The Pulse of Asia 2016 Seoul

September 24–26, 2016, Seoul, Republic of Korea

Guest Editor

Jeong Bae Park, Seoul

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## September 24, 2016 (Grand Intercontinental Hotel Seoul Parnas)

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Invited Lecture Summary

I-01
Defining Vascular Aging: From Bench to Bedside
Stéphane Laurent
Department of Pharmacology, Georges Pompidou Hospital, Paris Descartes University

The growing interest for the clinical measurement of arterial aging through the non-invasive assessment of arterial stiffness is associated with accumulating evidence that arterial stiffness has independent predictive value for cardiovascular events. In this review, we will address several issues. (1) The basic mechanisms of arterial ageing of large arteries have been intensively investigated during the last decades, and involve structural and functional changes of the 'lamellar unit' or 'musculo-elastic complex' under cumulative mechanical stress and disorders of molecular functions. Recently, the role of vascular smooth muscle cells has been emphasized, not only through connections with the extra-cellular matrix, modulating specific signaling pathways, but also through cell contraction and stiffness. The effects of cellular senescence and the role of sirtuin on cell stiffness are underlined. Arterial stiffness is now seen as an integrator of all damages done to the arterial wall, either well identified cardiovascular risk factors (high blood pressure, diabetes, ...) or poorly identified ones (oxidative stress, inflammation, ...). (2) The hemodynamics consequences of arterial ageing have been studied in healthy populations. In young healthy subjects, the mismatch of impedance between elastic proximal arteries and stiffer medium size muscular arteries can generate partial wave reflections, far from the small resistance arteries. Partial reflections limit the transmission of pulsatile energy to the periphery and protect the microcirculation. In older subjects, aortic stiffness increases, the stiffness gradient is attenuated, and less wave reflections are generated. The pulsatile pressure is not sufficiently dampened and is transmitted, damaging the microcirculation. (3) The concept of early vascular aging (EVA) is elaborating on the core idea that it is possible to early identify subjects with signs of an unsuccessful vascular aging that would lead them into cardiovascular disease and irreversible residual risk despite primary or secondary prevention measures undertaken later in time. Aortic stiffness, measured as regional pulse wave velocity, is generally accepted as one of the most precise and robust measurement of EVA. Essential hypertension is a good example of EVA, since arterial stiffness is increased at a given age in response to a higher blood pressure. However, other diseases associated with chronic low-grade inflammation are associated with elevated arterial stiffness despite normal blood pressure. Current epidemiological studies show that a high percentage of young subjects have abnormally high PWV, thus present with EVA. (4) International guidelines for routine clinical practice have included the measurement of regional stiffness for stratifying cardiovascular risk and determining primary or secondary prevention. (5) Novel apparatus have been developed for measuring arterial stiffness at the regional or local level. Regional stiffness is most often determined through pulse wave velocity between two arterial sites. Methods using a single-site cuff-based pulse wave velocity measurement are promising. Local determination of arterial stiffness, obtained either with the well-established high-resolution echotracking systems or more recently with magnetic resonance imaging, is rather indicated for pathophysiological and pharmacological studies.

I-02
Endothelial Dysfunction and Hypertension in Aging
Yukihiro Higashi a,b
a Department of Cardiovascular Regeneration and Medicine, Research Institute for Radiation Biology and Medicine (RIRBM), Hiroshima University, b Division of Regeneration and Medicine, Hiroshima University Hospital, Hiroshima University, Hiroshima, Japan

Reduced nitric oxide (NO) bioavailability and reduced number and function of endothelial progenitor cells (EPCs) by reactive oxygen species (ROS) and endothelial cell senescence may contribute to endothelial dysfunction in aging. In hypertension also, similar mechanisms may work in the process of endothelial dysfunction. Aging, aging-associated hypertension, and hypertension per se, either independently or collectively, impair endothelial function, leading to atherosclerosis, resulting in cardiovascular and cerebrovascular outcomes. Improvement or augmentation of endothelial function will prevent the development of atherosclerosis and reduce cardiovascular events. Intervention to reduce oxidative stress should be an effective strategy for treatment of atherosclerosis, including aging and hypertension, through, at least in part, improvement in endothelial function and endothelial cell senescence. In this session, I focus on recent findings and interactions between endothelial function, oxidative stress, and hypertension in aging.
Recent Guidelines Related to Arterial Stiffness and Pulsatile Hemodynamics in the US

Julio A. Chirinos
Associate Professor of Medicine, University of Pennsylvania, USA

We will discuss recent guidelines by the American Heart Association regarding the nomenclature, methods, utility, and limitations in the application of arterial stiffness to cardiovascular risk assessment. We will also mention some aspects of recent guidelines/position documents by the American Society of Hypertension and the American Society of Echocardiography. We will discuss the value of carotid-femoral PWV and the various methods available for its measurement, including arterial tonometry, tonometry/cuff-based hybrid devices, ultrasound and magnetic resonance imaging. The guidelines do not support 'single-point' brachial cuff-based measures of pulse wave velocity. The role of confounders in the measurement of carotid-femoral pulse wave velocity, such as mean arterial pressure will also be discussed. We will also discuss the value of aortic pressure-flow relations to evaluate pulsatile hemodynamics. In particular, the AHA guidelines place more value on wave separation analysis as opposed to augmentation index to assess wave reflections. Other indices of left ventricular afterload (such as aortic characteristic impedance and total arterial compliance) are also informative, whereas effective arterial elastance, a commonly measured and reported parameter, is strongly discouraged. Future perspectives in arterial stiffness research will be discussed.

Clinical Application of Non-Invasive Assessment of Vascular Damage: Current Status and Future Perspectives

Charalambos Vlachopoulos
1st Department Cardiology, University of Athens Medical School, Greece

While risk scores are invaluable for adapted preventive strategies in clinical decision making, they are not flawless and their head-to-head comparison opens many questions. Moreover, a significant gap exists between predicted and actual event rates, leading to under- and over-prediction, thus raising the issue of calibration. Additional tools to further stratify the risk of patients at an individual level are biomarkers. A surrogate endpoint is a biomarker that is intended as a substitute for a clinical endpoint. In order to be considered as a surrogate endpoint of cardiovascular events, a biomarker should satisfy several criteria, such as proof of concept, prospective validation, incremental value, clinical utility, clinical outcomes, cost-effectiveness, ease of use, methodological consensus, and reference values.

We scrutinized the role of peripheral (i.e. not related to coronary circulation) noninvasive vascular biomarkers for primary and secondary cardiovascular disease prevention. Most of the biomarkers examined fit within the concept of early vascular aging. The addition of a vascular biomarker adds modestly, yet significantly beyond classical risk factors and may be useful in patients classified as having intermediate CV risk and in whom there is a therapeutic dilemma. On the basis of stringent criteria, vascular biomarkers can be classified in three groups:

- Biomarkers that fulfill most of the criteria and, therefore, are close to being considered a clinical surrogate endpoint are carotid ultrasonography, ankle-brachial index and carotid-femoral pulse wave velocity;
- Biomarkers that fulfill some, but not (yet) all of the criteria are brachial ankle pulse wave velocity and central haemodynamics/wave reflections;
- Biomarkers that do not at present fulfill essential criteria are flow-mediated dilatation and endothelial peripheral arterial tonometry.

Nevertheless, it is still unclear whether a specific vascular biomarker is overly superior. Indirect evidence can be deducted from large studies and meta-analyses, but a prospective study in which all vascular biomarkers are measured is still lacking. In selected cases, the combined assessment of more than one biomarker may be required. Instead of a ‘one size fits all’ approach, a tailored choice of the best vascular biomarkers for each patient, dictated by clinical setting and comorbidities may be preferable, although research is still needed to identify the ideal vascular biomarker for the various clinical conditions. Importantly, the promise of vascular biomarker-driven therapeutic decisions should be validated through randomized clinical trials data.

Reservoir-Wave Analysis for Measuring Vascular Aging

Hao-Min Cheng
Department of Medical Education, and Cardiovascular Research Center, Faculty of Medicine, Department of Public Health, National Yang-Ming University, Taipei, Taiwan

The arterial system functions as a conduit and a reservoir. The Windkessel and wave transmission theories have been used to model the complex interactions between the heart and the arterial system and both distinctively provide explanations on the changes in the arterial pressure waveform with aging and diseases. Carotid-femoral pulse wave velocity (PWV), a measure of arterial stiffness which closely relates to the Windkessel function, and parameters of pressure wave
reflections (such as the backward wave amplitude, \(P_b\)), modelled by the wave transmission theory, have been demonstrated to carry incremental prognostic value on top of traditional cardiovascular risk factors in various study populations. Furthermore, from cumulative exposure to cardiovascular risk factors, the resulting early vascular aging identified by an increased PWV could be an intermediate step and a harbinger of future cardiovascular events. Therefore, an increased PWV has been suggested as a relevant intervention target. These efforts highlight the importance of identifying the discernible morphological changes of pressure waves rather than considering only the systolic and diastolic blood pressures.

The reservoir function of vascular systems has also been successfully modelled by Wang et al as the volume related pressure change in arterial and venous vascular systems. The aorta stiffens with vascular aging process, which leads to a faster wave speed, more pronounced wave reflections and, probably more importantly, a reduced reservoir function. Parameters calculated based on the reservoir-wave concept, combining elements of wave transmission and Windkessel models of arterial pressure generation, were shown to predict clinical outcomes in hypertensive patients of two randomized control trials, ANBP2 and ASCOT-CAFÉ studies. Deterioration of the arterial reservoir function is expected to produce a larger reservoir pressure wave with accelerated reservoir filling rate (increased systolic rate constant) and faster reservoir emptying rate (increased diastolic rate constant). The buffering function of elastic arteries could be characterized by the reservoir-pressure wave theory, and excess pressure integral (XSPI), a parameter derived from the reservoir pressure-wave analysis, may represent the unrequired surplus work done by L.V. Although there have been vehement debates regarding the correctness of the reservoir-wave analysis, the famous statistician, Prof. George E.P. Box, once stated ‘Remember that all models are wrong; but some are useful’. Since all models are wrong the scientist cannot obtain a ‘correct’ one by excessive elaboration. Just as the ability to devise simple but evocative models is the signature of the great scientist, so overelaboration and over-parameterization is often the mark of mediocrity. We therefore, based on the perspective of pragmatism, examined the prognostic significance and clinical utility of the reservoir-wave model in many different patient populations, including general population, uremia, and stable heart failure. In this talk, the usefulness of the parameters obtained from the reservoir-wave analysis as a tool for measuring vascular aging will be presented and discussed.

### I-06

**Using Epidemiological Data to Assess Vascular Risk**

*Giovanni Veronesi*\(^{a,b}\)

\(^a\)Research Center in Epidemiology and Preventive Medicine, \(^b\)Department of Clinical and Experimental Medicine, University of Insubria, Varese, Italy

The contribution of epidemiological studies to the assessment of vascular risk first began with the identification of risk factors at a population level, and then moved to the estimation of the probability of developing the disease within a fixed time frame for a given individual. Such prognostic models are used for risk stratification and clinical decision purposes. As an exemplification, we will illustrate the use of epidemiological data to estimate the risk of first atherosclerotic cardiovascular event in middle-aged adults. Data come from several prospective population-based cohort studies of middle-aged individuals recruited in Italy on a wide time span covering from mid 1980s to early 2010s. The earliest cohorts have now been followed-up for more than 16 years as a median time. First, we will discuss the accuracy of prognostic models developed in a given population when used either in another one, or in specific subgroups such as people in different social classes. Second, we will introduce the concept of ‘improvement’ in risk prediction due to the inclusion of additional risk factors on top of established ones, with particular reference to the ‘intermediate risk’ category, a grey area in which clinical decision making is uncertain. Finally, we will discuss the role of epidemiological data in the shifting paradigm of primary prevention, i.e. from modelling disease risk to promoting and enhancing the ideal cardio-vascular health.

### I-07

**Assessment of Arterial Stiffness Using the Cardio-Ankle Vascular Index**

*Toru Miyoshi*

Okayama University, Japan

With the aging of society and the adoption of Westernized lifestyles, a substantial number of patients are developing atherosclerosis that can, in turn, lead to cardiovascular events. Previous studies aimed at predicting cardiovascular events have focused on identifying biomarkers: A simple and noninvasive indicator for monitoring vascular lesions would be a powerful tool for improving lifestyle. Among the biomarkers reported to date, arterial stiffness is associated with atherosclerotic risk factors and is regarded as a surrogate marker for the development of cardiovascular disease. Although measurement of pulse wave velocity is a widely accepted, noninvasive approach for the assessment of arterial stiffness, its accuracy is affected by changes in blood pressure. The
cardio-ankle vascular index (CAVI) is an index of the overall stiffness of the artery from the origin of the aorta to the ankle and is theoretically independent from blood pressure at the time of measurement. CAVI increases linearly with age and is elevated even in mild atherosclerotic disease. It can identify differences in the degree of lesions among patients with atherosclerotic disease. Emerging evidence showed that patients with higher CAVI values show a poor prognosis compared with those with lower CAVI values. Furthermore, CAVI can be lowered by controlling diabetes mellitus, hypertension and other risk factors. The primary aims of assessing arterial stiffness using CAVI are to assist in the early detection of arteriosclerosis, allowing timely treatment and lifestyle modification, and to quantitatively evaluate the progression of disease and the effectiveness of treatment. In this session, I will review clinical evidences of CAVI and discuss about the future of assessing arterial stiffness.

I-08
Decreased Muscle Mass, Osteoporosis and Coronary Artery Calcification
Eun-Jung Rhee
Endocrinology and Metabolism, Kangbuk Samsung Hospital, Sungkyunkwan University School of Medicine, Seoul, Republic of Korea

Our body is composed of multiple organs. Recent studies suggest that these organs are all connected and cross-talks between these organs exist. Abdominal obesity is known to be associated with osteoporosis with mechanism of selective differentiation between osteogenic and adipogenic stem cells depending on the status of mesenchymal stem cells. Recent works suggest the association of decreased muscle mass with abdominal obesity and also with bone fractures. In addition, metabolic bone disease is suggested to be related with vascular calcification through many factors that manages circulating calcium levels and bone health. Muscle mass, bone and vascular health is all related in some part. In this talk, I will tell you about the current knowledges on the relationships among these organs.

I-09
NAFLD: The Triangular Relationship with Type 2-Diabetes and Cardiovascular Disease
Christopher D. Byrnea,b
aHuman Development and Health Academic Unit, Faculty of Medicine, University of Southampton, Southampton, UK; bNational Institute for Health Research Southampton Biomedical Research Centre, University Hospital Southampton NHS Foundation Trust and University of Southampton, Southampton, UK

Non-alcoholic fatty liver disease (NAFLD) encompasses a spectrum of liver diseases from simple steatosis with hepatic lipid accumulation to end stage liver disease with decompensated cirrhosis, liver failure and hepatocellular carcinoma. Recent data from the USA showed that in 2013, NAFLD was the second most frequent indication for liver transplantation behind Hepatitis C. Since there are now effective treatments for Hepatitis C and there is currently no licensed treatment for NAFLD, it has been predicted that over the next 10–15 years, NAFLD will replace Hepatitis C as the most frequent indication for liver transplantation. Besides, increasing the risk of hepatocellular carcinoma and end stage liver disease, recently it has become clear that NAFLD also increases risk of extra-hepatic diseases such as type 2 diabetes (T2DM), cardiovascular (CVD), cardiac diseases and chronic kidney disease. Of each of these extra-hepatic diseases, the evidence to date suggests that NAFLD is a strong risk factor for T2DM. When NAFLD occurs in combination with obesity and insulin resistance (as it frequently does), there is a marked increase in risk of incident T2DM with possible synergism occurring between liver fat accumulation, insulin resistance and obesity, to further increase risk of development of T2DM. When T2DM develops, there is a further increase in risk of progression of liver disease to liver fibrosis and development of premature vascular disease. Thus, there is a reciprocal relationship between NAFLD as a risk factor for T2DM, and T2DM as a risk factor for liver disease progression and vascular disease. Recent evidence now points to the importance of NAFLD as an independent risk factor for cardiovascular disease, cardiac disease and premature vascular ageing. The presentation will describe and discuss the triangular relationship between NAFLD, type 2 diabetes and cardiovascular disease.

I-10
Renal Dysfunction Caused by Aortic Stiffening
Sadayoshi Ito
Department of Medicine, Tohoku University School of Medicine, Japan

Aortic stiffness predicts the progressive decline of the glomerular filtration rate (GFR). However, the underlying pathophysiological mechanism remains to be determined.
Recent evidence has shown a close link between aortic stiffness and the bidirectional (systolic forward and early diastolic reverse) flow characteristics. We tested whether the aortic stiffening-induced renal dysfunction is attributable to altered central flow dynamics.

In 222 patients with hypertension, Doppler velocity waveforms were recorded at the proximal descending aorta to calculate the reverse/forward flow ratio. Tonometric waveforms were recorded to measure the carotid-femoral (aortic) and carotid-radial (peripheral) pulse wave velocities, to estimate the aortic pressure from the radial waveforms, and to compute the aortic characteristic impedance. In addition, renal hemodynamics was evaluated by duplex ultrasound.

The estimated GFR was inversely correlated with the aortic pulse wave velocity, reverse/forward flow ratio, pulse pressure, and characteristic impedance, whereas it was not correlated with the peripheral pulse wave velocity or mean arterial pressure. The association between aortic pulse wave velocity and estimated GFR was independent of age, diabetes mellitus, hypercholesterolemia, and antihypertensive medication. However, further adjustment for the aortic reverse/forward flow ratio and pulse pressure substantially weakened this association. After the adjustment, the reverse/forward flow ratio emerged as the strongest determinant of estimated GFR (P = 0.001). A higher aortic reverse/forward flow ratio was also associated with lower intrarenal forward flow velocities.

An increase in aortic flow reversal (i.e., retrograde flow from the descending thoracic aorta toward the aortic arch), caused by aortic stiffening and impedance mismatch, reduces antegrade flow into the kidney and thereby deteriorates renal function.

Advancing age is a major risk factor for cardiovascular diseases and leads to changes in vascular structure and function. Generally, the representative markers of vascular aging are arterial stiffness, intima-media thickness, and vascular calcification. Healthy lifestyle is a critical component to protect from vascular aging and the age-related vascular dysfunction. Cardiorespiratory fitness (fitness) is a physiological biomarker of cardiorespiratory and muscular system integrity that is reflective of physical activity behavior that has a strong protective effect against cardiovascular mortality in young and older populations. Physiologically, levels of fitness, like vascular aging, gradually decline with advancing age, while advancing aging also leads to a deterioration of vascular structure and function. Thus, fitness is just as powerful as vascular aging in predicting cardiovascular disease, and declines of fitness with age can be considered a sign of vascular aging. Several studies suggested that higher fitness delays the development of large elastic artery stiffness, intima-media thickening and vascular calcification with advancing age. Therefore, improving or maintaining relatively higher fitness level based on the value of age-specific VO2peak may serve as an effective approach to prevent or attenuate the age-related vascular dysfunction.
I-13

Physical Activity and Arterial Health – Does Age Matter?

Arno Schmidt-Trucksäss
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The current overaging of many industrialized countries is a growing major challenge for many health care systems generating a need for more efficient and cost-effective interventions. Important aims are to keep older people out of the care system and let them live independently at home. At the same time the increased life expectancy intensifies the necessity for prevention of non-communicable diseases as early during the life span as possible. Before this background established arterial biomarkers like arterial stiffness and wave reflection might be suitable to reflect the life-time burden of risk factors, cardio-vascular and other chronic diseases before manifest disease or major health events. Their predictive power for future cardio-vascular events is independent of classical risk factors and has been demonstrated in several medium to large scale prospective cohort studies. An important pillar of prevention and treatment of early-onset cardiovascular disease with an association or effect on vascular biomarkers is physical activity. This ‘drug’ is cheap, easy to access and available nearly for everybody and everywhere. Positive and negative effects of physical activity or inactivity on the organism may be visualized by a change of vascular biomarkers. However, age is an important determinant of arterial stiffness and wave reflection. Age may overlay the effect of physical activity and exercise training on arterial structure and function which is known to differ remarkably between younger and elder individuals. Thus one important question is whether the effect of physical activity and exercise training on arterial properties is still visible in elderly people. Does it make sense to exercise at advanced age? The results from our lab and the analysis of our cohort data point out, that it is never too late to get up from the chair. The aim of the lecture is to give a comprehensive overview of a more personalized age-adapted prescription of exercise training and to show what type of exercise is clinically best suitable in relation to widespread age-associated co-morbidities like hypertension.

