용한 자료는 없다. 동물시험에서는 임신, 배태자 발달, 분만 또는 출생 후 발달과 관련하여 직접적 또는 간접적인 유해한 영향이 나타나지 않았다. 예방적 조치로서, 임신 중에는 이 백신의 사용을 피하는 것이 좋다. 2) 수유: 이 백신의 접종이 수유 중인 어머니 모체에 미치는 영향은 연구된 바 없다. 이 백신이 사람의 모유로 분비되는지 여부는 알려져 있지 않다. 3) 수태능: 동물시험에서 수컷 또는 암컷의 수태능 면에서 직접적 또는 간접적인 유해한 영향이 나타나지 않았다.

Product Information

싱그릭스주

[대상포진바이러스백신 (유전자재조합)]



차별하기가 전 QR 코드 또는 식품의약품안전처 의약품통합정보시스템(<http://medrug.mfds.go.kr>)을 통해 상세제품정보를 참조하시기 바랍니다.

강력한 효과로 이상지질혈증, 걱정이 사라지다

위험도 분류에 따른 치료 환자군

초고위험군은 심혈관질환이 있는 환자, 즉 이미 관상동맥질환, 뇌혈관질환, 말초혈관질환으로 진단돼 치료 받고 있는 환자들이 해당됩니다.

고위험군은 관상동맥질환이 없는 당뇨병 환자, 고위험군으로 분류됩니다.

중등도위험군은 심혈관질환의 위험요소(흡연, 고혈압, 고지혈증, 당뇨병, 조기발병 가족력) 중 2개 이상에 해당하거나, 여자 55세 이상, 관상동맥질환이 발병한 경우) 중에서 LDL 콜레스테롤 수치가 190mg/dL 이상인 환자에게 속합니다.

저위험군은 LDL 콜레스테롤을 제외한 주요 위험인자가 1개 이하인 환자에게 속합니다.

스타틴에 의한 부작용

당뇨병 신규 발생을 줄여줍니다. 대부분의 당뇨병 신규 발생은 스타틴을 사용하지 않는 군에서 더 많이 발생하며, 고용량의 스타틴을 사용한 군에서 더 많이 발생하며...

강력한 이상지질혈증 솔루션
리바로젯®

효과성

- 복용 후 50% 이상 LDL-C 감소효과 입증¹⁾
- 저·중등도위험군은 물론, 고위험군 이상으로 넓어진 치료범위²⁾

안전성

- 당뇨병 안전성을 공인 받은 유일한 스타틴
- 32개국 당뇨병 안전성 공인³⁾



1) 2) 리바로젯 3상 허가임상 결과 3) 32개 국가 현황 : 영국, 독일, 프랑스, 스페인, 이탈리아, 핀란드, 네덜란드, 스웨덴, 오스트리아, 아일랜드, 포르투갈, 그리스, 노르웨이, 동유럽(5개국), 러시아, 폴란드, 우크라이나, 조지아, 아르메니아, 동아시아(5개국), 싱가포르, 대만, 인도네시아, 말레이시아, 카자흐스탄, 중동(8개국), 사우디아라비아, UAE, 쿠웨이트, 카타르, 요르단, 오만, 레바논, 바레인, 아프리카(17개국), 모로코



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혈관계: 홍조 / 전신: 피로, 부종 / 심혈관계: 심계항진 / 중추 및 말초신경계: 현기증, 두통, 졸음 / 소화기계: 복통, 오심. 노바스크는 디하이드로피리딘계 약물에 과민한 환자, 수유부, 중증의 간기능장애 환자, 중증의 대동맥판막질환 환자, 속 환자에게 투여하지 않아야 합니다.
노바스크는 중증의 저혈압 환자, 투석을 해야 하는 신부전 환자, 고령자, 임부 또는 임신하고 있을 가능성이 있는 여성 환자에게 신중히 투여해야 합니다.