I-14

Inflammation and Immunity: Role in Vascular Disease

Ernesto L. Schiffrin
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Over the past few years it has become increasingly appreciated that an inflammatory response that comprises immune mechanisms underlies the development of vascular disease in many conditions. We have studied specifically the role of inflammation and immunity in hypertension, diabetes and chronic kidney disease, in both humans and rodents. In mice, oxidative stress may trigger inflammation in the vascular wall in response to different mediators such as angiotensin II, endothelin-1 or aldosterone, whereas peroxisome proliferator activator receptors, which are nuclear receptors with significant metabolic effects, have anti-inflammatory actions. How the immune mechanisms are triggered remains unclear, but macrophage/monocytes and T lymphocytes are involved mediating the inflammatory and immune response found in the wall of vessels, both large and small, in hypertension, diabetes and chronic kidney disease, and as essential components participating in the progression of atherosclerosis. Among lymphocytes we have shown that unconventional innate-like gamma/delta T lymphocytes may participate as a link between the innate (macrophage/monocyte) immune response and adoptive immunity. The balance between pro-inflammatory alpha/beta T helper lymphocytes (mostly Th1) that produce gamma interferon, and anti-inflammatory T regulatory lymphocytes (Treg) that produce interleukin 10, will determine the degree of inflammation in the vascular wall and perivascular fat. This low-grade inflammatory and immune response drives vascular disease. Whether specific vascular anti-inflammatory treatments will be effective in preventing progression or contribute to regress vascular disease associated with hypertension, diabetes, chronic kidney disease or atherosclerosis, improving outcomes without adverse side effects due to immune suppression remains to be demonstrated.

I-15

Moderate Dietary Salt Reduction in Populations

Francesco Cappuccio
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Current salt consumption in human societies is now much greater than needed for survival. Furthermore, high salt intake substantially increases blood pressure (BP) in both
animals and humans. Conversely, a reduction in salt intake causes a dose-dependent reduction in BP in men and women of all ages and ethnic groups, and in patients already on medication. The risk of strokes and heart attacks rises with increasing BP, but can be decreased by anti-hypertensive drugs. However, the majority of cardiovascular disease (CVD) events occur in the numerous individuals with ‘normal’ BP levels below the ‘clinically hypertensive’ level which might trigger drug therapy. Non-pharmacological prevention is therefore the only option to reduce the majority of such events. Reductions in population salt intake consistently reduce the number of subsequent CVD events (with additional benefits for the heart, kidneys, stomach and skeleton). Indeed, this is one of the most important public health measures for reducing the global CVD burden. The most successful policies involve comprehensive programmes which ideally include population monitoring, health education and reformulation to reduce the salt content concealed in processed foods (which represent over 75% of daily salt intake). Such population-wide salt reduction policies are generally powerful, rapid, equitable and cost saving. Inevitably, the food and beverage industries, which profit from marketing salt will try and oppose such policies in many different ways. However, public health has succeeded in countries that considered the necessary levers: regulation, legislation and, at times, taxation.

### I-16

**Direct versus Indirect Link between Sodium Intake and Vascular Disease**

Yuhei Kawano  
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The relationship between salt and hypertension is well established, and salt restriction is widely recommended in the management of hypertension. However, people living in northeast Asia have consumed large amount of salt, and the prevalence of hypertension and the incidence of stroke have been high in that area. Mechanisms of salt-induced hypertension may be complex, but volume expansion in the presence of impaired natriuretic capacity of the kidney and action on the central nervous system and neurohormonal pathways seem to be important. Salt is also involved in blood pressure (BP) elevation caused by other factors, such as weight gain, stress, catecholamines, angiotensin and aldosterone. The interaction between sodium and aldosterone appears to play a critical role in the development of organ damage. The depressor effect of salt restriction in hypertensive patients is well demonstrated although the response of BP varies widely among individuals. It is suggested that population-wide reduction in salt intake may have huge impact on the prevention of cardiovascular disease and on medical coat through decrease in BP. Recent studies have also shown that the association of salt consumption and cardiovascular diseases, such as stroke and heart failure, is independent of BP. The adverse interaction between salt and aldosterone is also BP-independent. Although salt restriction is important to control blood pressure and to prevent cardiovascular diseases, the effect and safety of aggressive salt restriction remain to be clarified. There are large limitations to accomplish and maintain a low-salt diet. Both population strategy and individualized approach should be incorporated to reduce salt consumption.

### I-17

**Carotid-Femoral Pulse Wave Velocity Is the Best Biomechanical Marker for Risk Prediction**

Gary F. Mitchell  
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Aortic stiffness increases markedly with advancing age and is associated with widening of pulse pressure, an increase in pulse wave velocity, earlier return of reflected waves to the proximal aorta and increased risk for target organ damage and adverse outcomes. Various measures of arterial stiffness and wave reflection have been proposed as potential surrogate measures of aortic stiffness. Carotid-femoral pulse wave velocity is a direct measure of aortic wall stiffness that is easily measured with modest requirements for special equipment and training and has been shown to predict events and reclassify cardiovascular disease risk in models that include standard cardiovascular disease risk factors. Therefore, carotid-femoral pulse wave velocity has emerged as the best biomechanical marker for risk prediction.

### I-18

**Genetic Basis of Blood Pressure and Hypertension**

Anna F. Dominiczak  
Regius Professor of Medicine, University of Glasgow, UK

Human primary or essential hypertension is a complex, polygenic trait with some 50% contribution from genes and environment. Richard Lifton and colleagues provided elegant dissection of several rare Mendelian forms of hypertension, exemplified by the glucocorticoid remediable aldosteronism and Liddle’s syndrome. These discoveries illustrate that a single gene mutation can explain the entire pathogenesis of severe, early onset hypertension as well as dictating the best treatment. The dissection of the much more common polygenic hypertension has proven much more difficult. Early studies used a single polymorphic marker such as the I/D polymorphism in the ACE gene and small numbers of cases
I-19
Atherogenic Vascular Stiffness and Hypertension: Cause or Effect?
Alberto Avolio

Department of Biomedical Sciences, Faculty of Medicine and Health Sciences, Macquarie University, Sydney, Australia

Blood vessels function as conduits for distribution of blood throughout the circulatory system. Large arteries, in addition to the essential conduit function, also serve to dampen the effect of pulsatile ventricular ejection that generates pulsatile pressure with each cardiac cycle; that is, they exhibit a 'cushion' function. The conduit function can be compromised by intimal effects that cause obstruction to flow, generally attributed to plaque formation due to intimal changes affected by atherosclerotic processes. The cushion function is affected by medial changes altering the wall stiffness, and so the capacity of arteries to absorb pulsatile energy. This modulates pulse pressure through changes in wall stiffness and vessel compliance and characteristics of wave propagation. In addition, these changes are further affected by arterial pressure. Intimal changes related to obstructive phenomena are generally thought to be related to atherosclerosis, and medial change affecting vessel buffering capacity related to arteriosclerosis. This lecture explores aspects that characterise the potential inter-relationship between the two phenomena and arterial pressure. With advances in molecular biology, imaging and computational modelling, pathways involved in cell-signalling affecting intimal changes through endothelial function and medial changes through both endothelial and smooth muscle function are increasingly being identified. The nitric oxide pathway has been shown to influence protein expression affecting the stiffness of the extracellular matrix through alteration of cross-link formation. In turn, bioavailability of endothelial nitric oxide is also affected by wall stiffness. Changes in distribution of internal wall stress due to altered structure of the wall matrix can alter the mechano-transduction effects on the endothelial cell, modifying intimal changes. The phenotypic transdifferentiation of the smooth muscle cell is associated with changes in structural integrity of medial elastin, leading to arterial calcification and altered arterial stiffness. The changes in smooth muscle function are also affected by anchoring properties of integrins, in turn modifying wall properties. Superimposed on the cell-signalling phenomena modulating intimal and medial function is the modification of wall properties due to distending pressure. The task of assessing whether the relationship between atherosclerosis and arteriosclerosis and hypertension constitutes a cause or effect presents a formidable challenge. However, emerging evidence suggests that investigating the inter-relationships may elucidate potential feedback signalling pathways that may be interrogated to possibly delay the ill effects of compromised vascular function and development of hypertension.

I-20
Small Vessel Disease and Hypertension – Molecular Mechanisms and Clinical Implications
Rhian M. Touyz

Institute of Cardiovascular and Medical Sciences, University of Glasgow, Glasgow, UK

Pathophysiological mechanisms contributing to hypertension include injury to small arteries, characterised by endothelial dysfunction, vascular remodeling, fibrosis and inflammation, (so called hypertensive vascular phenotype). These changes are initially adaptive but in the long term become maladaptive leading to vascular damage and loss of function, particularly important in small resistance arteries, critically involved in the regulation of peripheral vascular resistance and consequently in blood pressure control. Common to these processes are changes in vascular cells that make up vessels (endothelial cells, vascular smooth muscle cells, adventitial fibroblasts and adipocytes) to a pro-inflammatory, vasoconstrictory, proliferative, pro-fibrotic, pro-migratory phenotype, influenced in large part by oxidative stress (increased bioavailability of reactive oxygen species). Increased reactive oxygen species production, due to activation of NADPH oxidases (Nox), and decreased cellular antioxidant defense mechanisms contribute to oxidative stress, which influences redox-sensitive signaling molecules that impact on endothelial dysfunction and vascular remodeling and inflammation. Our recent studies also elucidate a novel mechanism whereby microparticles may play a role in vascular dysfunction. Clinical studies demonstrate that
improved endothelial function, regression of arterial remodeling and decreased vascular inflammation are associated with decreased cardiovascular events and reduced hypertension-related target organ damage. Accordingly strategies to promote vascular health should be a therapeutic priority. Such strategies include drugs (RAAS inhibitors, calcium channel blockers) and lifestyle modifications (exercise, healthy diet, smoking cessation), which reduce oxidative stress and dampen activation of injurious signaling pathways (pro-fibrotic, pro-inflammatory, proliferative pathways). Novel approaches, such as Nox inhibitors, agents that increase antioxidant capacity (e.g. Nrf-2 activators) and anti-inflammatory immune modulators, may have potential in promoting vascular health and reducing blood pressure. This presentation highlights some molecular and cellular mechanisms that underlie vascular injury in hypertension, and focuses on processes of oxidative stress and redox-sensitive pro-inflammatory and pro-fibrotic signaling pathways. By elucidating such mechanisms it is hoped that new disease-specific molecular targets will be identified for development of innovative therapies that would prevent or regress vascular injury and thereby improve management of hypertension and associated target organ damage.

Blood pressure fluctuates beat to beat, minute to minute, day and night, day by day and over longer periods. However, changes in blood pressure (BP) itself reflect body’s ability to adapt. These fluctuation or variability makes it difficult to diagnose and treat hypertension. And therefore, even though the clinic BP was the standard of BP for more than 100 years, there were many attempts to find other BP effects which influence on prognosis independent from clinical BP since there was the breakdown of white coat effect and masked effect in clinic BP. One of the efforts includes home BP which is popular in Asia, initially and more commonly used in Europe and North America. Since long ago, their importance in diagnosis and treatment of hypertension has been highlighted.

Another still-ongoing issue is BP variability. Morning and evening BP differ quite large. After the importance of morning hypertension (versus evening) has been emphasized by Japanese scholars, treatment approach targeting morning hypertension has been introduced. But still it is in controversy. And per-beat, per-minute, per-hour or per-day BP differ significantly. Some clinical studies found that the degree of BP variability influence more on prognosis of hypertension than mean BP. Short-term BP variability is monitored by using 24-hour BP monitoring devices and for longer-term BP variability more than 24 hours, it can be measured at clinic and home, such as day-by-day. Clinical studies show more impact of longer-term BP variability on cardiovascular morbidity and mortality. Recent development of internet and healthcare devices allow us to find more detailed BP behaviors that were not available and even imagined before. There are watch-like wearable devices for 24-hour BP measurement and one can monitor individual’s changes in BP from a distance. This patient self-care behaviors will contribute to better diagnosis and treatment of hypertension by changing patient’s life style and non-adherence behaviors. In this era that allow us to examine comprehensive and dynamic BP behaviors, we are expecting a revolution in diagnosis and treatment of BP and thus, our approach to the disease should also be shifted.
However, there are conflicting reports of apparent pressure amplification between the brachial, where the cuff pressure are taken, and the radial, where the tonometry is normally performed. This 'Popeye phenomenon' of supposedly high amplification of the pulse between brachial and radial sites non-invasively has not been seen with invasive studies. Tonometry is difficult to apply at brachial site and provides 'blunted' waveforms compared to radial waves. The physical principle of applanation tonometry cannot be satisfied in this site. Brachial artery is deep, covered by brachial tendon aponeurosis and is not supported by bone behind. Artfactually blunted brachial waveform leads to all pressure amplification in the upper limb appearing to be in the forearm. The method of central pressure derivation from brachial tonometry used by some institutions have reported no value in measuring central pressure clinically, contradictory to other main studies from various laboratories which reported significant relationship between central pressure to cardiovascular events.

FI-02  
A New Interpretation of Ankle-Brachial Index  
Akio Ishida  
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Ankle, brachial and central pressures are used as important predictor of future cardiovascular risk. Pressure measurement in the brachial artery is widely used for the diagnosis and treatment of hypertension. However, systolic pressure varies throughout the arterial tree, and recent studies suggest that brachial pressure is less related future cardiovascular events than is central pressure. Age-related increase is different between central and brachial pressure; i.e., central systolic pressure increases greater than brachial systolic pressure. The ankle-brachial index (ABI), which represents the ratio of systolic pressure at the ankle to that at the brachial artery, has been used for diagnostic test for lower extremity artery disease (LEAD) in both sexes and at all ages in numerous epidemiological studies. Previous studies have reported that the ABI decreased with age over 55 years, probably because of increased prevalence and progression of LEAD. However, we have recently reported that the ABI was lowest at <40 years, and increased with age until 60 years in screened Japanese subject cohort. In younger adults (<40 years), 8% of men and 18% of women had borderline low ABI (0.91–0.99). ABI was positively correlated with systolic blood pressure, pulse pressure, and brachial-ankle pulse wave velocity (baPWV), indices of arterial stiffness in subjects with ABI ≥1.0. LEAD is rare in younger adults especially in Japanese women. We therefore hypothesized that ABI increases with age (i.e., ankle systolic pressure increases greater than brachial systolic pressure) as a result of arterial stiffness and associates with target organ damages including heart, kidney and brain. Low ABI in older adults or high-risk people represents atherosclerotic stenosis of lower extremity artery. A high normal ABI (1.2≤ ABI <1.4) was associated with proteinuria in participants aged <60 years. By contrast, in participants aged ≤60 years, only low ABI (≤0.9) was associated with proteinuria. The prevalence of left ventricular hypertrophy (LVH), defined by the Minnesota code, was only significantly associated with high normal ABI after multivariate adjustment. We found that both high normal ABI and high baPWV were associated with the presence of cerebral microbleeds, defined as small hypointense lesions on T2*-weighted images. Moreover, the combination of high normal ABI and high baPWV strongly indicates the presence of CMB. These observations provide a new interpretation of ABI as an index for arterial stiffness and target organ damage in younger adults or low-risk people.

FI-03  
PAR-1 Is a Novel Mechanosensor for Blood Flow  
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Department of Pharmacology and Smart-Aging Convergence Research Center, Yeungnam University College of Medicine, Daegu, Republic of Korea

Atherosclerosis is readily observed in certain areas where disturbed blood flow (d-flow) is known to occur. A positive correlation between PKCζ activation and d-flow has been reported, but the exact role of d-flow-mediated PKCζ activation in atherosclerosis remains unclear. We found that PKCζ-mediated p53-sumoylation is key regulator in d-flow- and peroxynitrite (ONOO−)-induced EC apoptosis. En face confocal microscopy revealed increases in non-nuclear p53 expression and apoptosis in aortic EC located in d-flow areas compared with those present in steady laminar flow areas. We propose a novel mechanism for p53-sumoylation mediated by PKCζ-PIASy interaction during d-flow-mediated EC apoptosis, which contributes early events of atherosclerosis. In contrast to d-flow, laminar shear stress governs anti-atherogenic responses in endothelial cells. We found that ERK5-Nrf2 cascade regulates laminar flow-mediated cytoprotective responses both in vitro and in vivo. In addition to flow-mediated endothelial signaling pathway, we recently found that PAR-1 is a novel mechanosensor for laminar flow. The related evidence will be discussed in the presentation.
Advanced Glycation End Products and Arterial Stiffness
Qi-Fang Huang
Shanghai Institute of Hypertension, Shanghai Jiao Tong University School of Medicine, Shanghai, China

Accumulation of advanced glycation end products (AGEs) in the human body might engender arterial stiffening. We investigated the relationship of plasma AGE concentration with arterial stiffness, wave reflections and blood pressure amplification in a Chinese population.

The study subjects were recruited from a newly established residential area in the suburb of Shanghai in 2009. Using the SphygmoCor system, we measured carotid-femoral pulse wave velocity (cfPWV) and central (cAI) and peripheral augmentation indices (pAI). The central-to-brachial pressure amplification was expressed as the central-to-brachial systolic pressure difference (SPD), pulse pressure difference (PPD), and pulse pressure ratio (PPR). Plasma AGE concentration was measured by the ELISA method and logarithmically transformed for statistical analysis.

The 1051 study participants (mean age 55.1 ± 13.1 years) included 663 (63.1%) women, 390 (37.1%) hypertensive patients and 90 (8.6%) diabetic or prediabetic subjects. Plasma AGE concentration was higher in men than women (5.62 vs. 5.07 μg/mL, P = 0.02) and with older age (r = 0.13 in both sexes, P ≤ 0.01) and higher serum total-to-high density lipoprotein cholesterol ratio (r = 0.20 in men and r = 0.15 in women, P < 0.0001). In multiple regression analyses, plasma AGE concentration was significantly associated with cAI and pAI (1.9% and 4.0% increase per 10-time increase in plasma AGE concentration, respectively, P ≤ 0.02) but not with cfPWV (P = 0.62). However, there was significant (P = 0.001) interaction between plasma AGE concentration and age in relation to cfPWV. Only in subjects of 70 years or older, cfPWV increased with higher levels of plasma AGE concentration (bottom vs. top quintile distributions 8.10 vs. 8.90 m/s, P = 0.02). Multiple regression analyses also demonstrated that plasma AGE concentration was significantly associated with PPR (2.39% decrease per 10-time increase in plasma AGE concentration, P = 0.03) but not with SPD and PPD (P = 0.11 and 0.13, respectively). In subjects with at least one of the following cardiovascular risk factors, ie, overweight/obesity, hyperglycemia and current smoking (P = 0.03), but not those without (P = 0.55), PPR tend to decrease with higher plasma AGE concentration.

AGEs accumulate with aging and high cholesterol and are associated with arterial wave reflections, arterial stiffness in an age-dependent manner and pulse pressure amplification as assessed by PPR, especially in the presence of cardiovascular risk factors.
Oral Abstracts

O-01
The Correlation Study of Blood Pressure Trajectories and Brachial-Ankle Pulse Wave Velocity
Lu Song, Hualing Zhao, Chunhui Li, Yiming Wang, Shouhua Chen, Shouling Wu
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Objective: To examine whether the long-term blood pressure (BP) pattern can predict the future risk of arterial stiffness in a large prospective cohort.

Design and Method: This prospective cohort included 16,378 participants in the Kailun study. We used latent mixture modeling to identify systolic BP (SBP) and diastolic BP (DBP) trajectories in 2006, 2008 and 2010. We used multivariate logistic regression model to examine the association between SBP/DBP trajectory patterns and the future risk of arterial stiffness, which was assessed by brachial-ankle pulse wave velocity (baPWV) in 2010–2016. We adjusted for possible confounding factors, including baseline age, sex, heart rate, body mass index, and fasting serum concentration of glucose, total cholesterol, uric acid, triglycerides, high-sensitive C-reactive protein, smoking, alcohol drinking, physical activity, use of antihypertensives and baseline SBP/DBP.

Results: We identified 5 distinct SBP/DBP trajectory patterns in our cohort (low-stable (SBP/DBP), normal-stable (SBP/DBP), Hypertension I-stable (SBP/DBP), Hypertension II-stable (SBP)/Hypertension II-Hypertension I group (DBP)). We found that individuals with Hypertension II-stable SBP/Hypertension II-Hypertension I trajectory (DBP) patterns had the highest baPWV value and individuals with the low-stable SBP/DBP trajectory pattern had the lowest value (mean difference = 734.78 cm/s, 514.15 cm/s, P.

Conclusions: Long-term BP pattern is a strong predictor of arterial stiffness.

O-02
Impact of Triglycerides as Residual Risk for Cardiovascular Events on Endothelial Function: FMD-Japan Registry
Masato Kajikawa, Tatsuya Maruhashi, Nozomu Oda, Shinji Kishimoto, Shogo Matsu, Takayuki Hidaka, Yasuki Kihara, Kenseke Nomao, Ayumu Nakashima, Hirofumi Tomiyama, Bonpei Takase, Akira Yamashina, Yukihito Higashi

Objective: In contrast to low-density lipoprotein cholesterol, and high density lipoprotein cholesterol, the importance of triglycerides remains controversial. In this study, we evaluated the associations between triglycerides and endothelial function in the general population.

Design and Method: We enrolled 4,908 subjects who were enrolled in FMD-Japan registry. We investigated cross-
sectional associations between triglycerides and endothelial function by measurement of flow-mediated vasodilation (FMD).

**Results:** Subjects were divided into six groups on the basis of the triglycerides level. FMD was significantly decreased with an increase in the triglycerides level. After adjustment for cardiovascular risk factors, high triglycerides level groups independently remained associated with low quartile of FMD using the triglycerides ≤63 mg/dl group as the reference (Table).

**Conclusions:** These findings supported an independent association between triglycerides and cardiovascular disease.

### Table 1. Odds ratios and 95% confidence intervals for low quartile of FMD according to triglyceride (for Abstract O-02)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR (95% CI)</td>
<td>p value</td>
<td>OR (95% CI)</td>
<td>p value</td>
</tr>
<tr>
<td>Triglyceride, mg/dl</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>63≥</td>
<td>1 (reference)</td>
<td>1 (reference)</td>
<td>1 (reference)</td>
<td>1 (reference)</td>
</tr>
<tr>
<td>64–83</td>
<td>1.50 (1.18–1.91)</td>
<td>0.001</td>
<td>1.31 (1.03–1.69)</td>
<td>0.03</td>
</tr>
<tr>
<td>84–105</td>
<td>1.50 (1.18–1.91)</td>
<td>0.001</td>
<td>1.18 (0.92–1.52)</td>
<td>0.20</td>
</tr>
<tr>
<td>106–131</td>
<td>1.97 (1.56–2.50)</td>
<td>&lt;0.001</td>
<td>1.52 (1.19–1.95)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>132–179</td>
<td>1.86 (1.47–2.36)</td>
<td>&lt;0.001</td>
<td>1.42 (1.11–1.82)</td>
<td>&lt;0.005</td>
</tr>
<tr>
<td>180≤</td>
<td>2.19 (1.74–2.77)</td>
<td>&lt;0.001</td>
<td>1.70 (1.34–2.17)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

FMD = Flow-mediated vasodilation; ABI = ankle-brachial index; OR = odds ratio; CI = confidence interval.

Low quartile of FMD indicate less than 3.9%.

Model 1: unadjusted model.
Model 2: adjusted for age, gender.
Model 3: adjusted for age, gender, body mass index, systolic blood pressure, low-density lipoprotein cholesterol, glucose and current smoking.
Model 4: adjusted for age, gender, body mass index, systolic blood pressure, high-density lipoprotein cholesterol, glucose and current smoking.

**O-03**
**Combined Oral Contraceptive Induces Hypertension and Is Accompanied by Endothelial Dysfunction and Upregulated Intrarenal Angiotensin II Type 1 Receptor**

**Lawrence Olatunji** a, **Young-Mi Seok** b, **Adedoyin Igunnu** b, **Seol-Hee Kang** a, **In-Kyeom Kim** a

a Department of Physiology, College of Health Sciences, University of Ilorin, Nigeria; b Cardiovascular Research Institute, Kyungpook National University School of Medicine, Republic of Korea; c Department of Pharmacology, Kyungpook National University School of Medicine, Republic of Korea

**Objective:** Combined oral contraceptive (COC) use is associated with increased risk of developing hypertension. Activation of the intrarenal renin-angiotensin system (RAS) and endothelial dysfunction play an important role in the development of hypertension. We tested the hypothesis that COC causes hypertension that is associated with endothelial dysfunction and upregulation of intrarenal angiotensin-converting enzyme 1 (Ace1) and angiotensin II type 1 receptor (AT1R).

**Design and Method:** Female Sprague-Dawley rats aged 12 weeks received (p.o.) olive oil (control), a combination of 0.1 μg ethinylestradiol and 1.0 μg norgestrel (low COC) or 1.0 μg ethinylestradiol and 10.0 μg norgestrel (high COC) daily for 6 weeks. Blood pressure was recorded by tail cuff plethysmography. Expression of genes in kidney cortex was determined by quantitative real-time polymerase chain reaction.

**Results:** COC treatment led to increased blood pressure, circulating uric acid, C-reactive protein and plasminogen activator inhibitor-1, renal uric acid, expression of renal Ace1 and AT1R. COC treatment resulted in increased contractile responses to phenylephrine in endothelium-denuded aortic rings. Endothelium-dependent relaxation responses to acetylcholine, but not endothelium-independent relaxation responses to nitric oxide (NO) donation by sodium nitroprusside were attenuated in COC-exposed rings. Impaired relaxation responses to acetylcholine were masked by the presence of NO synthase inhibitor (L-NAME) in the COC-exposed rings, whereas the responses to acetylcholine in the presence of selective cyclooxygenase-2 inhibitor (NS-398) were enhanced.

**Conclusions:** These findings indicate that COC induces hypertension that is accompanied by endothelial dysfunction, upregulated intrarenal Ace1 and AT1R expression and elevated proinflammatory biomarkers.
O-04
Sarcopenia Is Independently Associated with Arterial Stiffness in Patients with Type 2 Diabetes Mellitus

Yuki Imaizumia, Kazuo Eguchib, Mitsuyoshi Yamamotoc, Ryuichiro Kaku, Kazuomi Kario

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Objective: We tested the hypothesis that sarcopenia, an age-related loss of skeletal muscle mass and function, is associated with arterial stiffness in patients with type 2 diabetes mellitus (DM).

Design and Method: We studied 150 hypertensives or possibly hypertensive patients in the Real BP study, an observational study of home BP telemonitoring system. As parameters of sarcopenia, we used circumference of the wrist, thigh (10 cm above the patella) and lower leg, grip strength, and 6 minute-walk distance. Brachial-ankle pulse wave velocity (baPWV) was used as a parameter of arterial stiffness.

Results: The mean age of the patients was 71.0 yrs, 42.0% were female, and 47.3% had DM. In all patients, circumference of the thigh (r = –0.27, p = 0.001), circumference of the lower leg (r = –0.29, p = 0.001), grip strength (r = –0.29, p = 0.001), and 6 minute-walkdistance (r = –0.25, p = 0.01) were negatively associated with baPWV. These associations did not remain significant after adjusting for covariates.

Table 1. Parameters of sarcopenia associated with baPWV (for Abstract O-04)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Non-DM β</th>
<th>p value</th>
<th>DM β</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circumference of the thigh</td>
<td>0.05</td>
<td>0.80</td>
<td>-0.61</td>
<td>0.04</td>
</tr>
<tr>
<td>Circumference of the lower leg</td>
<td>-0.08</td>
<td>0.68</td>
<td>-0.61</td>
<td>0.01</td>
</tr>
<tr>
<td>Grip strength</td>
<td>-0.09</td>
<td>0.63</td>
<td>-0.12</td>
<td>0.53</td>
</tr>
<tr>
<td>6 minute-walk distance</td>
<td>-0.13</td>
<td>0.26</td>
<td>-0.17</td>
<td>0.21</td>
</tr>
</tbody>
</table>

n = 150. Multiple regression analysis. We put each parameter of sarcopenia as an independent variable, and adjusted by age, sex, BMI, Clinic SBP, current smoking and presence of dyslipidemia.

Conclusions: The parameters of sarcopenia were independently associated with the measure of arterial stiffness. This association was stronger in patients with DM. Impaired glucose metabolism may play an important role as a mechanism behind sarcopenia and arterial stiffness.

O-05
Amyloid Precursor Protein Processing and Inflammatory Markers Are Modulated by Pulsatile Stretch of Human Cerebral Endothelial Cells

Alberto Avolioa, Sumudu Gangodaa, Bhargava Avadhana, Mark Butlina, Eun-Hwa Sohnb, Vivek Guptaa, Roger Chunga

aDepartment of Medicine and Health Sciences, Macquarie University, Australia; bDepartment of Herbal Medicine Resources, Kangwon National University, Republic of Korea

Objective: Amyloid β (Aβ), a hallmark of Alzheimer’s disease, is generated via enzymatic cleavage of amyloid precursor protein (APP). Increased APP expression is associated with elevated amyloid burden. Markers associated with vascular stiffness such as increased pulsatility, inflammation and endothelial dysfunction are associated with Alzheimer’s disease. This study investigated whether pulsatile stretch of human cerebral microvascular endothelial cells (hCMEC) alters expression of key proteins involved in amyloid deposition (APP), inflammation (intercellular cell adhesion molecule-1, ICAM-1) and endothelial dysfunction (endothelial nitric oxide synthase, eNOS).

Design and Method: hCMECs were subjected to 5%, 10% or 15% magnitude cyclic stretch for 18 hours at 1 Hz and were compared to the control (0% stretch) using RT-qPCR and/or western blots (n = 5–10). Secreted Aβ42 in the cell culture supernatants was measured by ELISA (n = 8–10) while LDH activity being measured using a commercial LDH assay kit (n = 7–9).

Results: APP mRNA was significantly higher than the static control (104 ± 17%) at 5% (211 ± 35%, P = 0.001), 10% (199 ± 19%, P = 0.01) and 15% (242 ± 17%, P = 0.0001) but with minimal change in eNOS mRNA. APP protein expression was significantly higher at 10% of cyclic stretch magnitude (161 ± 21%, P = 0.05) compared to both the static control (100%) and 5% cyclic stretch magnitude (108 ± 12%). Protein expression of eNOS was significantly higher at 15% stretch magnitude (362 ± 63%) relative to 0% (100%; P = 0.001), 5% (190 ± 49%, P = 0.05) and 10% (130 ± 18%, P = 0.01) cyclic stretch magnitude. In contrast, ICAM-1 protein expression at cyclic stretch magnitudes of 10% (124.8 ± 10%, P = 0.05) and 15% (128 ± 15%, P = 0.05) was significantly higher than at 5% cyclic stretch magnitude (87 ± 9%). Aβ42 levels in the supernatant had a positive linear relationship with increased
Stretch magnitude ($P = 0.01$). There was no relationship of LDH activity with cell stretch, with maximum cell death being 8% of the initial seeding density.

**Conclusions:** Increasing cyclic stretch of cerebral vascular ECs altered the expression of APP and the secretion of Aβ42. Findings mechanistically support the association of elevated vascular pulsatility and stiffness with Alzheimer's disease.

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**O-06**

**Longitudinal Changes in Aortic Reservoir Function Independently Predict Declining Renal Function among Heart Thy Individuals**

*Dean Picone, Rachel Climie, James Sharman*

Menzies Institute for Medical Research, University of Tasmania, Australia

**Objective:** Aortic reservoir function independently predicts end organ damage in cross-sectional analyses. However, longitudinal associations are more important regarding causation, but this has never been examined and was the goal of this study.

**Design and Method:** Aortic reservoir function (excess pressure integral $[\text{xsP}]$ and aortic reservoir pressure), aortic stiffness, brachial and central blood pressure (BP), and renal function (estimated glomerular filtration rate $[\text{eGFR}]$) were recorded among 33 healthy individuals (57 ± 9 years; 55% male) at baseline and after an average 3.0 ± 0.3 years.

**Results:** Over the follow-up period there was no significant change in brachial BP ($p = 0.05$), whereas there was a trend for $\text{xsP}$ ($p = 0.061$) and central BP ($p = 0.068$) to increase. On the other hand, aortic stiffness and blood glucose increased significantly ($p = 0.05$ each). The change over time in $\text{xsP}$ (but not aortic stiffness) was significantly related to the change in $\text{eGFR}$ ($\rho = -0.370$, $p = 0.044$) and this remained independent of age, 24 hour systolic BP and body mass index ($\beta = -0.031$, $p = 0.045$), but not blood glucose ($\beta = -0.031$, $p = 0.053$). There was no interaction between the change in glucose and change in $\text{xsP}$.

**Conclusions:** Aortic reservoir function, as determined by excess pressure, is independently associated with a decline in renal function among healthy people followed over 3 years. These novel findings indicate the need to determine the underlying physiological determinants of aortic reservoir function.

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**Moderated Poster Abstracts**

**MP-01**

**Association of Aterial Stiffness and Long-Term Cardiovascular Outcomes in High-Risk Thai Cohort (ASGARD)**

*Witsanu Tantivitayatan*, Teerapat Yingchoncharoen, Prin Vathesatogkit, Sukit Yamwong, Arintaya Phrommintikul, Piyanit Sriwatanaboon

Department of Internal Medicine, Ramathibodi Hospital, Mahidol University, Thailand; *Department of Cardiology, Internal Medicine, Chiang Mai Hospital, Chiang Mai University, Thailand

**Objective:** Cardio-ankle vascular index (CAVI) is a non-invasive measurement of the arterial stiffness. We sought to determine the correlation between CAVI and the clinical outcomes in patients with high cardiovascular risks or established cardiovascular disease.

**Design and Method:** Patients with more than three atherosclerotic risk factors or established cardiovascular disease from Cohort Of patients with high Risk for cardiovascular Events (CORE) study who had a complete follow-up data at 6 months after enrollment were studied. CAVI and conventional baseline characteristics were recorded at the baseline. Patients were follow-up for all cause mortality as identified by death certificate. Multivariable Cox regression analysis was performed to identify the associations with outcomes.

**Results:** A total of 5,737 patients were enrolled in our study (53.3% men; mean age, 65 ± 9.6 years). During the average time to follow-up of 367 ± 54 days, there were 42 deaths. Multivariable Cox regression analysis showed that all-cause mortality were predicted by CAVI 10 ($\text{HR}, 2.256 \ [95\% \text{ CI}, 1.2–4.5], P = 0.02$), independent of age ($\text{HR}, 1.04 \ [95\% \text{ CI}, 1.01–1.09], P = 0.008$), gender ($\text{HR}, 0.99 \ [95\% \text{ CI}, 0.5–1.9], P = 0.99$), high blood pressure as defined by SBP

<table>
<thead>
<tr>
<th>Hazard ratio (HR)</th>
<th>$p$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1.06 (1.02–1.09)</td>
</tr>
<tr>
<td>Sex</td>
<td>1.01 (0.55–1.86)</td>
</tr>
<tr>
<td>Current smoker</td>
<td>0.96 (0.23–3.9)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>1.88 (0.25–13.67)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>1.40 (0.73–2.71)</td>
</tr>
<tr>
<td>Old MI</td>
<td>1.47 (0.76–2.83)</td>
</tr>
<tr>
<td>Stroke</td>
<td>1.12 (0.3–3.6)</td>
</tr>
<tr>
<td>Dyslipidemia</td>
<td>3.70 (1.95–7.0)</td>
</tr>
<tr>
<td>CKD</td>
<td>4.89 (2.66–9.01)</td>
</tr>
<tr>
<td>CAVI &gt;10</td>
<td>3.255 (1.7–6.1)</td>
</tr>
</tbody>
</table>
140 mm Hg or DBP 90 mm Hg (HR, 1.03 [95% CI, 0.55–1.93], P = 0.95) and smoking (HR, 0.74 [95% CI, 0.18–3.17], P = 0.69).

Nested regression model showed incremental value of CAVI when added to the conventional risk factors (2 improved from 13.8 to 22.1, p = 0.025).

Conclusions: This is the largest cohort study determining association of CAVI and mortality in high-risk population. CAVI >10 is not only an independent risk factor for all-cause mortality, but also incremental to the conventional risk factors in high risk Thai population.

MP-02
A Comparative Study on Skin and Plasma Advanced Glycation End Products and Their Associations with Arterial Stiffness in Untreated Chinese
Changyuan Liu, Qifang Huang, Yan Li, Jiguang Wang
Department of Hypertension, Shanghai Institute of Hypertension, China

Objective: We compared skin and plasma measurements of advanced glycation end products (AGEs), with particular focus on their levels in the presence of hypertension or diabetes and prediabetes and their associations with arterial stiffness in outpatients with suspected or diagnosed hypertension.

Design and Method: Skin AGEs accumulation was measured as autofluorescence on the left forearm using the skin autofluorescence Reader and expressed in arbitrary units in the range from 0 to 25. Plasma AGEs concentration was measured by the enzyme-linked immunosorbent assay kits and logarithmically transformed for statistical analysis. Arterial stiffness was assessed by carotid-femoral pulse wave velocity (PWV) using the SphygmoCor system (Sydney, Australia).

Results: The 218 participants (96 [44.0%] men, mean age 51.9 years), had a mean skin and plasma AGEs of 1.89 arbitrary units and 4.47 μg/ml, respectively, and carotid-femoral PWV of 8.0 m/s. Skin autofluorescence was significantly correlated with plasma AGEs in diabetic or prediabetic patients (n = 31, r = 0.37, P = 0.04), but not in subjects with normoglycemia (n = 187, r = –0.05, P = 0.48). Nonetheless, both measurements were significantly (P ≤ 0.001) higher in men (2.00 arbitrary units and 6.73 μg/ml, respectively) than women (1.81 arbitrary units and 3.60 μg/ml, respectively) and in diabetic or prediabetic (2.03 arbitrary units and 6.61 μg/ml, respectively) than normoglycemia subjects (1.87 arbitrary units and 4.17 μg/ml, respectively), but not in hypertensive (n = 105) than normotensive subjects (n = 113, P = 0.35). In adjusted multiple regression analyses, plasma AGEs concentration was significantly associated with PWV in all subjects (β = 0.44 m/s for each 10–time increase; P = 0.04) and in subgroups of men, diabetes and prediabetes (β = 0.12 to 0.55 m/s for each 10–time increase; P ≤ 0.02).

Conclusions: In conclusion, although skin and plasma AGEs were similarly associated with gender and diabetes or prediabetes, they might measure something different and have different clinical relevance, such as for arterial stiffness.

MP-03
Association of the Cardio-Ankle Vascular Index with Gene Polymorphisms Attributed to Arterial Stiffness in Young Russians
Alexander Sorokin, Kazuhiko Kotani, Olga Bushueva
aDepartment of Internal Medicine, Kursk State Medical University, Russia; bDivision of Community and Family Medicine, Jichi Medical University, Japan; cDepartment of Biology, Medical Genetics and Ecology, Kursk State Medical University, Russia

Objective: The cardio-ankle vascular index (CAVI) is a well-estimated noninvasive approach used to assess arteriosclerosis in young subjects. This study aimed to investigate the association between the CAVI and some cardio-vascular related gene polymorphisms in young Russians.

Design and Method: Among 89 enrolled healthy subjects (mean age, 21.6 years) 26 specific gene polymorphisms have been determined.

Results: A higher CAVI level was detected in carriers with the KK-genotype of flavin-containing monoxygenase 3 (FMO3) than in those without (mean levels: 6.2 vs. 5.6, respec-
tively, p 0.05). Similarly, a higher CAVI level was seen in carriers with the CC-genotype of glutathione peroxidase 4 (GPX4) polymorphisms (6.0 vs. 5.5, respectively, p 0.05). Although subjects with the 6A/6A-genotype of matrix metalloproteinase 3 (MMP3) had lower levels of the CAVI than carriers of the 5A allele (5.5 vs. 5.9, respectively, p 0.05). AA-genotypes of γ-glutamyltransferase 1 (GGT1) polymorphisms showed lower levels of the CAVI as well compared to subjects with G allele (5.2 vs. 5.9, respectively, p 0.05). Of note, carriers with the LL-genotype of glutathione peroxidase 1 (GPX1) polymorphism had a higher diastolic blood pressure level than those without.

Conclusions: The observed changes in polymorphisms related to antioxidant and matrix metalloproteinase genes may be responsible for early arterial stiffening in the young Russian population. However, additional studies are warranted.

MP-04
Excess Pressure Integral Predicts All-Cause Mortality in Patients with End-Stage Renal Disease
Jui-Tzu Huanga, Hao-Ming Chengb, Shih-Hsien Sungc, Wen-Chung Yud, Chen-Huan Chenc

Objective: Excess pressure integral (XSPI) represents the surplus work performed by the left ventricle and is a novel predictor of cardiovascular events in the hypertensive patients in a prospective clinical trial. We investigated whether XSPI predicts long-term mortality in patients with end-stage renal disease (ESRD).

Design and Method: A total of 226 ESRD patients (48% female; mean age: 53 ± 15 years) who were receiving chronic hemodialysis were enrolled during 1998–2002. Calibrated central arterial pressure waveforms obtained with the carotid tonometry were analyzed according to the reservoir-pressure theory. XSPI was calculated by subtracting the reservoir pressure from the measured pressure waveform. With a median follow-up of 9.8 years, 81 fatal events (35.8%) incurred. The baseline covariates of the prognostic model were age, sex, body mass index, systolic blood pressure,

Table 1. Multivariable cox regression analyzes with standardized hazard ratio (for Abstract MP-04)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total mortality</th>
<th>Cardiovascular mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>standardized HR (95% CI)</td>
<td>p value</td>
</tr>
<tr>
<td>Reservoir parameters</td>
<td></td>
<td></td>
</tr>
<tr>
<td>XSPI</td>
<td>1.409 (1.112–1.783)</td>
<td>0.0044</td>
</tr>
<tr>
<td>Kd</td>
<td>1.222 (0.892–1.674)</td>
<td>0.2113</td>
</tr>
<tr>
<td>Amp P_res</td>
<td>1.226 (0.842–0.544)</td>
<td>0.288</td>
</tr>
<tr>
<td>Hemodynamic parameters</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PWV</td>
<td>1.125 (0.83–1.524)</td>
<td>0.4488</td>
</tr>
<tr>
<td>Zc</td>
<td>1.129 (0.876–1.456)</td>
<td>0.3491</td>
</tr>
<tr>
<td>cPP</td>
<td>1.661 (1.119–2.465)</td>
<td>0.0118</td>
</tr>
<tr>
<td>Pf</td>
<td>1.534 (1.148–2.052)</td>
<td>0.0039</td>
</tr>
<tr>
<td>Pb</td>
<td>1.642 (1.116–2.416)</td>
<td>0.0118</td>
</tr>
<tr>
<td>LVEF</td>
<td>0.685 (0.560–0.837)</td>
<td>0.0002</td>
</tr>
</tbody>
</table>

*Adjusted for age, sex, body mass index, brachial systolic blood pressure, diabetes, hypertension, cholesterol, hematocrit, albumin, and hemodialysis treatment adequacy.
diabetes, hypertension, cholesterol, hematocrit, albumin, and hemodialysis treatment adequacy. Cox regression analysis was performed to determine the independent prognostic value of XSPI. Incremental utility of XSPI was assessed by the net reclassification improvement (NRI).