References 1. 노바스크® 의약품 등 제조품목 허가증 (노바스크® 5 mg 허가일 1990.09.05 기준) 2. 노바스크정 제형설명서(최종변경일자: 2024.08.30 (2.5 mg), 2024.09.03 (5 mg), 2024.10.07 (10 mg)).

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※ 제품에 대한 자세한 정보는
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성분·함량 : benidipine HCl 2mg / benidipine HCl 4mg / benidipine HCl 6mg / benidipine HCl 8mg
효능·효과 : 고혈압, 협심증 저장방법 : 밀폐용기, 실온(1~30°C)보관 사용기간 : 제조일로부터 36개월
용법·용량 :

- 1. 고혈압** · 베니디핀염산염으로서 1일 1회 2~4mg을 아침식사 후 경구투여한다.
 - 2. 협심증** · 이 약으로서 1회 4mg을 1일 2회 아침, 저녁 식사 후 경구투여한다.
- 효과가 불충분할 경우에는 1일 1회 8mg까지 증량할 수 있다.
 - 증상에 따라 적절히 증감한다.
 - 단, 중증고혈압증에는 1일1회 4~8mg을 아침식사 후 경구투여한다.

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후루덱스 서방정
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1.5mg



프로코라란정
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7.5mg

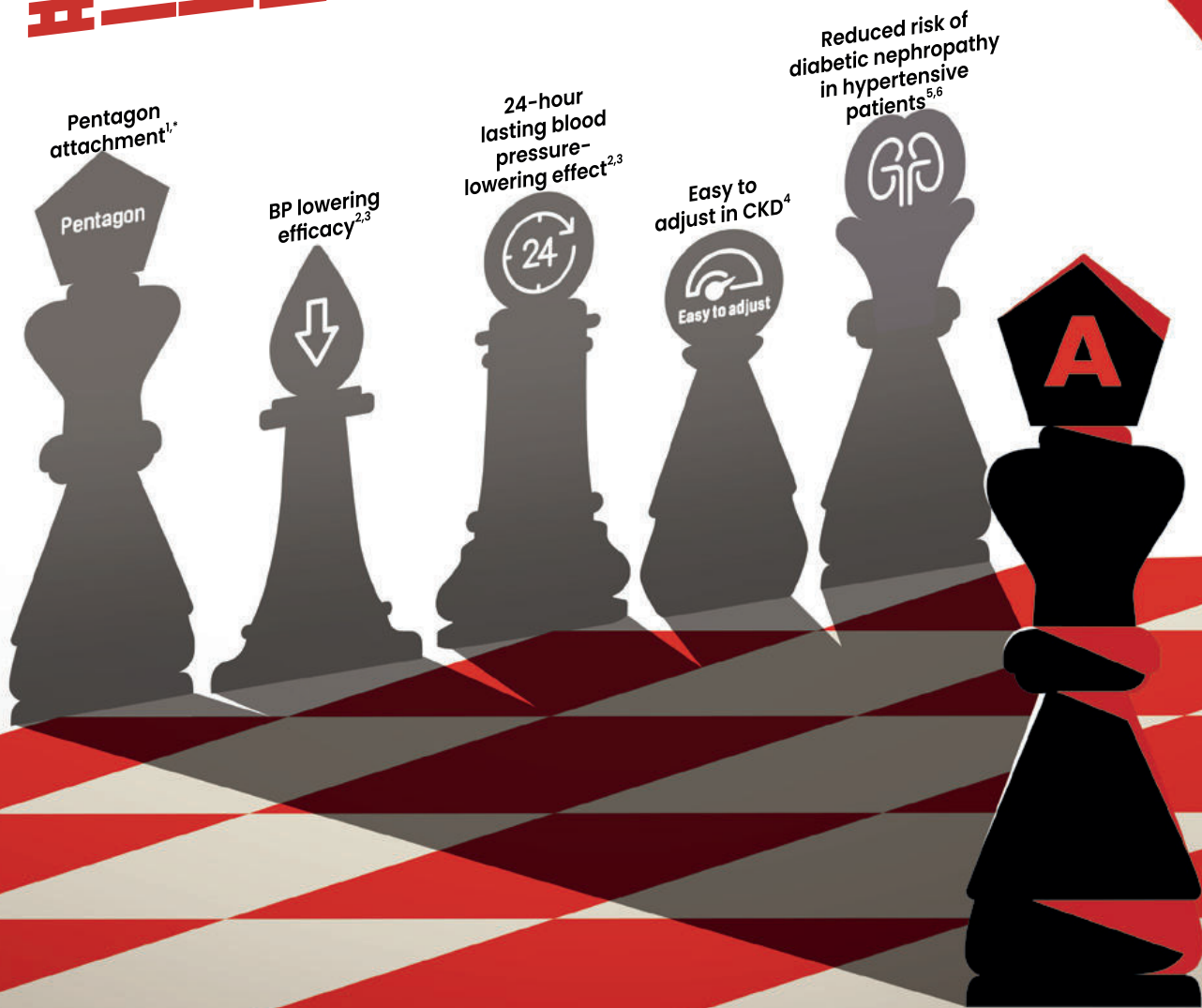


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*Pentagon attachment: hydrophobic interaction between irbesartan's cyclopentyl group and the AT₁ receptor

References 1. Miura S et al. J Renin Angiotensin Aldosterone Syst. 2011 Mar;12(1):1-7. 2. Fabia MJ et al. J Hypertens. 2007;25(7):1327-1336. 3. Borghi C et al. High Blood Press Cardiovasc Prev. 2012 Mar 1;19(1):19-31. 4. Sica DA et al. Clin Pharmacol Ther. 1997 Dec;62(6):610-8. 5. Parving HH, et al. N Engl J Med. 2001;345(12):870-878. 6. Lewis EJ, et al. N Engl J Med. 2001 Sep 20;345(12):851-60.

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아프로벨®정
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300mg