**Results:** Baseline XSPI was significantly higher in patients with mortality and could significantly independently predict mortal events after accounting for the baseline covariates (hazard ratio, 1.409; 95% confidence interval, 1.112–1.783; P = 0.0044 for all-cause mortality). Addition of XSPI to the baseline prognostic model significantly improved the prediction of mortality (NRI = 0.110, P = 0.038).

**Conclusions:** In ESRD patients undergoing regular hemodialysis, XSPI is independently predictive of mortality and has an incremental value to conventional prognostic factors.

### Table 1. Pi in pairwise comparisons with other parameters (for Abstract MP-05)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total mortality HR (95% CI)</th>
<th>p value</th>
<th>Cardiovascular mortality HR (95% CI)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pi</td>
<td>2.820 (1.058–7.517)</td>
<td>0.038</td>
<td>2.387 (0.845–6.746)</td>
<td>0.1006</td>
</tr>
<tr>
<td>Pf</td>
<td>0.613 (0.235–1.599)</td>
<td>0.3174</td>
<td>0.750 (0.27–2.084)</td>
<td>0.5816</td>
</tr>
<tr>
<td>Pi</td>
<td>2.251 (1.18–4.297)</td>
<td>0.0138</td>
<td>2.421 (1.116–5.25)</td>
<td>0.0252</td>
</tr>
<tr>
<td>cPP</td>
<td>0.685 (0.289–1.624)</td>
<td>0.3905</td>
<td>0.642 (0.225–1.834)</td>
<td>0.4079</td>
</tr>
<tr>
<td>Pi</td>
<td>1.687 (1.237–2.3)</td>
<td>0.0011</td>
<td>1.731 (1.187–2.525)</td>
<td>0.0044</td>
</tr>
<tr>
<td>LVEF</td>
<td>0.696 (0.552–0.878)</td>
<td>0.0023</td>
<td>0.633 (0.475–0.843)</td>
<td>0.0018</td>
</tr>
</tbody>
</table>

*Adjusted for age, sex, body mass index, brachial systolic blood pressure, diabetes, hypertension, cholesterol, hematocrit, albumin, and hemodialysis treatment adequacy.
albumin, hemodialysis treatment adequacy. Survival analysis was performed by using cox regression analysis to determine the correlation between hemodynamic parameters and fatal events in uremic patients. The incremental utility of hemodynamic parameters was assessed by the net reclassification improvement indices (NRI).

Results: In multivariate Cox regression analysis Pí, LVEF, Pf, and Pb remained significant after adjusting for baseline covariates in predicting all-cause mortality of ESRD patients. In addition, Pí was associated with a significantly incremental clinical utility (NRI = 0.158; p = 0.004).

Conclusions: Of all parameters representing cardiovascular structures and functions, Pí is an independent predictor for predicting cardiovascular and all-cause mortality and could be used to provide a more accurate risk stratification of ESRD patients.

**MP-06**

The Comparing of Screening Value of baPWV and hs-crp to Atherosclerotic Cardiovascular Disease in Middle and Elderly Community Population

Liang Zheng, Qin Lan, Yuzhen Zhang, Zhongmin Liu, Huimin Fan

Research Center for Translational Medicine, Tongji University, Shanghai East Hospital, China

Objective: To estimate the prevalence of Atherosclerotic cardiovascular disease (ASCVD) in middle and elderly community population in Shanghai. To compare the screening value of baPWV and hs-crp to ASCVD and explore the risk factors to cause ASCVD.

Design and Method: Simple linear correlation was adopted to indicate the relationship between different variables; ROC curve analysis was used to compare the screening value between baPWV and hs-crp predicting ASCVD. Logistic regression was conducted to explore the risk factors of ASCVD.

Results: In present study, 1150 subjects were included in Lujiazui community, Shanghai, and 1065 individuals had completed data including of 295 men and 770 women. The mean age, BMI, SBP, BNP and baPWV were significantly higher in ASCVD group while TG was higher in non-ASCVD group (P = 0.05). As for the constituent ratio, there were differences on variables smoking and drinking between two groups (P = 0.05). On the other hand, the prevalence of ASCVD was 12.58% in target population. There are significant relationships between baPWV and age (r = 0.49, P = 0.05)/SBP (r = 0.56, P = 0.05)/WC (r = 0.15, P = 0.05), while there are no significant relationships between baPWV and hs-crp (r = 0.04, P = 0.05). ROC curve analysis was conducted to estimate the screening value of baPWV and hs-crp to ASCVD. The AUC and its 95% CI was 0.65 and 0.61–0.71 for the baPWV and 0.59 and 0.53–0.65 for hs-crp. Compared with hs-crp, the screening value of baPWV was more significant to discriminate the ASCVD. When adjusted variables were gender and baPWV, the logistic regression (in model 1) showed that higher baPWV over 1550 cm/s was a risk factor for ASCVD (OR: 1.53 and 95% CI: 1.04–2.27) comparing to lower baPWV under 1350 cm/s. In model 2, overweight and baPWV ≥1550 cm/s entered the final regression equation after adjusting gender, marital, overweight, drinking and baPWV.

Conclusions: The prevalence of ASCVD was 12.58% in middle and elderly community population in Shanghai, China. Compared with hs-crp, the screening value of baPWV was more significant to discriminate the ASCVD. Overweight and higher baPWV rank ≥1550 cm/s were risk factors to cause the ASCVD when adjusting gender, marital, BMI, drinking status and baPWV.

**MP-07**

Prevalence of Central Hypertension and Its Association with Target Organ Damage in Untreated Chinese Patients

Yi-Bang Cheng, Ting-Yan Xu, Yan Yang, Qian-Hui Guo, Jing-Jing Li, Dong-Yan Zhang, Ji-Guang Wang, Yan Li

Shanghai Institute of Hypertension, Shanghai Jiaotong University School of Medicine, China

Objective: Central blood pressure (BP) is suggested to be more closely related to target organ damage and cardiovascular events than brachial BP. Outcome-based thresholds for the diagnosis of central hypertension has been recently proposed. However, little is known about central hypertension. In an untreated patient cohort, we therefore investigated the prevalence of central hypertension and its association with target organ damage.

Design and Method: Consecutive untreated patients referred for ambulatory BP monitoring to the Hypertension Outpatient Clinic of the Ruijin Hospital, Shanghai, China were recruited. Office brachial and central BP were measured using the Omron 7051 (Omron, Japan) and Sphygmocor (AtCor, Australia) devices, respectively. Patients were cross-classified according to the presence of brachial and central hypertension defined as a brachial and central systolic BP of at least 140 mm Hg and 130 mm Hg, respectively. Measures of target organ damage, including left ventricular mass index by echocardiography (GE9), carotid-femoral pulse wave velocity (cfPWV) and urinary albumin-to-creatinine ratio (ACR), were determined.

Results: The 1928 participants (mean age, 51 years; women, 52%) included 1036 (54%) patients with brachial and central consistent normotension, 662 (34%) brachial and central combined hypertension, 74 (4%) isolated central hypertension, and 156 (8%) isolated brachial hypertension. Compared to patients with isolated brachial hypertension, patients with brachial and central combined hypertension...
had significant greater urinary ACR (0.96 vs. 0.68 mg/mmol, P = 0.001) and more patients with microalbuminuria (5% vs. 0.7%, P = 0.017), faster cfPWV (8.50 vs. 8.17 m/s, P = 0.003), but similar left ventricular mass index (85.7 vs. 86.6 g/m², P = 0.60) after multivariate adjustment. Patients with isolated central hypertension also had faster cfPWV (7.83 vs. 7.51 m/s, P = 0.03) than those with consistent normotension.

Conclusions: Central hypertension was prevalent (about 38%) in this untreated patient cohort, 90% combined with brachial hypertension. Patients with brachial and central combined hypertension were associated with worse target organ measures and might be a subtype that we shall pay attention to in our clinical practice.

**MP-08**

**Association of Isolated Morning Hypertension with Arterial Stiffness and Microalbuminuria in Untreated Chinese Patients**

Qian-hui Guo, Yi-Bang Cheng, Dong-Yan Zhang, Qi-Fang Huang, Chang-Sheng Sheng, Ji-Guang Wang, Yan Li
Shanghai Institute of Hypertension, China

**Objective:** Morning hypertension was suggested to be closely associated with target organ damage and cardiovascular events. However, the independent contribution of morning hypertension to cardiovascular damage remains controversial. The purpose of our study was to investigate the association of isolated morning hypertension with measures of arterial stiffness and microalbuminuria in an untreated outpatient cohort.

**Design and Method:** We recruited consecutive outpatients who was suspected of having hypertension but not taking antihypertensive drugs for at least 2 weeks and referred to our hypertension clinic from November 2010 to June 2015. Home BP was self-measured with the Omron 7051 monitors for 7 days. Hypertension was defined as a mean home BP of at least 135/85 mm Hg either in the morning or in the evening. We assessed carotid-femoral pulse wave velocity (cfPWV) and central augmentation index (cAIx) with the SphygmoCor system as measures of arterial stiffness, and the morning urinary albumin/creatinine ratio (ACR) as measures of microalbuminuria.

**Results:** In the 1537 untreated outpatients (mean age, 51.0 years; women, 51.9%), 200 (13.0%) had isolated morning hypertension. Patients with isolated morning hypertension compared to normotensive subjects had faster cfPWV (8.1 vs. 7.5 cm/s, P = 0.001), increased urinary ACR (0.76 vs. 0.65 mg/mmol, P = 0.049), but similar cAIx (26.7 vs. 25.3%, P = 0.14). After adjustment for age, sex, body height and weight, heart rate, current smoking and alcohol intake, serum total cholesterol and fasting glucose, and evening systolic BP, the between-group difference in cfPWV (8.1 vs. 7.8 cm/s, P = 0.003) and cAIx (26.2 vs. 24.5%, P = 0.005) were statistically significant. In continuous analysis with aforementioned multivariate adjustment, home morning systolic BP was significantly (P = 0.007) associated with cfPWV and cAIx in men and cfPWV and urinary ACR in women.

**Conclusions:** Isolated morning hypertension is associated with arterial stiffness and increased wave reflections in untreated Chinese patients. Home morning BP was independently associated with arterial damage.

**MP-09**

**Can Contour of the Arterial Pressure Waveform Be Used to Assess Brain Death in Potential Organ Transplant Donors?**

Su San Lim, Audrey Adji, Mohsen Agharazi, Michael O'Rourke

aDepartment of Cardiology, St. Vincent's Private Clinic, Australia, bCHU de Quebec, L’Hotel-Dieu de Quebec, Canada

**Objective:** Non-invasive measurement of pressure and flow waves in arteries supplying the brain may potentially give information on brain death and elevated IntraCranial Pressure (ICP). Changes in arterial pressure and flow waves, indicating high wave reflection at the cranium, have been observed in patients with elevated ICP (Kim et al., 2015. J Hypertension. 33, p1-9). Our study aims to supplement these observations in a cohort of brain dead cadaveric donors with presumed raised ICP. Findings of altered patterns may add to existing methods of ICP measurement, expediting the assessment of raised ICP and brain-death in potential donors to enhance timing of transplantation.

**Fig. 1.** (for Abstract MP-09).
**Design and Method:** 20 brain-dead transplant donors (M = 11, F = 9) were studied by measurement of radial artery pressure waves by applanation tonometry, with central aortic waves calculated using a validated generalized transfer function (SpyhgoCor). Aortic Augmentation Index (Alx) was calculated from pressure waveforms. Subjects aged 57 years (SD = 11) were brain-dead from different causes, predominantly stroke (n = 11) and cerebral trauma (n = 4). Minimal co-morbidities made them potential transplant donors. Comparisons were made with a normal cohort using published data (Wojciechowska et al: Hypertension Research. 2006;29:475–483).

**Results:** Aortic Alx was positive in all donors and in the upper range of normal, despite minimal co-morbidities. Average Alx were 23% in males (SD = 13), compared to 18% normals and 27% in females (SD = 7), compared to 28% normals. Figure shows the ensemble-averaged aortic, radial and carotid pressure waveforms of donors, with relatively prominent aortic augmentation.

**Conclusions:** Results are consistent with increased wave reflection from the cranium, associated with cerebral pathology and increased ICP. Extension of this work will require a larger sample size, measurement of carotid flow velocity and invasively measured ICP, with flow wave derivation from cerebral impedance of patients with known raised ICP.

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**MP-10**

**Combination of Office BP and Central BP Is Useful in Predicting CV Events in Patients with Type 2 Diabetes? The J-HOP Study?**

Kazuo Eguchi, Yuki Imaizumi, Satoshi Hoshide, Kazuomi Kario

Department of Cardiology, Jichi Medical University, Japan

**Objective:** It is not established whether or not central BP is useful in predicting cardiovascular (CV) events in clinical practice especially in patients with type 2 diabetes mellitus (DM). We sought to clarify the hypothesis that central BP, evaluated by applanation tonometry, is useful in predicting future CV events in subjects with type 2 DM.

**Design and Method:** We analyzed 1,714 subjects who have at least one CV risk factor, and performed applanation tonometry for all subjects in the J-HOP study. Subjects were stratified by the presence of DM, and the cutoff values of office and central BP were set as 140/90 mm Hg and 130 mm Hg in each group, and 4 categories (Group 1, high clinic and central BP; Group 2, high clinic BP; Group 3, high central BP; Group 4, both low) were tested. Multivariable Cox regression analyses were performed adjusting for age, sex, BMI, history of CV disease, renal dysfunction, and atrial fibrillation were used for combined CV outcomes consisting of cardiovascular and sudden deaths, stroke, MI, heart failure, and DA.

**Results:** There were 432 subjects with type 2 DM, and 1232 subjects without T2DM. In the overall subjects, office BP was associated with outcomes in the DM group (P = 0.012), but not in the non-DM group. On the other hand, central BP was not associated with the outcomes in both groups. When the analyses were performed by 4 categories, Group 1 was associated with increased risk of CV events in the DM group (HR = 2.44, 95% CI 1.04–5.74, P = 0.041), but not in the non-DM group. In the non-DM group, Group 2 and 3 were not the risk of increased outcomes in the DM and non-DM groups.

**Conclusions:** In a large cohort sample of DM, higher office BP combined with higher central BP was a risk of CV events, but either alone was not the risk. Contrary, the trend was not seen in the non-DM group. Central BP in addition to office BP is recommended in patients with type 2 DM.

**Table 1. (for Abstract MP-10)**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Hazard ratio (95% CI)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-DM Group 1 vs. Group 4</td>
<td>1.31 (0.63–2.74)</td>
<td>0.473</td>
</tr>
<tr>
<td>Group 2 vs. Group 4</td>
<td>0.78 (0.31–1.95)</td>
<td>0.587</td>
</tr>
<tr>
<td>Group 3 vs. Group 4</td>
<td>1.94 (0.69–5.44)</td>
<td>0.208</td>
</tr>
<tr>
<td>DM Group 1 vs. Group 4</td>
<td>2.44 (1.04–5.74)</td>
<td>0.041</td>
</tr>
<tr>
<td>Group 2 vs. Group 4</td>
<td>1.57 (0.61–4.05)</td>
<td>0.348</td>
</tr>
<tr>
<td>Group 3 vs. Group 4</td>
<td>0.93 (0.20–4.49)</td>
<td>0.932</td>
</tr>
</tbody>
</table>

Group 1: high clinic and central BP; Group 2: high clinic BP; Group 3: high central BP; Group 4: both low age, sex, BMI, history of CV disease, renal dysfunction, and atrial fibrillation.
Thermo-Sensitive Hypertension: A Novel Phenotype of High Risk Hypertension

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Objective: Temperature is a well-known factor associated with blood pressure (BP) variation. We aimed this study to elucidate the characteristics of patients who show enhanced BP change by the change of in-door temperature.

Design and Method: This is an observational study which investigates the relationship between home BP and temperature using telemonitoring system (HEM-7252G). Home systolic BP (SBP) and accompanying in-door temperature are evaluated in the morning (just after waking up) and at night (before going to bed) for seven consecutive days, three times per each occasion. The BP values are defined as the mean of those three BP measurements. Brachial-ankle pulse wave velocity (baPWV) and maximum intima-media thickness (max-IMT) of carotid artery are also evaluated at the time of the study entry.

Results: We studied 150 hypertensives/possibly hypertensives; mean age was 71 yrs; 42% of them were female. The temperature was negatively associated with home SBP (r = –0.17, p = 0.001) even after adjusting for covariates (β = –0.14, p = 0.001). Then we divided the subjects by the age 65 yrs, presence of hypertension, baPWV (first quartile/second to fourth quartiles) and max-IMT (first quartile/second to fourth quartiles), and the temperature was negatively associated with home SBP only in the group with older (r = –0.21, p = 0.001), hypertensive (r = –0.18, p = 0.001), higher baPWV (r = –0.20, p = 0.001) and higher max-IMT (r = –0.18, p = 0.001), and the results were unchanged even after adjusting for covariates (Table). When the subjects are divided by sex and the presence of DM, the temperature was significantly associated with home SBP in both groups.

Conclusions: In-door temperature was significantly associated with home SBP, and this association was only seen in the older, hypertensive subjects, and those with high baPWV and max-IMT. Thus, they can be called ‘thermo-sensitive hypertension’. Control of in-door temperature would be an important therapeutic strategy in these patients.

Cardio-Ankle Vascular Index Is Independently Associated Increased Carotid Intima-Medial Thickness and Left Ventricular Dysfunction in Hospitalised Australian Adults with High Cardio-Metabolic Risks

Yih-Kai Chan, Melinda Carrington, Chiew Wong, Simon Stewart

aMary MacKillop Institute for Health Research, Australian Catholic University, Australia; bDepartment of Cardiology Unit, Western Health, Australia

Objective: The cardio-ankle vascular index (CAVI) has been broadly studied in Asian populations to assess arterial stiffness and estimate atherosclerotic risk, but its application in Australian cardiac inpatients at risk of developing de novo chronic heart failure is unknown.

Design and Method: A total of 242 hospitalized cardiac patients (78% men, 68 ± 10 years) with high levels of antecedent cardiovascular disease (CVD) risk and hidden cardiac dysfunction were assessed. CAVI and comprehensive echocardiography measurements were performed concurrently. More than 72% of the subjects had coronary artery disease and/or metabolic syndrome, 23% had diabetes, 11% had cerebrovascular disease and approximately 6% had atrial fibrillation or intermittent claudication. Sub-optimal body mass index (75%), blood pressure (71%) and lipid levels (49%) were also common.

Results: Mean CAVI was 9.0 ± 1.5 (9.1 ± 1.4 in men versus 8.5 ± 1.5 in women, p = 0.015) and mean carotid intima-medial thickness (CIMT) was 0.72 ± 0.15 mm (0.73 ± 0.16 mm in men versus 0.69 ± 0.14 mm in women, p = 0.093). Approximately 23% of subjects had left ventricular (LV) diastolic dysfunction and 12% had largely undiagnosed peripheral arterial disease. CAVI positively correlated with increasing age (r = 0.524, p = 0.001), CIMT (r = 0.194, p = 0.003), E / E’ ratio (r = 0.184, p =

Table 1. The association between in-door temperature and home SBP (for Abstract MP-11)

<table>
<thead>
<tr>
<th>Age</th>
<th>Presence of HT</th>
<th>baPWV</th>
<th>max-IMT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>high</td>
<td>low</td>
</tr>
<tr>
<td>≥65 yrs</td>
<td>HT</td>
<td>-0.19**</td>
<td>-0.16**</td>
</tr>
<tr>
<td>&lt;65 yrs</td>
<td>NT</td>
<td>-0.02</td>
<td>-0.01</td>
</tr>
<tr>
<td>≥65 yrs</td>
<td>HT</td>
<td>-0.18**</td>
<td>-0.11*</td>
</tr>
<tr>
<td>&lt;65 yrs</td>
<td>NT</td>
<td>-0.16**</td>
<td>-0.02</td>
</tr>
</tbody>
</table>

Values show correlation coefficients adjusted by age, sex, body mass index, current smoking, presence of diabetes mellitus and dyslipidemia. * p < 0.05, ** p < 0.001. SBP = Systolic blood pressure; HT = hypertensives; NT = normotensives; PWV = pulse wave velocity; max-IMT = maximum intima-media thickness.
0.004), deceleration time (r = 0.135, p = 0.041) and inter-ventricular septal end diastole (r = 0.144, p = 0.027); and negatively correlated with end diastolic volume (r = -0.186, p = 0.004) stroke volume (r = -1.40, p = 0.027), left ventricular length (r = -0.177, p = 0.008) and E/A ratio (r = -0.129, p = 0.050). CAVI was also significantly associated LV diastolic dysfunction, hypertension and impaired renal and cognitive functions.

Conclusions: CAVI is significantly associated with carotid atherosclerosis and LV diastolic dysfunction independent of underlying CVD risk and pharmacotherapy used.

MP-13
Association between Urine Albumin to Creatinine Ratio Within Normal Range and Incident Hypertension in Men and Women
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Objective: There have been few studies on gender difference on the impact of urine albumin to creatinine ratio (UACR) within normal range on the risk of hypertension. We evaluated whether the association between UACR below the microalbuminuric range and the incident risk of hypertension is different in men and women.

Design and Method: A total of 1173 individuals (442 men and 731 women) aged 40 to 70 years without hypertension was examined at baseline (2005–2008) and followed (2008–2011). We defined UACR as the amount of albumin (mg/dl) divided by creatinine (g/dl) in randomly voided urine. The subjects were classified into the tertile value of the UACR.

Results: During an average of 2.6 years of follow-up, 57 men (12.9%) and 66 women (9.0%) developed hypertension. In multivariable-adjusted models, the odd ratio for new-onset hypertension comparing the highest with the lowest tertiles of UACR was 1.83 (95% CI 1.80–3.94) in men and 2.69 (95% CI 1.27–5.73) in women. In stratified analyses by menopausal status, the higher tertiles of UACR were associated with increased risk of incident hypertension in postmenopausal women.

Conclusions: Higher normal levels of UACR were associated with an increased risk of incident hypertension in women. UACR could have a clinical role in predicting the development of hypertension.

MP-14
Impact of Physical Activity and Inflammation on All-Cause, Cardiovascular-Related and Cancer-Related Mortality: A Cohort Study
Jong-Young Lee, Ki-Chul Sung
Division of Cardiology, Kangbuk Samsung Hospital, Republic of Korea

Objective: To investigate the association between physical activity (PA) and risk of mortality in a large middle-aged cohort stratified by inflammatory status.

Design and Method: A total of 336,560 subjects (mean age, 39.7 years; 58% male) who underwent comprehensive health screenings were enrolled in this prospective cohort study. They were grouped according to self-reported PA level using questionnaire as follows: no regular PA with a sedentary lifestyle; regular but insufficient PA (below the guidelines); sufficient PA; and health-enhancing PA. Inflammation was assessed via high-sensitivity C-reactive protein (hsCRP) level. Study endpoints were all-cause, cardiovascular-related, and cancer-related mortality.

Results: During the 1,976,882 person-years of follow-up (follow-up duration, median 6.17 years), 2,062 deaths occurred. Compared with a sedentary lifestyle, the hazard ratios (HRs) (95% confidence intervals [CI]) on the multi-variable Cox proportional hazards regression analyses for all-cause mortality by PA level were 0.95 (0.84–1.07), 0.85 (0.72–0.99), and 0.75 (0.60–0.93) (P for trend = 0.003), while those for cardiovascular-related and cancer-related mortality were 0.95 (0.70–1.28), 0.80 (0.52–1.23), and 0.55 (0.29–1.02) (P for trend = 0.05); and 0.82 (0.68–0.97), 0.83 (0.65–0.99), and 0.78 (0.57–0.98) (P for trend = 0.01), respectively. Compared with subjects with a low hsCRP (1 mg/l) and any regular PA, those with a high hsCRP (≥1.0 mg/l) and no regular PA showed a significantly higher risk of mortality.

Conclusions: Higher PA level was associated with a dose-dependent reduced risk of cardiovascular-related, cancer-related, and all-cause mortality, especially in those with high hsCRP levels.
Objective: Individual variability in aortic-to-peripheral systolic BP (SBP)-amplification may influence brachial cuff BP accuracy. However, this has never been determined and therefore we aimed to achieve this by characterising SBP-amplification phenotypes and examining associations with cuff BP accuracy.

Design and Method: Intra-arterial BP was measured at the ascending aorta, brachial and radial arteries in 77 patients (aged 61.5 ± 10.3 years; 68% male) following coronary angiography. SBP-amplification was defined by 5 mm Hg SBP increase between the aorta-to-brachial or brachial-to-radial arteries. Cuff BP was measured bilaterally by oscillometric devices before catheterisation, and then simultaneously with intra-arterial brachial BP.

Results: Aortic-to-brachial and brachial-to-radial SBP-amplification were on average 8.5 ± 9.5 mm Hg and 6.4 ± 9.4 mm Hg. Four distinct SBP-amplification phenotypes were observed: 1) both aortic-to-brachial and brachial-to-radial SBP-amplification (n = 24); 2) only aortic-to-brachial SBP-amplification (n = 24); 3) only brachial-to-radial SBP-amplification (n = 16); 4) no aortic-to-brachial or brachial-to-radial SBP-amplification (n = 13). Compared with the first three phenotypes, patients with no SBP-amplification had elevated aortic SBP (143.1 ± 23.0 mm Hg versus 122.4 ± 18.3; 126.0 ± 19.5 and; 134.8 ± 12 mm Hg) respectively; p = 0.0066). Brachial cuff BP significantly underestimated aortic SBP in the no SBP amplification phenotype (−11.7 ± 8.7 mm Hg, p = 0.004). There were no differences in clinical characteristics or cuff BP between phenotypes (p = 0.1 all).

Conclusions: These novel data describe distinctive aortic-to-peripheral SBP-amplification phenotypes. The presence of no SBP-amplification was associated with significantly increased aortic SBP that was not detected by conventional cuff BP and therefore, these patients may be at elevated cardiovascular risk.
**MP-17**

First Evidence of Pulsatile Pressure Interaction between the Macro-Vasculature and Micro-Vasculature: Proof-of-Concept by Association with Kidney Dysfunction among Patients with Type 2 Diabetes

Rachel Climie, Dean Picone, Sarah Blackwood, Ahmad Qasem, Stephen Rattigan, James Sharman

Menzies Institute for Medical Research, University of Tasmania, Australia; Department of Biomedical Engineering, University of New South Wales, Australia

**Objective:** It is widely thought that excess pulsatile pressure energy from increased stiffness of large central arteries (macro-vasculature) is transmitted to capillary networks (micro-vasculature) and causes end-organ damage (i.e. kidneys). However, this hypothesis has never been tested, and we sought to achieve this by examining people with increased macro-vascular stiffness (patients with type 2 diabetes; T2DM) compared with non-diabetic controls.

**Design and Method:** Among 13 T2DM (68 ± 6 years) and 15 controls (58 ± 11 years) macro-vascular function was measured by aortic stiffness and radial artery waveforms by tonometry. Forearm micro-vascular waveforms were simultaneously measured via laser Doppler flowmetry, with augmentation index (AIx) and augmented pressure (AP) derived on all waveforms. Kidney function was assessed by estimated glomerular filtration rate (eGFR).

**Results:** Aortic stiffness was higher among T2DM (9.3 ± 2.5 vs. 7.5 ± 1.4 m/s, p = 0.046). There was an obvious pulsatile micro-vascular waveform, with qualitative features similar to radial waveforms. Macro-vasculature AIx and AP were significantly related to micro-vasculature AIx (r = 0.428, p = 0.005 and r = 0.545, p = 0.004 respectively). Micro-vascular (but not macro-vascular) AIx was associated with eGFR in T2DM (r = −0.632, p = 0.037).

**Conclusions:** This is the first in-human evidence of pulsatile pressure interaction between the macro-vasculature and micro-vasculature, and provides potential explanation for accelerated kidney dysfunction.

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**MP-18**

Validation Testing for the Non-Invasive Measurement of Aortic Reservoir Characteristics from Brachial Cuff Oscil-Lomeric Pressure Waveforms

Xiaoqing Peng, Martin Schultz, Justin Davies, Dean Picone, Andrew Black, Nathan Dwyer, Phil Roberts-Thomson, James Sharman

Menzies Institute for Medical Research, University of Tasmania, Australia; International Centre for Circulatory Health, Imperial College, UK; Royal Hobart Hospital, Australia

**Objective:** Aortic reservoir characteristics (reservoir pressure (RP) and excess pressure (XSP)) derived non-invasively from radial tonometry independently predict cardiovascular events. However, whether RP and XSP can be derived non-invasively from brachial oscillometric cuff pressure waveforms has never been undertaken. This study sought to determine the validity and clinical relevance of measuring aortic reservoir characteristics from non-invasive oscillometric cuff waveforms.

**Design and Method:** 172 participants (aged 62 ± 11 years, 68% male) undergoing coronary angiography had the simultaneous measurement of ascending aortic pressure (via fluid-filled catheter) and oscillometric brachial cuff pressure (via SphygmoCor XCEL, AtCor Medical). RP and XSP derived non-invasively from cuff waveforms were compared with invasive measures. Clinical relevance was determined by associations of RP and XSP with estimated glomerular filtration rate (eGFR).

**Results:** There were small mean differences between non-invasive and invasive methods for both peak RP (33.9 ± 15.5 mm Hg versus 42.0 ± 16.4 mm Hg, mean difference –8.1 ± 1.1 mm Hg, p = 0.001) and peak XSP (23.5 ± 12.9 mm Hg versus 25.5 ± 10.7 mm Hg, mean difference –2.1 ± 0.8 mm Hg, p = 0.012), and there was good agreement for peak RP (ICC 0.633; 95% CI 0.436–0.747), but this was lower for peak XSP (ICC 0.348; 95% CI 0.212–0.462). Non-invasive peak XSP was significantly related to eGFR (r = –0.201, p = 0.05), independent from cuff blood pressure and BMI.

**Conclusions:** Reasonable reproduction of clinically relevant aortic reservoir characteristics can be derived non-invasively from oscillometric brachial pressure waveforms, thus providing a potential tool applicable to research and clinical use.
**MP-19**

**Optimal Protocol to Detect Hypertension Using Automated Unobserved Office Blood Pressure May Only Require 10-Minutes and Four Readings**

*Myles Moore*, Andrew Black, Nathan Dwyer, Ella Hoban, Mark Nelson, Dean Picone, Martin Schultz, Panagiota Veloudi, James Sharman

*Menzies Institute for Medical Research, University of Tasmania, Australia; Department of Cardiology, Royal Hobart Hospital, Australia*

**Objective:** A practical alternative to daytime ambulatory blood pressure (DaytimeABP) during one clinic visit is automated office blood pressure (AutoBP), involving unobserved repeated BP readings. However, the optimal AutoBP protocol to determine hypertension control in the least amount of time with the fewest BP readings is yet to be determined and was the aim of this study.

**Design and Method:** 117 patients (mean age 61.5 ± 12.5 years) referred to a specialist BP clinic underwent AutoBP in a quiet room alone. Eight BP measurements were taken at 2-minute intervals immediately after sitting. Smallest mean difference and highest intraclass correlation coefficient (ICC) defined the optimal AutoBP protocol with the highest concordance to DaytimeABP. Hypertension threshold for DaytimeABP and AutoBP was defined as ≥135/85 and ≥130/80 mm Hg, respectively. The same BP device (Mobil-o-graph, IEM) was used for both AutoBP and DaytimeABP.

**Results:** Average 15-minute AutoBP and DaytimeABP were 138.4 ± 18.1/84.8 ± 12.2 and 140.9 ± 15.2/86.2 ± 10.6 mm Hg, respectively. The average of four AutoBP measures taken between two and ten minutes had the highest concordance to DaytimeABP (systolic BP: mean difference: –1.7 mm Hg [95% Confidence Interval (95% CI): –4.3, 0.9], p = 0.2; ICC = 0.8; diastolic BP: mean difference: –1.0 mm Hg [95% CI: –2.6, 0.5], p = 0.2; ICC = 0.9). This protocol had high specificity for predicting hypertension (85%), but poor sensitivity (50%).

**Conclusions:** Only ten minutes and four AutoBP readings may be needed as a practical alternative to DaytimeABP for detection of hypertension.

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**MP-20**

**Variability in Mean Arterial Pressure and Diastolic Blood Pressure from Central to Peripheral Large Arteries: Relevance to Arterial Physiology and Estimated Central Blood Pressure**

*Martin Schultz, Dean Picone, Xiaqing Peng, Andrew Black, Nathan Dwyer, Philip Roberts-Thomson, James Sharman*

*Menzis Institute for Medical Research, University of Tasmania, Australia*

**Objective:** Mean arterial pressure (MAP) and diastolic blood pressure (DBP) are thought to consistently decline approximately 1–3 mm Hg from the aorta to peripheral large arteries, thus providing a small pressure gradient to aid blood flow. The magnitude of this gradient is important for correct waveform calibration and central BP estimation. However, there is little invasive data determining the variability in MAP and DBP from central to peripheral arteries, which was the goal of this study.

**Design and Method:** 52 patients (mean age 62 ± 11 years) undergoing cardiac angiography had intra-arterial BP measured via catheter in the ascending aorta, brachial and radial arteries by sequential pull-back. MAP was calculated by integration of ensemble averaged waveforms, and DBP from the foot of the waveforms.

**Results:** On average, MAP and DBP decreased from the aorta-to-brachial (MAP –1.5 ± 3.9 mm Hg; DBP –2.7 ± 4.1 mm Hg) and brachial-to-radial (MAP –2.0 ± 4.4 mm Hg; DBP –1.8 ± 3.3 mm Hg) arteries. However, changes in aortic-to-radial MAP (range –14.9 to 6.8 mm Hg) and DBP (range –13.1 to 2.1 mm Hg) were highly variable, including increases in MAP among 23% of patients. Importantly, the relationship between MAP and DBP changes were synergistic, with DBP decreasing if MAP increased and vice versa. The magnitude of aorta-to-radial MAP and DBP differences were significantly related to height and age.

**Conclusions:** Although MAP and DBP are reduced on average from central to peripheral large arteries, the magnitude of change is variable and related to patient characteristics. These new observations are highly relevant to understanding arterial hemodynamic (patho)physiology and accurate non-invasive estimates of central BP.
P-01
Modulation of Na+/K+ ATPase Activity of Rat Brain Synaptosome by Norepinepherine and Serotonin
Sukrat Sinha
Centre of Biotechnology, University of Allahabad, India

Objective: Sleep and wakefulness are behavioral and physiological activities. Sleep has been defined as a reversible behavioral state of perceptual disengagement from and unresponsiveness to the environment. It is modified form of the basic rest activity cycle.

Design and Method: We have studied the effect of Norepinephrine, Serotonin (5HT) individually, in combination and in presence of receptor antagonists Prazosin and Propranolol in different permutations and combinations.

Results: It was found that Norepinephrine increases Na+/K+ ATPase activity. It was also validated that NE induced increase is blocked by prazosin which is a α-1 adrenoceptor blocker antagonist but propranolol which is a β adrenoceptor blocker antagonist cannot block it. There is a marginal but significant increase in Na+/K+ ATPase activity. Propranolol seems to block 5HT mediated increase in Na+/K+ ATPase activity. When both NE and 5HT are given in combination an increase in ATPase activity has been found which is equal to the sum of the two given separately. Both Prazosin and Propranolol could decrease the basal values of the enzyme which could be due to some mechanism involving endogenous NE and 5HT present in the sample or by other mechanism leading to nonspecific binding and decrease of ATPase activity.

Conclusions: The results seem to assume significance in response to the REM and non REM stages of sleep. Many sleep disorders could be addressed by studying the significance of NE and 5HT with blockers.

P-02
Liver Enzymes, Body Mass Index, and the Risk of Diabetes
Bo Mi Songa, Il Suhb, Dae Jung Kimc, Song Vogue Ahnd, Kyoung Min Kim, Hyeon Chang Kim
aDepartment of Public Health, Yonsei University Graduate School, Republic of Korea; bDepartment of Preventive Medicine, Yonsei University College of Medicine, Republic of Korea; cDepartment of Endocrinology and Metabolism, Ajou University School of Medicine, Republic of Korea; dDepartment of Preventive Medicine, Yonsei University Wonju College of Medicine, Republic of Korea; eDepartment of Internal Medicine, Seoul National University Bundang Hospital, Republic of Korea

Objective: This study was performed to investigate whether the relationship between body mass index (BMI) and the incident diabetes is modified by ALT or AST levels.

Design and Method: This study used data from the Korean Genome Epidemiology Study which enrolled 10,615 participants aged 40 years or older from rural communities between 2005 and 2011. We carried out a prospective analysis of 6,484 participants (2,497 men and 3,987 women) who completed follow-up examinations until 2014. Serum ALT and AST were measured using the enzymatic methods. BMI was analyzed as both a continuous and categorized variable. Diabetes was defined as fasting blood glucose ≥126 mg/dl or current treatment. To examine the associations of BMI with the incident diabetes according to ALT or AST levels, multiple logistic regression models were used after stratification into the low and high groups based on the median ALT or AST levels.

Results: The median follow-up time was 4.5 years, during which 304 participants (4.7%) developed diabetes. In people with high ALT levels, compared with the first BMI quartile, the adjusted odds ratios (ORs) for incident diabetes of the second, third, and fourth BMI quartiles were 1.88 (95% CI, 0.98–3.62), 2.24 (1.21–4.13), and 3.32 (1.84–5.99), respectively (p-trend 0.001) after adjustment for potential confounders, while in people with low ALT levels, high BMI was not independently associated with the incident diabetes. Similarly, in people with high AST levels, the adjusted ORs for incident diabetes of the second, third, and fourth BMI quartiles, were 2.14 (1.13–4.08), 2.44 (1.32–4.53), and 3.65 (2.02–6.60), respectively (p-trend 0.001), while in people with low AST levels, categorized BMI was not significantly associated with the incident diabetes but the adjusted OR per 1 kg/m² increase in BMI was 1.10 (1.02–1.19).

Conclusions: These findings suggest that there was a strong association between BMI and incident diabetes among people with high liver enzyme levels, but the association was only modest among those with low liver enzyme levels.
Table 1. Odds ratio for incident diabetes according to baseline BMI after stratification into the two groups of liver enzymes (for Abstract P-02)

<table>
<thead>
<tr>
<th>BMI</th>
<th>Case/no. of participants (%)</th>
<th>OR* (95% CI)</th>
<th>Case/no. of participants (%)</th>
<th>OR* (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>low ALT &lt;20 U/l (n = 3,026)</td>
<td></td>
<td></td>
<td>high ALT ≥20 U/l (n = 3,458)</td>
<td></td>
</tr>
<tr>
<td>Q1 (&lt;22.4 kg/m²)</td>
<td>15/962 (1.6)</td>
<td>reference</td>
<td>16/660 (2.4)</td>
<td>reference</td>
</tr>
<tr>
<td>Q2 (22.4–&lt;24.2 kg/m²)</td>
<td>18/840 (2.1)</td>
<td>1.17 (0.54–2.53)</td>
<td>39/780 (5.0)</td>
<td>1.88 (0.98–3.62)</td>
</tr>
<tr>
<td>Q3 (24.2–&lt;26.4 kg/m²)</td>
<td>24/698 (3.4)</td>
<td>1.77 (0.84–3.72)</td>
<td>62/923 (6.7)</td>
<td>2.24 (1.21–4.13)</td>
</tr>
<tr>
<td>Q4 (≥26.4 kg/m²)</td>
<td>27/526 (5.1)</td>
<td>1.78 (0.84–3.78)</td>
<td>103/1,095 (9.4)</td>
<td>3.32 (1.84–5.99)</td>
</tr>
<tr>
<td>P-trend</td>
<td>0.079</td>
<td></td>
<td>Per 1 kg/m²</td>
<td></td>
</tr>
<tr>
<td>Per 1 kg/m²</td>
<td>1.08 (0.99–1.18)</td>
<td></td>
<td></td>
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<tr>
<td>P-interaction</td>
<td>0.829</td>
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</table>

<table>
<thead>
<tr>
<th>Low AST &lt;24 U/l (n = 3,148)</th>
<th>High AST ≥24 U/l (n = 3,336)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1 (&lt;22.4 kg/m²)</td>
<td>15/825 (1.8)</td>
</tr>
<tr>
<td>Q2 (22.4–&lt;24.2 kg/m²)</td>
<td>19/845 (2.3)</td>
</tr>
<tr>
<td>Q3 (24.2–&lt;26.4 kg/m²)</td>
<td>36/782 (4.6)</td>
</tr>
<tr>
<td>Q4 (≥26.4 kg/m²)</td>
<td>43/696 (6.2)</td>
</tr>
<tr>
<td>P-trend</td>
<td>0.032</td>
</tr>
<tr>
<td>Per 1 kg/m²</td>
<td>1.10 (1.02–1.19)</td>
</tr>
<tr>
<td>P-interaction</td>
<td>0.380</td>
</tr>
</tbody>
</table>

* Adjusted for age, sex, study year, residential area, hypertension, family history of diabetes, smoking status, alcohol intake, exercise, fasting glucose, and ALT or AST.

The low and high groups were classified based on the median.