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* IQVIA 2022.3Q ~ 2023.2Q MAT, 베타차단제 C07A, ETC 기준



References 1. Bowman AJ, et al. Nitric oxide mediated venodilator effects of nebivolol. *Br J Clin Pharmacol*. 1994 Sep;38(3):199-204. 2. Broeders MA, et al. Nebivolol: a third-generation beta-blocker that augments vascular nitric oxide release: endothelial beta(2)-adrenergic receptor-mediated nitric oxide production. *Circulation*. 2000 Aug 8;102(6):677-84. 3. IQVIA data 2023 based on global data, supported by IQVIA as retrieved on 8 Nov 2023.

* 75 countries with applicable scope, reflecting estimates of real-world activity in retail/hospital pharmacy channels.

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* 보다 자세한 제품정보를 위해 QR code로 연결된 제품설명서 전문을 참고하시기 바랍니다.

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【제품명】 푸로골서방캡슐 【원료약품 및 그 분량】 1캡슐 중 · 푸로골서방캡슐120밀리그램 · 딜티아젬염산염(EP) 120mg/푸로골서방캡슐180밀리그램 · 딜티아젬염산염(EP) 180mg 【성상】 흰색 내지 거의 흰색의 펠렛이 든 상하부 흰색의 불투명 경질캡슐제 【효능 · 효과】 협심증, 본태성고혈압(경증-중등도) 【용법 · 용량】 1. 성인: 초회량으로 딜티아젬염산염으로서 1일 1회 180mg을 경구투여한다. 용량은 증상에 따라 2-4주 간격으로 증량할 수 있으며, 통상적인 유지용량은 1일 1회 240-360mg 이다. 1일 최대투여량은 360mg 이다. 2. 노인 및 간·신장에 환자: 초회량으로 1일 1회 120mg을 투여한다. 투여 중에 심박동수를 측정하여 50회 이하로 저하된 경우에는 증량하지 않는다. 【저장방법】 기밀용기, 실온보관(1~25℃) 【포장단위】 28 캡슐/상자(14캡슐/PTP포장 x 2), 56 캡슐/상자(14캡슐/PTP포장 x 4)

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듀카브 플러스			
Fimasartan / Amlodipine / HCTZ			
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투베로			
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