Fig. 1. Odds ratio for incident diabetes according to baseline liver enzymes and BMI. a Adjusted odds ratio for incident diabetes according to baseline ALT level and BMI. b Adjusted odds ratio for incident diabetes according to baseline AST level and BMI. c Adjusted odds ratio for incident diabetes according to baseline ALT and AST level and BMI. Adjusted for age, sex, study year, residential area, hypertension family history of diabetes, smoking status, alcohol intake, exercise, and fasting glucose. * p < 0.05. † High ALT and low AST or low ALT and high AST (for Abstract P-02).
P-03
Comparison between Right and Left Upper Arms in Detection of Hypertension
Bo Mi Song\textsuperscript{a}, Jee-Seon Shim\textsuperscript{b}, Hyeon Chang Kim\textsuperscript{c}
\textsuperscript{a}Department of Public Health, Yonsei University Graduate School, Republic of Korea; \textsuperscript{b}Department of Cardiovascular and Metabolic Disease Etiology Res, Yonsei University College of Medicine, Republic of Korea; \textsuperscript{c}Department of Preventive Medicine, Yonsei University College of Medicine, Republic of Korea

Objective: This study aimed to investigate the right-left arm difference in detection of hypertension in the general Korean population.

Design and Method: This study analyzed data from the Cardiovascular and Metabolic Disease Etiology Research Center (CMERC) cohort which started in 2013. Study population for the current analysis was 1,435 people who were aged 30 to 64 years old, without history of major cardiovascular diseases, and did not use antihypertensive medication. Brachial blood pressures were measured for both arms using an automated oscillometric device equipped with two cuffs for simultaneous double-arm measurements. Systolic and diastolic blood pressure (SBP and DBP) were repeatedly measured after at least 5 minutes of rest in the seated position, and the average of the three measurements was used in the analysis. Overall hypertension was defined as elevated blood pressure (SBP/DBP ≥140/90 mm Hg) at either arm, while right-arm or left-arm hypertension was defined as elevated blood pressure at each arm. The sensitivity rate was calculated as the number of each-arm hypertension divided by the number of overall hypertension.

Results: Overall 7.9% of the population had hypertension at either arm, while 7.3% had right-arm hypertension and 6.2% had left-arm hypertension. The sensitivity for the detection of hypertension was 92.1% when blood pressure was measured only at right arm, and 78.1% when measured only at left arm. Corresponding sensitivity rates were 88.6% and 84.3% in men, and 97.7% and 68.2% in women.

Conclusions: Single-arm measurements, compared to double-arm measurements, may underestimate the prevalence of hypertension. However, if double-arm measurements are unavailable, right-arm is preferred for measurement of blood pressure, especially in women.

Table 1. Inter-arm blood pressure difference according to subgroups (for Abstract P-03)

<table>
<thead>
<tr>
<th>Subgroups</th>
<th>N</th>
<th>Right BP</th>
<th>Left BP</th>
<th>p value</th>
<th>BP (R-L)</th>
<th>ICC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>SBP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men and women</td>
<td>1,435</td>
<td>114.3±13.1</td>
<td>113.7±13.2</td>
<td>&lt;0.001</td>
<td>0.6±4.6</td>
<td>0.939</td>
</tr>
<tr>
<td>Men, total</td>
<td>504</td>
<td>119.9±12.1</td>
<td>119.6±12.7</td>
<td>0.221</td>
<td>0.3±5.3</td>
<td>0.907</td>
</tr>
<tr>
<td>Younger</td>
<td>297</td>
<td>118.9±10.8</td>
<td>118.7±11.2</td>
<td>0.417</td>
<td>0.3±5.7</td>
<td>0.865</td>
</tr>
<tr>
<td>Older</td>
<td>207</td>
<td>121.4±13.6</td>
<td>121.1±14.4</td>
<td>0.330</td>
<td>0.3±4.8</td>
<td>0.942</td>
</tr>
<tr>
<td>Low BMI</td>
<td>252</td>
<td>116.8±11.3</td>
<td>116.5±11.7</td>
<td>0.520</td>
<td>0.2±5.1</td>
<td>0.902</td>
</tr>
<tr>
<td>High BMI</td>
<td>252</td>
<td>123.1±12.0</td>
<td>122.8±12.9</td>
<td>0.286</td>
<td>0.4±5.6</td>
<td>0.899</td>
</tr>
<tr>
<td>Women, total</td>
<td>931</td>
<td>111.2±12.6</td>
<td>110.5±12.4</td>
<td>&lt;0.001</td>
<td>0.7±4.1</td>
<td>0.945</td>
</tr>
<tr>
<td>Younger</td>
<td>391</td>
<td>106.5±11.1</td>
<td>106.1±11.0</td>
<td>0.028</td>
<td>0.4±3.8</td>
<td>0.940</td>
</tr>
<tr>
<td>Older</td>
<td>540</td>
<td>114.7±12.5</td>
<td>113.7±12.3</td>
<td>&lt;0.001</td>
<td>1.0±4.4</td>
<td>0.939</td>
</tr>
<tr>
<td>Low BMI</td>
<td>466</td>
<td>107.9±12.4</td>
<td>107.3±12.4</td>
<td>0.000</td>
<td>0.7±3.8</td>
<td>0.953</td>
</tr>
<tr>
<td>High BMI</td>
<td>465</td>
<td>114.6±11.9</td>
<td>113.7±11.5</td>
<td>&lt;0.001</td>
<td>0.8±4.5</td>
<td>0.928</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DBP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men and women</td>
<td>1,435</td>
<td>73.2±9.7</td>
<td>72.5±9.3</td>
<td>&lt;0.001</td>
<td>0.6±2.9</td>
<td>0.955</td>
</tr>
<tr>
<td>Men, total</td>
<td>504</td>
<td>77.9±9.4</td>
<td>77.1±9.1</td>
<td>&lt;0.001</td>
<td>0.8±3.0</td>
<td>0.949</td>
</tr>
<tr>
<td>Younger</td>
<td>297</td>
<td>77.0±9.2</td>
<td>76.4±9.0</td>
<td>&lt;0.001</td>
<td>0.6±2.9</td>
<td>0.948</td>
</tr>
<tr>
<td>Older</td>
<td>207</td>
<td>79.2±9.5</td>
<td>78.1±9.3</td>
<td>&lt;0.001</td>
<td>1.1±3.0</td>
<td>0.950</td>
</tr>
<tr>
<td>Low BMI</td>
<td>252</td>
<td>76.5±9.1</td>
<td>75.8±8.9</td>
<td>&lt;0.001</td>
<td>0.7±2.8</td>
<td>0.950</td>
</tr>
<tr>
<td>High BMI</td>
<td>252</td>
<td>79.3±9.5</td>
<td>78.4±9.2</td>
<td>&lt;0.001</td>
<td>0.9±3.1</td>
<td>0.946</td>
</tr>
<tr>
<td>Women, total</td>
<td>931</td>
<td>70.6±8.8</td>
<td>70.0±8.5</td>
<td>&lt;0.001</td>
<td>0.6±2.8</td>
<td>0.948</td>
</tr>
<tr>
<td>Younger</td>
<td>391</td>
<td>68.2±8.7</td>
<td>67.9±8.3</td>
<td>0.033</td>
<td>0.3±2.7</td>
<td>0.950</td>
</tr>
<tr>
<td>Older</td>
<td>540</td>
<td>72.4±8.5</td>
<td>71.6±8.3</td>
<td>&lt;0.001</td>
<td>0.8±2.9</td>
<td>0.942</td>
</tr>
<tr>
<td>Low BMI</td>
<td>466</td>
<td>68.9±8.8</td>
<td>68.5±8.4</td>
<td>0.004</td>
<td>0.3±2.5</td>
<td>0.956</td>
</tr>
<tr>
<td>High BMI</td>
<td>465</td>
<td>72.4±8.5</td>
<td>71.6±8.3</td>
<td>&lt;0.001</td>
<td>0.8±3.0</td>
<td>0.936</td>
</tr>
</tbody>
</table>

Data are expressed as means ± SD.
P-value was derived from paired t-test. ICC = Intraclass correlation coefficient.
P-04

Non-Invasive Characterization of Cardiovascular Autonomic Dysfunction in Multiple Sclerosis
Edward Barin‡, Fatemeh Shirbani*b, Y.C. Lee*c, K. Parratt‡, Mark Butlinb, Alberto Aviolb
‡Department of Health Sciences, Macquarie University, Australia; *Macquarie University Health Sciences Centre, Macquarie University, Australia; ‡Department of Neurology, Royal North Shore Hospital, University of Sydney, Australia

Objective: Multiple Sclerosis (MS) is associated with damage of the autonomic nervous system. Reported cardiovascular autonomic dysfunction (CAD) prevalence in MS varies between studies. As CAD lowers quality of life and may contribute to sudden death in MS, early CAD detection may assist in treatment and in risk identification.

Design and Method: A comprehensive suite of cardiovascular autonomic tests was applied to 53 MS patients and results associated with clinical markers of MS severity. CAD was identified through analysis of continuous electrocardiogram and non-invasive continuous finger blood pressure recording during 5-minutes supine rest, short-term deep breathing, Valsalva manoeuvre, orthostatic challenge and isometric exercise. The latter four tests were used to calculate parasympathetic and sympathetic age-corrected scores.

Results: There was greater prevalence of sympathetic (58%) than parasympathetic (34%) impairment based on reflex tests. Total brain and spine lesions was correlated with dampened sympathetic response in Valsalva manoeuvre and orthostatic challenge (R² = 0.22, p = 0.010). Age-corrected score for sympathetic control showed deterioration with longer disease duration (p = 0.047) and treatment delay greater than 10 years (p = 0.007). Localization of lesions and disease severity scores showed no relation to autonomic variables.

Conclusions: Results indicate a high prevalence of CAD in MS that can be evaluated using non-invasive measures during cardiovascular challenges. Sympathetic markers may assist in diagnosing disease progression and are exacerbated with delay in treatment.
Prevalence of Pre-Hypertension in Children and Adolescents Using Simplified versus Complex Assessment Criteria

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Menzies Institute for Medical Research, University of Tasmania, Australia, Department of Monash Health, Monash Medical Centre, Melbourne, Medicine, School of Clinical Sciences, Australia

Objective: The identification of elevated blood pressure (BP) in children and adolescents relies on probabilistic criteria defined by age, sex and height percentiles, as recommended by guidelines. The use of height percentiles is regarded as complex and has been suggested to result in underdiagnosis of elevated BP. To address this, a simplified criteria has been proposed that uses age and sex (simplified 1) or only age (simplified 2) criteria to identify elevated BP. Although simplified criteria are increasingly being used in research, their clinical value remains to be determined. The extent to which these different criteria may affect the prevalence of elevated BP has never been assessed. This study aimed to determine the prevalence of elevated BP across different BP criteria (complex, simplified 1 and simplified 2) in a nationally representative population of young people.

Design and Method: Data were analysed from the 2011–2013 Australian Health Survey among 3,047 children and adolescents, aged 5–17 years old (mean age 12 [95% CI; 12,13] years, males 52%). Two consecutive BPs were recorded by oscillometry, with elevated BP defined according to the simplified assessment criteria, which was in the pre-hypertension stage only.

Results: The prevalence of pre-hypertension was 20% (23% with the half year criteria) using the complex criteria, but 27% and 29% using simplified 1 and simplified 2 criteria, respectively. Despite these discrepancies there were no clinically meaningful differences in the cardiovascular risk profile of subjects identified with pre-hypertension across the different criteria. However, there was a 7% to 8% difference in the prevalence of tall stature using the simplified criteria (table). The highest prevalence of tall stature (36%) was observed using simplified 2 criteria.

Conclusions: Using simplified criteria to identify elevated BP resulted in an increase in the prevalence of children and adolescents with pre-hypertension. The difference in tall stature between the different criteria suggests an overestimation of pre-hypertension with criteria which are not height-dependent.

Table 1. Clinical profile of children and adolescents identified with pre-hypertension according to complex and simplified blood pressure criteria (for Abstract P-05)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre-hypertension* (complex) n = 629</th>
<th>Pre-hypertension† (simplified 1) n = 854</th>
<th>Pre-hypertension‡ (simplified 2) n = 909</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Years)</td>
<td>13 (13, 14)</td>
<td>12 (12, 13)</td>
<td>13 (12, 13)</td>
</tr>
<tr>
<td>Male (%)</td>
<td>63 (58, 66)</td>
<td>60 (56, 64)</td>
<td>60 (55, 64)</td>
</tr>
<tr>
<td>Overweight (%)</td>
<td>42 (37, 48)</td>
<td>41 (37, 46)</td>
<td>42 (38, 46)</td>
</tr>
<tr>
<td>Short stature (%)</td>
<td>5 (2, 7)</td>
<td>3 (1, 5)</td>
<td>4 (1, 6)</td>
</tr>
<tr>
<td>Tall stature (%)</td>
<td>28 (23, 33)</td>
<td>35 (31, 40)</td>
<td>36 (32, 40)</td>
</tr>
<tr>
<td>Systolic blood pressure (mm Hg)</td>
<td>123 (122, 124)</td>
<td>120 (119, 121)</td>
<td>119 (118, 120)</td>
</tr>
<tr>
<td>Diastolic blood pressure</td>
<td>75 (74, 76)</td>
<td>74 (73, 74)</td>
<td>73 (72, 73)</td>
</tr>
<tr>
<td>Microalbuminuria (%)</td>
<td>14 (7, 21)</td>
<td>13 (7, 19)</td>
<td>12 (7, 18)</td>
</tr>
<tr>
<td>Creatinine</td>
<td>11.7 (10.2, 12.3)</td>
<td>11.4 (10.2, 12.7)</td>
<td>11.3 (10.2, 12.4)</td>
</tr>
<tr>
<td>Albumin</td>
<td>19.9 (11.2, 28.5)</td>
<td>18.6 (11.9, 25.2)</td>
<td>14.2 (9.8, 18.7)</td>
</tr>
<tr>
<td>Cholesterol (mmol/l)</td>
<td>4.1 (3.9, 4.3)</td>
<td>4.1 (3.9, 4.3)</td>
<td>4.1 (4.0, 4.3)</td>
</tr>
<tr>
<td>HDL (mmol/l)</td>
<td>1.2 (1.2, 1.3)</td>
<td>1.3 (1.2, 1.3)</td>
<td>1.2 (1.2, 1.3)</td>
</tr>
<tr>
<td>LDL (mmol/l)</td>
<td>2.4 (2.3, 2.3)</td>
<td>2.4 (2.3, 2.6)</td>
<td>2.4 (2.3, 2.6)</td>
</tr>
<tr>
<td>Triglycerides (mmol/l)</td>
<td>0.9 (0.8, 1.0)</td>
<td>0.9 (0.8, 1.0)</td>
<td>0.9 (0.8, 1.0)</td>
</tr>
<tr>
<td>Glucose (mmol/l)</td>
<td>4.8 (4.6, 5.0)</td>
<td>4.8 (4.6, 5.0)</td>
<td>4.8 (4.6, 5.0)</td>
</tr>
<tr>
<td>Glycated hemoglobin (mmol/mol)</td>
<td>34.0 (32.6, 35.3)</td>
<td>33.8 (32.7, 35.0)</td>
<td>33.8 (32.7, 34.8)</td>
</tr>
</tbody>
</table>

Data are presented as mean or % (95% CI) and are weighted to provide population estimates. * Based on BP criteria from the fourth report of the National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents (≥90th percentile; prehypertension stage or a ≥120/80 mm Hg). † Based on simplified 1 BP criteria. ‡ Based on simplified 2 BP criteria.
Abstracts: The Pulse of Asia 2016 Seoul

P-06
Association of Inflammatory Markers and Heart Rate Recovery Response among Exercise Treadmill Test Patients

Park Dong Hyun, Heo Jung Ho, Kim Bong Joon, You GaIn
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Objective: Heart rate recovery (HRR) is a simple non-invasive measurement analyzing the autonomic dysfunction, and independent predictor of cardiovascular mortality. Chronic inflammation may associate with autonomic dysfunction and several variables can represent these conditions. Neutrophil to lymphocyte ratio is a newly emerging marker of chronic inflammatory state. However, there is limited data between inflammatory markers and heart rate recovery response. The aim of this study was to evaluate relationship between inflammatory markers including neutrophil to lymphocyte ratio and heart rate recovery response to exercise test.

Design and Method: A total of 608 Healthy persons (mean age 53.59 ± 8.24, 152 female, 456 male) who underwent exercise treadmill test and serologic test were enrolled. Immediately following exercise bouts, heart rate recovery of 3 minutes after exercise was assessed in the supine position. Heart rate recovery was obtained by the gap of the maximum heart rate during exercise and heart rate of 3 minutes after completion of a treadmill exercise test. We examined neutrophil to lymphocyte ratio, platelet to lymphocyte ratio, ESR, uric acid, HS-CRP as chronic inflammation variables. We performed correlation analysis of these variables.

Results: HRR was negatively correlated with neutrophil to lymphocyte ratio (r = –0.83, p = 0.041), ESR (r = –0.96, p = 0.017), uric acid (r = –0.108, p = 0.008), HS-CRP (r = –0.116, p = 0.024), respectively. However, there was no significant association between platelet to lymphocyte ratio and heart rate recovery (r = 0.04, p = 0.328).

Conclusions: These finding showed us chronic inflammation is correlated with autonomic dysfunction.

P-07
Association between Cardiovascular Parameters of Pulse Wave Analysis and Qi Deficiency and Blood Stasis Syndromes

Xiaoqin Hu, Edward Barin, Mark Butlin, Alberto Avolio

aChinese Traditional Medicine, Guangxi University of Chinese Medicine, China; bDepartment of Medicine and Health Sciences, Macquarie University, Australia

Objective: Qi Deficiency (QD), Blood Stasis (BS) and Qi Deficiency and Blood Stasis (QDBS) syndromes are diagnosed in traditional Chinese medicine through palpaton of the pulse, observation of tongue and colour of the face, and patient feedback on questions regarding areas such as pain, lassitude, dysmenorrhea, numbness, roughness of skin and nails, and propensity to sweat. The syndromes are viewed as being related to cardiovascular factors; QD is believed to compromise the efficiency of the circulatory system and BS is believed to be associated with reduced perfusion. This pilot study investigated if these syndromes are associated with conventional cardiovascular parameters obtained from pulse wave analysis of brachial and aortic blood pressure.

Design and Method: From a cohort of 36 subjects (46 ± 18 years, 18 female), a qualified traditional Chinese Medicine doctor diagnosed 13 subjects with QD and 15 subjects with BS. Within these, 9 subjects had both QD and BS. Brachial blood pressure and derived aortic blood pressure (SphygmoCor Xcel, AtCor Medical) was obtained in all subjects in the seated position; carotid-femoral pulse wave velocity (cfPWV) was measured in the supine position. Pulse wave analysis was performed for all blood pressure waveforms. For this pilot study, p = 0.1 was deemed to designate parameters potentially worthy of further study.

Results: The sample size was not sufficiently powered for assessing significance in stepwise multiple linear regression, though there was a trend toward syndromes being more likely to be present in older subjects. A subset of QD (n = 6), BS (n = 9) and QDBS (n = 6) were compared to age and gender matched control subjects. There was no significant difference in any pulse wave analysis parameters between controls and QD. Brachial systolic pressure (BS: 134 ± 28, control: 123 ± 11 mm Hg, p = 0.08), brachial and aortic mean pressure (BS: 98 ± 11, control: 91 ± 10 mm Hg, p = 0.04), and aortic diastolic pressure (BS: 80 ± 8, control: 75 ± 12 mm Hg, p = 0.09) were different (at p = 0.1) between controls and BS. Aortic mean pressure was higher in QDBS subjects than controls (QDBS: 99 ± 11, control: 90 ± 13 mm Hg, p = 0.07). Across all syndromes, there was no trend toward higher cfPWV or aortic augmentation index or changes in ejection duration, features often reported in the Chinese journal literature.
Conclusions: Results indicate that there may be cardiovascular parameters associated with Qi deficiency and blood stasis syndromes, though properly designed studies in large cohorts are required to confirm these findings.

P-08
Acute Bout of Exergaming Attenuates Arterial Stiffening Following Postprandial Lipemia in Persons with Spinal Cord Injury
Eun Sun Yoon, Hyun Jeong Kim, Kanokwan Bunsawat, Jacqueline Augustine, Jina Choo, Kyung Hee Park, Bo Fernhall, Sae Young Jae

Objective: Cardiovascular disease (CVD) is a leading cause of mortality in persons with spinal cord injury (SCI). Postprandial lipemia after a high fat meal is a predictor of CVD risk and may be exaggerated in the setting of SCI. We tested the hypothesis that postprandial lipemia following a high-fat meal may increase CVD risk in SCI as measured by increases in aortic stiffness. We further tested the effect on an acute bout of exergaming on postprandial lipemia and aortic stiffness in persons with SCI, hypothesizing that exercise may attenuate postprandial lipemia and attenuate increases in aortic stiffness.

Design and Method: Forty persons with SCI (aged 41 ± 8 years) were randomly assigned to either an exergaming group (n = 20) or seated rest as a control group (n = 20) after a high fat meal. Blood parameters and aortic stiffness were measured at baseline and 4 hours after a high fat meal. Carotid-femoral pulse wave velocity (cf-PWV) was measured as an index of aortic stiffness. After an hour following a high fat meal, the exergame group performed 50 minutes of moderate intensity active video games (Nintendo Wii sports, boxing) at 40–60% of heart rate reserve.

Results: A high fat meal significantly increased triglyceride, insulin, and glucose levels, but decreased mean blood pressure in both groups in a similar manner (p = 0.05), no significant group-by-time interaction was found in these variables (p = 0.05). However, cf-PWV significantly increased in the control group (8.1 ± 1.9 m/s to 8.9 ± 2.1), but decreased in the exergame group (9.0 ± 1.3 m/s to 8.6 ± 1.3), with a significant interaction (p = 0.01).

Conclusions: These results show that a high-fat meal causes arterial stiffening in persons with SCI, but aortic stiffening was attenuated by an acute bout of exergaming. Findings suggest that exergaming may have a cardioprotective effect on aortic stiffness in persons with SCI when exposed to a high-fat meal.

P-09
Influence of Losartan and Amlodipine Combinations on Blood Pressure and Echocardiographic Parameters in Patients with Metabolic Syndrome
Jamol Uzokov, Anis Alyavi

Objective: Patients with hypertension (H) with metabolic syndrome (MS) have a high risk of cardiovascular events. The aim of the study was to assess the effects of combination therapy with Losartan (L) and Amlodipine (A) on BP, left ventricular (LV) hypertrophy, LV diastolic function in patients with hypertension and MS.

Design and Method: Fifty two patients with second and third stage hypertension and metabolic syndrome were provided to L (25 mg) + A (5 mg) in combination once a day (23 males and 29 females). The presence of metabolic syndrome was diagnosed by ‘Harmonized’ Metabolic Syndrome definition. Anthropometric measures and echocardiography was performed at baseline and after 24 weeks of therapy. Statistical comparisons were performed by 2 tailed Student’s t test for quantitative parameters.

Results: All patients completed the study without showing intolerance or side effects to the drugs. At the end of the study therapy normalized BP (from 173.81 ± 7.1/106.2 ± 5.4 mm Hg to 126.9 ± 5.0/76.3 ± 2.7 mm Hg, p = 0.05) in 94.2% of patients. LV mass index reduced from 158.4 ± 7.2 to 134.5 ± 3.9 g/m², (p = 0.05) in 78.8% of patients. At the end of the study E/A ratio increased from 0.89 ± 0.02 to 1.39 ± 0.03 (p = 0.02) in 84.6% of patients. IVRT has been decreased from 106.2 ± 6.4 to 75.8 ± 4.3 msec (p = 0.05) in 80.7% of patients. Deceleration time passed from 172.5 ± 8.3 to 131.4 ± 2.9 msec (p = 0.01) in 86.5% of patients.
Conclusions: These data suggest significant antihypertensive efficacy of the combination of L 25 mg + A 5 mg. Combination therapy with L + A has been demonstrated qualitative regression of LV hypertrophy and improvement of LV diastolic function in patients with second and third stage hypertension and metabolic syndrome.

P-10
The Impact of Diabetes Mellitus and Glucose Control on Carotid Intima, Media, and Intima-Media Thickness in Subjects Asymptomatic for Cardiovascular Disease

Jang-Ho Bae a, Wuon-Shik Kim b, Jeong Taek Woo a
aDepartment of Cardiology, Konyang University Hospital, Republic of Korea; bDepartment of Cardiology, Korea Research Institute of Standards and Science, Republic of Korea; cDepartment of Cardiology, Cheil General Hospital, Dankook University, Republic of Korea; dDepartment of Cardiology, Daegu Catholic University Medical Center, Republic of Korea; eDepartment of Endocrinology, Kyung Hee University Medical Center, Republic of Korea.

Objective: We evaluated to see the impact of diabetes mellitus (DM) and DM control status on each layers of carotid artery in asymptomatic population.

Design and Method: This is an observational cohort study consisted of 1,479 patients. The carotid images were sent to Korea Research Institute of Standards and Science for core laboratory analysis using specialized software which can measure intima and media wall also.

Results: DM patients (n = 634, 42.9%) were likely to be older, more male, hypertension, dyslipidemia and higher creatinine level than non-DM patients (n = 845, 57.1%). There was no significant demographic difference according to DM control status in DM patients. DM patients showed higher carotid intima-media thickness (CIMT, 0.70–0.15 mm vs. 0.66–0.16 mm, p = 0.001) and media thickness (CMT, 0.41–0.12 mm vs. 0.36–0.12 mm, p = 0.001) than non-DM patients, whereas intima thickness (CIT) showed no significant difference (0.29–0.07 mm vs. 0.30–0.06 mm, p = 0.067) between 2 groups. Well controlled DM patients (HbA1C<7.0%, n = 232, 47.4%) showed higher CIT (0.30–0.08 mm vs. 0.27–0.06 mm, p = 0.003) than poorly controlled DM (HbA1C ≥ 7.0%, n = 257, 52.6%). Old age and LDL-cholesterol were the independent factors for CIMT, CIT and CMT in total asymptomatic adults as well as DM patients. DM control status was not significant independent factor for CIMT.

Conclusions: The increased CIMT in DM patients was mainly due to the increased CMT. DM control status did not impact on carotid arterial wall thickness in this study. Lipid control rather than glucose control may be the most important factor to decrease atherosclerosis progression in subclinical adults.

P-11
Relationship between 24-h Urine Sodium/Potassium Ratio and Central Aortic Systolic Blood Pressure in Patients with Hypertension

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Objective: Studies evaluated the relationship between measured 24-h urine sodium (24HUNa) and potassium (24HUK), and aortic blood pressure (BP) is very rare, and none in Asian.

Design and Method: We evaluated the relationship between 24HUNa and 24HUK, and casual BP, 24-h ambulatory BP, and aortic BP by analyzing data from 524 participants with valid 24-h urine collection, 24-h ambulatory BP and central BP measurement (age 48.1 ± 9.8 years, 193 men). Hypertension was defined by 24-h ambulatory BP ≥130/80 mm Hg, or current treatment of hypertension (n = 219).

Results: Participants with hypertension and high 24HUNa (mean 210.5 ± 52.0 mmol/day, range 151.0–432.0) showed higher 24-hour systolic (p = 0.037) and diastolic BP (p = 0.037) and aortic systolic BP (AoSBP, p = 0.038) than participants with hypertension and low 24HUNa (mean 115.7 ± 25.0 mmol/day, range 45.6–150.0) by adjusted analysis for confounders. Participants with hypertension and high ratio of 24HUNa and 24HUK (24HUNa/24HUK, mean 4.03 ± 1.00, range 2.93–7.96) had higher AoSBP than participants with hypertension and low 24HUNa/24HUK ratio (mean 2.13 ± 0.54, range 0.53–2.91) by adjusted analysis for confounders (p = 0.026). Participants with hypertension showed a significant linear relationship between AoSBP and 24HUNa/24HUK ratio in multiple regression analysis, which was independent to 24HUNa (p = 0.047).

Conclusions: In patients with hypertension, 24HUNa/24HUK was related to AoSBP, with a stronger effect compared to 24HUNa alone. The result indicates that
high sodium and low potassium intake may increase the subsequent risk of cardiovascular disease by elevation of AoSBP

P-12
Increased Ambulatory Pulse Pressure and Pulse Pressure Variability in True Resistant Hypertension: An Observation from the China Ambulatory and Home Blood Pressure Registry

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Objective: Resistant hypertension was associated with adverse cardiovascular outcome. The aim of this study was to evaluate if patients with true resistant hypertension would have a stiff artery as measured by pulse pressure and its variability.

Design and Method: From August 2009 to February 2015, 4134 patients were enrolled in the China Ambulatory and Home Blood Pressure Registry. True resistant hypertension was defined as uncontrolled blood pressure in both office (≥140/90 mm Hg, for diabetic patients, ≥130/80 mm Hg) and 24-hour ambulatory monitoring (≥130/80 mm Hg) settings despite optimal treatment with at least 3 antihypertensive drugs including a diuretic. Office blood pressure was measured with validated electronic monitors (Omron HEM-7011-C). We performed the analysis of variance to compare the clinical characteristics between groups while accounting for sex, age, body mass index, current smoking and drinking habit, the presence of diabetes and cardiovascular diseases, and duration of hypertension history.

Results: Among the 4134 registered subjects, 643 had incomplete data, leaving 3491 (50.8% men, average age 56.7 years) subjects in the current analysis. Among all subjects, 3028 were hypertensive patients and 2392 were treated with antihypertensive drugs, in whom 1108 (46.3%) had both office and 24-hour ambulatory blood pressure controlled, and 159 (6.65%) had true resistant hypertension. Compared to controlled hypertensive patients, patients with true resistant hypertension had greater body mass index (26.4 vs. 25.3, P = 0.0003) and included more patients with diabetes (35.9% vs. 18.3%, P = 0.001), more patients with cardiovascular diseases (19.5% vs. 13.6%, P = 0.03). After multivariate adjustment, patients with true resistant hypertension had significantly higher 24-hour, daytime and nighttime pulse pressure (P 0.0001), higher standard deviation (SD) of daytime and nighttime pulse pressure (P 0.0001), higher weighted SD of pulse pressure (wSD) and higher 24-hour average real variability (ARV) of pulse pressure (P 0.0001) than patients with controlled hypertension. Logistic regression analysis showed that current drinking, long duration of hypertension and 24-hour ambulatory pulse pressure was positively associated with (ORs ≥ 1.04; P ≤ 0.03) higher odds of true resistant hypertension and each 5 mm Hg-increase in 24-hour pulse pressure was associated with 150% (95% CI: 90%-230%, P = 0.0001) higher odds of true resistant hypertension.

Conclusions: In our study, the prevalence of true resistant hypertension was 6.65%. True resistant hypertension was associated with current drinking, a long duration of hypertension, and increased pulse pressure. Increased pulse pressure might render hypertension more difficult to be controlled.

P-13
The Role and Mechanism of Transient Receptor Potential Melastatin 7 on Vascular Adventitial Remodeling Caused by Overload of Pressure

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Objective: Transient receptor potential melastatin 7 (TRPM7) is a novel molecule identified in 2001 which constructed with a channel domain and a kinase domain. It has been recently found in the vasculature; however, the effect of TRPM7 on vascular diseases is still unclear. To clarify the role of TRPM7 in vascular remodeling, we sought to detect regulation of TRPM7 on vascular remodeling induced by pressure overload and further to find the mechanism in vitro.

Design and Method: Vascular remodeling was formed in the right common carotid artery proximal to band by transverse aortic constriction in male Sprague-Dawley (SD) rats. Changes of vascular wall were detected by morphometric method and immunofluorescence assay. Vascular adventitial fibroblasts (AFs) were treated with 20% stretch stress for 24 hours. The function of TRPM7 to stretched AFs was tested using RT-PCR and western blot.

Results: Vascular wall was obviously thickened after transverse aortic constriction in the right common carotid artery, especially in the adventitia. TRPM7 expression was increased in thickened adventitia where CD68, a marker of microphages, was elevated accompanied with an amplified level of monocyte chemotactic protein-1 (MCP-1), whereas anti-inflammatory annexin-1 was decreased. Adventitial fibroblasts were transformed to myofibroblasts by overload pressure with an enhanced collagen I synthesis. The accumulation of microphages and expression of MCP-1 were alleviated by 2-aminoethoxydiphenyl borate (2-APB), a blocker of TRPM7, and the level of annexin 1 was rescued. The formation of myofibroblasts and synthesis of Collagen I were also inhibited by 2-APB. Unlike amplified shear-stress on the endothelium, the vascular adventitia bears the increased stretch stress under...
overload pressure. So we further examined whether stretch alters cell function in adventitial fibroblasts. TRPM7 expressed in adventitial fibroblasts and was increased by stretch stress. Elevated alpha-SM-actin, a marker of myofibroblasts, accompanied with raised proliferated and migrated ability in fibroblasts was exhibited under stretch stress. Collagen I content was also up-regulated in stretch fibroblasts. These changes were largely prevented by treatment with 50 μM of 2-APB.

Conclusions: Our findings showed that TRPM7 mediated the vascular adventitia remodeling under overload pressure.

P-14
Predictive Value of Sitting and Supine Heart Rate for Mortality in Elderly Chinese
Chang-Sheng Sheng, Yan Li, Ji-Guang Wang
Ruijin Hospital, Shanghai Institute of Hypertension, China

Objective: Body position might markedly influence the estimation of heart rate. We compared the predictive value of heart rate for mortality between sitting and supine position in elderly Chinese.

Design and Method: In a population-based prospective study in the elderly (≥60 years), the heart rate was recorded using a cuff-oscillometric method in both sitting and supine position, after the patient having rested for at least 10 minutes. Information on total and cardiovascular mortality was collected during follow-up.

Results: In the 4051 participants (1808 men, mean age 68.5 years), heart rate at baseline was significantly higher in sitting than supine position (76.3 [11.9] vs. 72.2 [14.0] beats/min, P = 0.0001). During 5.9 years (median) of follow-up, the cumulated number of person-years was 20,529 and total and cardiovascular deaths occurred in 376 and 186 subjects, respectively. In adjusted Cox regression analyses, the hazard ratios (HRs) associated with 1-SD increase were 1.18 (95% CI, 1.08–1.29; P = 0.0004) and 1.23 (95% CI, 1.15–1.32; P = 0.0003) in sitting and supine heart rate, respectively. When supine and sitting heart rate were simultaneously included into the same Cox model, only supine heart rate significantly (P = 0.0001) predicted both total and cardiovascular mortality. The corresponding HRs for per SD increase were 1.20 (95% confidence interval, 1.11–1.30) and 1.26 (1.14–1.39), respectively.

Conclusions: In conclusion, both sitting and supine heart rate are associated with mortality. Compared with sitting heart rate, supine heart rate is a much stronger predictor for both total and cardiovascular mortality.

P-15
Endothelial Function Is Impaired in Subjects with Decreased Frequency and Duration of Tooth Brushing
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aDepartment of Cardiovascular Medicine, Hiroshima University, Japan; bDivision of Regeneration and Medicine, Hiroshima University, Japan

Objective: Periodontal disease is associated with endothelial dysfunction, leading to cardiovascular disease. The effect of detailed tooth brushing behavior, not only frequency but also duration of tooth brushing, on endothelial function is unclear. The purpose of this study was to evaluate the relationships of detailed methods of tooth brushing with vascular function.

Design and Method: We evaluated flow-mediated vasodilation (FMD), nitroglycerine-induced vasodilation, and frequency and duration of tooth brushing in 447 subjects including 113 patients with cardiovascular diseases.

Results: We divided the subjects into three groups according to frequency and duration of tooth brushing: low frequency and short duration group (1 minute/procedure). FMD in the low frequency and short duration group was significantly lower than FMD in the either low frequency or short duration group and FMD in the non-low frequency and non-short duration group (3.2 ± 2.9% vs. 4.5 ± 3.5 and 4.8 ± 3.2%, P = 0.03 and 0.003, respectively). Nitroglycerine-induced vasodilation was similar in the three groups. Multiple logistic regression analysis revealed that age (65 years) (OR 2.20, 95% CI: 1.44–3.40; P = 0.0003), hypertension (OR 1.68, 95% CI: 1.06–2.70; P = 0.03), diabetes mellitus (OR 1.69, 95% CI: 1.01–2.79; P = 0.045), and low frequency and short duration of tooth brushing (OR 2.11, 95% CI: 1.07–4.17; P = 0.03) were independent predictors of low tertile of FMD.

Conclusions: These findings suggest that low frequency and short duration of tooth brushing are associated with endothelial dysfunction.
**P-16**

**Effect of Trigonella Foenum Graecum on Altered Cardiac Membrane Functions in Alloxan Diabetic Rats**

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**Objective:** The present study was carried out to observe, the antihyperglycemic effect of sodium orthovanadate (SOV) and Trigonella foenum graecum seed powder (TSP) administration on blood glucose, insulin levels, Ca2+ATPase activity, lipid peroxidation, calcium levels and, expression of glucose transporter (GLUT4), Protein kinase C (PKC) β2 and membrane fluidity in heart tissues and to see whether the treatment with SOV and TSP was capable of reversing the diabetic effects.

**Design and Method:** Diabetes was induced by administration of alloxan monohydrate (15 mg/100 g body weight) and rats were treated with 2 IU insulin, 0.6 mg/ml SOV, 5% TSP in the diet and a combination of 0.2 mg/ml SOV and 5% TSP separately for three weeks. Expression of GLUT4 protein and PKC β2 levels was also examined by immunoblotting method in experimental rat heart muscle after three weeks of diabetes induction.

**Results:** Diabetic rats showed hyperglycemia with almost four fold high blood glucose levels. Activity of Ca2+ATPase decreased in diabetic heart. Diabetic rats exhibited an increased level of lipid peroxidation, intracellular Ca2+ levels, and decreased membrane fluidity. GLUT4 distribution was also significantly lowered in heart of alloxan diabetic rats. The increased level of PKC β2 in heart membranes was shown in diabetic rats. Treatment of diabetic rats with insulin, TSP, SOV and a combined therapy of lower dose of SOV with TSP revived normoglycemia and restored the altered level of Ca2+ATPase, lipid peroxidation and membrane fluidity and also induced the redistribution of GLUT4 transporter. TSP treatment alone is partially effective in restoring the above diabetes induced alterations.

**Conclusions:** Our results showed that lower doses of SOV (0.2 mg/ml) could be used in combination with TSP to effectively in normalization of altered metabolic parameters and membrane linked enzymes without any harmful side effect.

**P-17**

**Intravenous Thrombolysis for Acute Ischemic Stroke in Patients Receiving Antiplatelet Therapy: A Systematic Review and Meta-Analysis of 19 Studies**

*Shengyuan Luo, Chen Su, Jun Tao*

Department of Hypertension and Vascular Disease, The First Affiliated Hospital of Sun Yat-Sen University, China

**Objective:** The safety and long-term outcome of systemic thrombolysis in patients receiving antiplatelet medications remain subjects of great clinical significance. The objective of this meta-analysis was to determine how prestroke antiplatelet therapy affects the risks and benefits of intravenous thrombolysis in patients with acute ischemic stroke.
**Design and Method:** A dual-reviewer search was conducted in PubMed and EMBASE databases through November 2015, from which 19 studies involving a total of 108,588 patients with acute ischemic stroke were identified based on preset inclusion criteria. Information on study designs, patient characteristics, exposures, outcomes, and adjusting confounders was extracted, and estimates were combined by using random-effects models.

**Results:** The pooled crude estimates suggested that taking long-term antiplatelet medications was associated with higher odds of symptomatic intracranial hemorrhage (odds ratio [OR] 1.70, 95% CI 1.47–1.97) and death (OR 1.46, 95% CI 1.22–1.75) and lower odds of favorable functional outcomes (OR 0.86, 95% CI 0.80–0.93). However, the combined confounder-adjusted results only confirmed a relatively weak positive association between prior antiplatelet therapy and symptomatic intracranial hemorrhage (OR 1.21, 95% CI 1.02–1.44) and demonstrated no significant relationship between antiplatelet therapy and the other 2 outcomes (favorable outcome OR 1.09, 95% CI 0.96–1.24; death OR 1.02, 95% CI 0.98–1.07). Subgroup analyses revealed that the associations between prestroke antiplatelet therapy and outcomes were dependent on time and antiplatelet agents.

**Conclusions:** Patients with acute ischemic stroke receiving long-term antiplatelet medications were associated with greater risks of developing symptomatic intracranial hemorrhage after systemic thrombolysis. However, the overall independent association between prestroke antiplatelet therapy and unfavorable outcomes or mortality was insignificant.

**Table 1.** The analysis of logistic regression about risk factor of dyslipidemia in female (for Abstract P-18)

<table>
<thead>
<tr>
<th>Dependent variables</th>
<th>Risk factor</th>
<th>B</th>
<th>SE</th>
<th>Wales</th>
<th>OR (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lipid metabolism is normal or not</td>
<td>rs12953258 CC</td>
<td>0.351</td>
<td>0.184</td>
<td>3.630</td>
<td>1.420 (0.990, 2.036)</td>
<td>0.057</td>
</tr>
<tr>
<td></td>
<td>rs12953258 CA</td>
<td>1.185</td>
<td>0.560</td>
<td>4.483</td>
<td>3.271 (1.092, 9.797)</td>
<td>0.034</td>
</tr>
<tr>
<td></td>
<td>rs12953258 AA</td>
<td>0.061</td>
<td>0.016</td>
<td>13.99</td>
<td>1.063 (1.030, 1.098)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>HDL-C is normal or not</td>
<td>CC+ normal BMI</td>
<td>2.201</td>
<td>1.060</td>
<td>4.314</td>
<td>9.032 (1.132, 72.06)</td>
<td>0.038</td>
</tr>
<tr>
<td></td>
<td>AA+ abnormal BMI</td>
<td>0.198</td>
<td>0.199</td>
<td>0.991</td>
<td>1.219 (0.825, 1.801)</td>
<td>0.32</td>
</tr>
<tr>
<td></td>
<td>rs12953258 CC</td>
<td>1.263</td>
<td>0.566</td>
<td>4.983</td>
<td>3.357 (1.167, 10.723)</td>
<td>0.026</td>
</tr>
<tr>
<td></td>
<td>rs12953258 AA</td>
<td>0.038</td>
<td>0.019</td>
<td>4.095</td>
<td>1.039 (1.001, 1.077)</td>
<td>0.043</td>
</tr>
<tr>
<td>TG is normal or not</td>
<td>rs12953258 CC</td>
<td>0.415</td>
<td>0.26</td>
<td>2.544</td>
<td>1.515 (0.909, 2.524)</td>
<td>0.118</td>
</tr>
<tr>
<td></td>
<td>rs12953258 CA</td>
<td>1.142</td>
<td>0.70</td>
<td>4.067</td>
<td>4.105 (1.041, 16.197)</td>
<td>0.038</td>
</tr>
<tr>
<td></td>
<td>rs12953258 AA</td>
<td>0.061</td>
<td>0.11</td>
<td>31.29</td>
<td>1.060 (1.001, 1.077)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>TC is normal or not</td>
<td>abdomen circumference</td>
<td>0.029</td>
<td>0.014</td>
<td>4.406</td>
<td>1.030 (1.002, 1.058)</td>
<td>0.036</td>
</tr>
<tr>
<td>LDC-C is normal or not</td>
<td>BMI</td>
<td>0.077</td>
<td>0.031</td>
<td>6.282</td>
<td>1.080 (1.017, 1.148)</td>
<td>0.012</td>
</tr>
</tbody>
</table>
women in Xinjiang, prevalence of lipid metabolic disturbance increases significantly in crowd carrying AA genotype with abnormal BMI.

P-19
Vascular Smooth Muscle Function in Coronary and Brachial Arteries in Patients with Suspected Coronary Artery Disease
Tatsuya Maruhashi, Masato Kajikawa, Ayumu Nakashima, Akimichi Iwamoto, Nozomu Oda, Shinji Kishimoto, Shogo Matsui, Kenjuke Nomao, Yasuki Kihara, Yukihito Higashi

Objective: Nitroglycerine-induced vasodilation, an index of endothelium-independent vasodilation, is measured for the assessment of vascular smooth muscle cell function or alterations of vascular structure. Both coronary and brachial artery responses to nitroglycerine have been demonstrated to be independent prognostic markers of cardiovascular events. The purpose of this study was to compare the nitroglycerine-induced vasodilation in the coronary and brachial arteries in the same patients.

Design and Method: We measured nitroglycerine-induced vasodilation in coronary and brachial arteries in 30 subjects who underwent coronary angiography with suspected coronary artery disease (19 men and 11 women; mean age, 69.0 ± 8.8 years; age range, 42 to 85 years).

Results: The mean value of nitroglycerine-induced vasodilation in the brachial artery, left anterior descending coronary artery, and left circumflex coronary artery were 12.6 ± 5.2%, 11.6 ± 10.3%, and 11.9 ± 11.0%, respectively. Nitroglycerine-induced vasodilation in the brachial artery correlated significantly with that in the left anterior descending coronary artery (r = 0.43, P = 0.02) and that in the left circumflex coronary artery (r = 0.49, P = 0.006), with a significant correlation between nitroglycerine-induced vasodilation in the left anterior descending coronary artery and that in the left circumflex coronary artery (r = 0.72, P = 0.001).

Conclusions: These findings suggest that vascular smooth muscle cell dysfunction is a systemic disorder and thus impairments of endothelium-independent vasodilation in peripheral and coronary arteries are simultaneously present. Nitroglycerine-induced vasodilation in the brachial artery could be used as a surrogate for that in coronary artery and as a prognostic marker for cardiovascular events.

P-20
The Value Estimation of Controlling Fasting Plasma Glucose of Exercise-Only Versus Exercise-Diet among a Pre-Diabetic Population: A System Review and Meta-Analysis
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Objective: Exercise is considered as a protective factor in the prevention of type 2 diabetes, although its role as a sole treatment for pre-diabetes remains unknown. The present study compared the effect of exercise-only with exercise-diet interventions on plasma glucose levels among a pre-diabetic population.

Design and Method: A literature search was conducted using PubMed, EMBASE and Cochrane databases. The Cochrane Collaboration tool was used to assess the quality of each trial. Two reviewers independently performed quality assessment of all included articles. A random effects model was used to calculate the pooled effect.

Results: A total of 4021 participants from 12 studies were included in this meta-analysis, 2045 of them were in the intervention group and 1976 were in the control group. Compared with the exercise-only interventions, the exercise-diet interventions showed a significant effect on decreasing fasting plasma glucose (FPG) levels, with a weighted mean difference (WMD) = –0.22 mmol/l, 95% confidence interval (CI): –0.25, –0.18 (Z = 12.06, P = 0.05). The subgroup effect of exercise-only intervention did not produce a statistical significant result (WMD = –0.09 mmol/l, 95% CI: –0.18, 0.00, Z = 1.91, P = 0.05). According to the periods of intervention, the pooled effect in the 2-years group was the highest, and its WMD (95% CI) was –0.24 mmol/l (–0.43, –0.05). The pooled effects were statistically significant among the elderly and those of American and European descent, with WMD (95% CI) being –0.19 mmol/l (95% CI: –0.22, –0.15), –0.17 mmol/l (–0.21, –0.12) and –0.22 mmol/l (–0.27, –0.17), respectively.

Conclusions: Therefore, evidence from published trials indicated that exercise-diet interventions showed a significant effect on decreasing FPG levels and combine effect was better than exercise-only.
### Table 1. Characteristic of included studies (for Abstract P-20)

<table>
<thead>
<tr>
<th>Study publication year</th>
<th>Study country</th>
<th>During of follow-up</th>
<th>Population</th>
<th>Mean age (s.d.) Study of participants</th>
<th>Type of intervention</th>
<th>Change of fasting glucose(^a) (mmol/l) in control group</th>
<th>Change of fasting glucose(^a) (mmol/l) in intervention group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>n mean ± SD age (years) male/female</td>
<td>n mean ± SD age (years) male/female</td>
</tr>
<tr>
<td>Katula JA(^2) (2013)</td>
<td>United States</td>
<td>0.5 year 1.0 year 1.5 years 2.0 years</td>
<td>IGT(^b) BMI: 25–39 kg/m(^2)</td>
<td>57.9 (9.57)</td>
<td>RCT</td>
<td>Exercise-diet</td>
<td>150 0.07±0.04 –0.04±0.05 0.09±0.05 0.10±0.05</td>
</tr>
<tr>
<td>Oldroyd Z(^2) (2006)</td>
<td>England</td>
<td>0.5 year 1.0 year 2.0 years</td>
<td>IGT(^c) Age: 24–75 years</td>
<td>57.85</td>
<td>RCT</td>
<td>Exercise-diet</td>
<td>32 0.18±1.10 0.08±0.97 24 0.12±1.00</td>
</tr>
<tr>
<td>Lu HY(^2) (2003)</td>
<td>China</td>
<td>2.0 years</td>
<td>IFG(^d) or IGT(^d) Age: 40–80 years; BMI ≥19 kg/m(^2)</td>
<td>63.58 (8.60)</td>
<td>RCT</td>
<td>Exercise-diet</td>
<td>86 0.03±0.72</td>
</tr>
<tr>
<td>Linds(^2) (2003)</td>
<td>Finland</td>
<td>1.0 year 2.0 years</td>
<td>IGT*, Age: 40–60 years; BMI ≥25 kg/m(^2)</td>
<td>55.00 (7.00)</td>
<td>RCT</td>
<td>Exercise-diet</td>
<td>250 0.00±0.70 203 0.10±0.70</td>
</tr>
<tr>
<td>Pan(^2) (1997)</td>
<td>China</td>
<td>6.0 years</td>
<td>IGT*, Age: 25 years</td>
<td>45.35 (9.00)</td>
<td>RCT</td>
<td>Exercise-only</td>
<td>50 1.87±1.92</td>
</tr>
<tr>
<td>Carr(^2) (2005)</td>
<td>United States</td>
<td>0.5 year 2.0 years</td>
<td>IGT*</td>
<td>56.45 (1.80)</td>
<td>RCT</td>
<td>Exercise-only</td>
<td>32 0.09±0.09 0.07±0.08</td>
</tr>
<tr>
<td>Steven(^2) (2012)</td>
<td>United States</td>
<td>12 weeks</td>
<td>IGT, or IFG(^d)</td>
<td>47.60 (9.56)</td>
<td>Non-randomized trial</td>
<td>Non-randomized trial</td>
<td>8 0.00±0.15</td>
</tr>
<tr>
<td>Eriksson(^2) (1999)</td>
<td>Finland</td>
<td>1.0 year</td>
<td>IGT*, Age: 40–64 years; BMI ≥25 kg/m(^2)</td>
<td>53.00 (7.00)</td>
<td>RCT</td>
<td>Exercise-diet</td>
<td>100 0.30±0.60 33/67</td>
</tr>
<tr>
<td>Jaakko(^3) (2001)</td>
<td>Finland</td>
<td>3.2 years</td>
<td>IGT*, Age: 40–65 years; BMI ≥25 kg/m(^2)</td>
<td>55.00 (7.00)</td>
<td>RCT</td>
<td>Exercise-diet</td>
<td>250 0.05±0.66</td>
</tr>
<tr>
<td>Matti(^3) (2003)</td>
<td>Finland</td>
<td>4.0 years</td>
<td>IGT*, Age: 40–64 years; BMI ≥25 kg/m(^2)</td>
<td>53.50 (7.53)</td>
<td>RCT</td>
<td>Exercise-diet</td>
<td>21 0.10±0.75</td>
</tr>
<tr>
<td>Roumen(^3) (2008)</td>
<td>The Netherlands</td>
<td>1.0 year 2.0 years 3.0 years</td>
<td>IGT*, Age: 40 years; BMI ≥25 kg/m(^2)</td>
<td>56.30 (6.33)</td>
<td>RCT</td>
<td>Exercise-diet</td>
<td>54 0.02±0.63 0.40±0.84 0.55±0.82</td>
</tr>
<tr>
<td>Mensink(^3) (2003)</td>
<td>The Netherlands</td>
<td>1.0 year 2.0 years</td>
<td>IGT*, Age: 40 years; BMI ≥25 kg/m(^2)</td>
<td>56.50 (1.00)</td>
<td>RCT</td>
<td>Exercise-diet</td>
<td>48 0.10±0.10 0.50±0.10</td>
</tr>
</tbody>
</table>

BMI = Body mass index; IFG = impaired fasting glucose; IGT = impaired glucose tolerance; OGTT = oral glucose tolerance test; RCT = randomized controlled trial. \(^a\) Mean change of fasting glucose was calculated by glucose level\(_{baseline}\) minus glucose level\(_{follow-up}\). \(^b\) Fasting Blood glucose >5.3 and <6.9 mmol/l. \(^c\) WHO criteria of 1985: IGT, 2-h post glucose load plasma glucose concentration >7.8 and <11.1 mmol/l; IFG, fasting blood glucose >5.6 and <6.9 mmol/l. \(^d\) American Diabetes Association criteria of 2003: IGT, 2-h post glucose load plasma glucose concentration >7.8 and <11.0 mmol/l; IFG, fasting blood glucose >5.6 and <6.9 mmol/l. \(^e\) WHO criteria of 1998: IGT, 75-g OGTT. \(^f\) Mean value 2-h glucose concentration of both OGTTs had to be between 7.8 and 12.5 mmol/l, together with a fasting glucose concentration of <7.8 mmol/l. 
Abstracts: The Pulse of Asia 2016 Seoul

P-21

**Association of Brachial-Ankle Pulse Wave Velocity with Asymptomatic Intracranial Arterial Stenosis in Hypertension Patients**

Yan Wang\(^a\), Jin Zhang\(^a\), Yuesheng Qain\(^a\), Xiaofeng Tang\(^a\), Yan Li\(^a\), Huawei Ling\(^b\), Kemin Chen\(^b\), Pingjin Gao\(^b\), Dingliang Zhu\(^b\)

\(^a\)Shanghai Institute of Hypertension, Ruijin Hospital, China; \(^b\)Department of Radiology, Ruijin Hospital, China

**Objective:** Intracranial arterial stenosis is a common cause of ischemic stroke in Asians. We therefore sought to explore the relationship of brachial-ankle pulse wave velocity and intracranial arterial stenosis in 834 stroke-free hypertensive patients.

**Design and Method:** Intracranial arterial stenosis was evaluated through computerized tomographic angiography. Brachial-ankle pulse wave velocity was measured by an automated cuff device.

**Results:** The top decile of brachial-ankle pulse wave velocity was significantly associated with intracranial arterial stenosis (P = 0.027, odds ratio = 1.82, 95% confidence interval: 1.07–3.10). The patients with the top decile of brachial-ankle pulse wave velocity showed 56% higher risk for the presence of intracranial arterial stenosis to the whole population, which was more significant in patients under 65 years old. We also found that brachial-ankle pulse

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**Fig. 1.** Forest plot according to intervention style (group 1: exercise-diet intervention; group 2: exercise-only interventions) (for Abstract P-20).
wave velocity related to both intracranial arterial stenosis and homocysteine.

Conclusions: In conclusion, our study showed the association of brachial-ankle pulse wave velocity with asymptomatic intracranial arterial stenosis in hypertension patients, especially in relative younger subjects. Brachial-ankle pulse wave velocity might be relatively simple and repeatable measurement to detect hypertension patients in high risk of intracranial arterial stenosis.

P-22
Subtypes of Masked Hypertension and Their Associations with Target Organ Damage in Untreated Chinese Patients

Dong-Yan Zhang, Yi-Bang Cheng, Qian-Hui Guo, Ting-Yan Xu, Yan Yang, Jing-Jing Li, Chang-Sheng Sheng, Qi-Fang Huang, Ji-Guang Wang, Yan Li
Shanghai Institute of Hypertension, Shanghai Jiaotong University School of Medicine, China

Objective: Masked hypertension is office normotension in the presence of ambulatory hypertension, which can be subdivided into isolated daytime, isolated nighttime or day-night hypertension. Up to now, no previous studies contrasted the subtypes of masked hypertension in their associations with target organ damage.

Design and Method: Consecutive untreated patients referred for ambulatory blood pressure (BP) monitoring to our Hypertension Clinic were recruited. Office and ambulatory BP were measured using the Omron 7051 and SpaceLabs 90217 monitors, respectively. The cutoff values for daytime and nighttime hypertension were a BP of ≥135/85 mm Hg and ≥120/70 mm Hg, respectively. Measures of target organ damage, including left ventricular mass index (LVMI) by echocardiography, carotid-femoral pulse wave velocity (cfPWV) and urinary albumin-to-creatinine ratio (ACR), were determined.

Results: The 1808 participants (mean age, 51 years; women, 52%) included 580 (30.4%) normotensive subjects, and 672 (37.2%) with masked hypertension, among whom 123 (18%) had isolated daytime hypertension, 78 (12%) isolated nighttime hypertension, and 471 (70%) day-night hypertension. After multivariate adjustment, patients with isolated nighttime hypertension, and 471 (70%) day-night hypertension were a BP of ≥135/85 mm Hg and ≥120/70 mm Hg, respectively. Measures of target organ damage, including left ventricular mass index (LVMI) by echocardiography, carotid-femoral pulse wave velocity (cfPWV) and urinary albumin-to-creatinine ratio (ACR), were determined.

Conclusions: Masked hypertension was prevalent in this untreated outpatient cohort, 70% of which was day-night hypertension. Masked daytime hypertension was associated with arterial stiffness while nighttime hypertension was associated with kidney damage and day-night hypertension with both target organ measures.

P-23
Between-Visit Reproducibility of Inter-Arm Systolic Blood Pressure Difference in Treated Hypertensive Patients: The Coconet Study

Jang Young Kim, Eung Ju Kim, June Namgung, Byung-Ryul Cho, Chang-Wook Nam, Young-Kwon Kim, Jeong Bae Park

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Objective: Inter-arm systolic blood pressure difference (sIAD) has recently been recognized as a risk factor for cardiovascular mortality. However, sIAD reproducibility remains unresolved from a controlled trial perspective.

Design and Method: We evaluated between-visit reproducibility of sIAD in hypertensive patients. We examined 1,875 hypertensive participants aged 20 years and older (mean age of 61.1 years, 45.1% female) from nine primary clinics and 27 secondary and tertiary hospitals. Blood pressure (BP) in both arms was automatically and simultaneously measured in triplicate using a cuff-oscillometric BP device. BP measurements were obtained at baseline and 3-month follow-up time points. Increased sIAD was defined as ≥10 mm Hg of the absolute difference in averaged systolic BPs between left and right arms.

Results: Overall mean sIAD was 4.33 ± 4.17 mm Hg. The prevalence of increased sIAD at baseline and 3-month measurements was 7.6% and 7.1%, respectively. Intra-class correlation coefficient for between-visit sIAD was 0.304 (95% CI 0.262–0.344). The kappa value between baseline and follow-up increased sIAD was 0.165 (95% CI 0.096–0.234). The percent chance of increased sIAD at 3 months from initially increased sIAD at baseline was 21.8%.

Conclusions: The reproducibility in sIAD determination between baseline and 3-month follow-up measurements lacked agreement in hypertensive patients.
Reciprocal Effect of Early Wave Reflection on Central Aortic Pressure and Flow Velocity

**Objective:** Previous studies have shown the reciprocal effects of wave reflection on aortic pressure and aortic flow waves. Invasive (Electro-Magnetic (EM)) and non-invasive (Cardiac Magnetic Resonance (CMR)) studies of aortic blood flow have shown characteristic aging changes as reduction in late systolic flow, which corresponds in time to the late systolic boost of aortic pressure. These are not always apparent in Doppler flow tracings.

**Design and Method:** This study aimed to better understand the mechanisms of aortic pressure and flow changes due to early wave reflection and stiffening of arteries. Using SphygmoCor system, radial artery pressure waveforms were collected from 161 male subjects (age 21–80 years) undergoing cardiac catheterisation for suspected coronary disease. Ascending Aortic (AA) pressure was derived from radial artery pressure using validated transform function (SphygmoCor). AA flow velocity waves were generated from AA pressure and age-related AA impedance using mathematical relations governing flow and pressure in the frequency domain and solved using discrete Fourier transform analysis (Matlab v2014).

**Results:** Pressure (PAIx) and Flow Augmentation Index (FAIx), as manifestations of AA impedance and wave reflection, were compared. FAIx shows significant decrease with age, whereas PAIx increases with age, as shown in previous EM and CMR studies (table). Findings are consistent with the disparate effect of early wave reflection with aging: aging augments aortic pressure in late systole while simultaneously lowering AA late systolic flow velocity. This inverse relationship, when combined, sums to a straight line which approximates zero. No such relationship was seen with conventional aortic Doppler waveforms.

**Conclusions:** Findings confirm the reciprocal effect of early wave reflection which adds to AA pressure and subtracts from AA flow velocity. This gives fresh insight into Left Ventricular (LV) failure with preserved or reduced LV ejection fraction. ‘Might wave reflection be the cause of both?’

### Table 1. (for Abstract P-24)

<table>
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<th></th>
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<td>No of subjects</td>
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<tr>
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<tr>
<td>old (&gt;50)</td>
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<td>Height (cm)</td>
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<tr>
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<tr>
<td>Weight (kg)</td>
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<td>NS</td>
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<tr>
<td>old (&gt;50)</td>
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<td>Flow AIx (%)</td>
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</tr>
<tr>
<td>old (&gt;50)</td>
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<tr>
<td>Pressure + flow AIx</td>
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<td></td>
</tr>
<tr>
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<td>0.4 (15.4)</td>
<td>NS</td>
</tr>
<tr>
<td>old (&gt;50)</td>
<td>4.9 (137)</td>
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</table>

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The Study of the Relationship between Morning Blood Pressure and Sleep and Aterial Stiffness in Patients with Essential Hypertension

**Objective:** Sleep is associated with nighttime blood pressure and aterial stiffness. Nighttime blood pressure is associated with morning blood pressure (MBP). However, the relationship between sleep and MBP has not been examined. The aim of this study is to investigate whether sleep architecture and sleep breathing is associated with MBP in patients with hypertension and the interrelationship among sleep, blood pressure and aterial stiffness.

**Design and Method:** Our sample included 144 patients with essential hypertension aged 55.8 ± 14.6 years. We collected data on demographics, the serum index, 24-hour ambulatory blood pressure, overnight polysomnography, and noninvasive arterial stiffness. Then, multiple regression stepwise analysis is used to analyse the association between sleep parameters with MBP and the association between sleep and BP with aterial stiffness.

**Results:** Based on whether MBP controlled, patients were divided into morning hypertension group and control group. There was no statistical significance between two group in demographics, the serum index, smoking, drinking, diabetes, and the parameters of sleep architecture (sleep latency, total sleep time, sleep efficiency, the proportion of REM, N1+N2 (%), N3 (%), arousal index) and sleep breathing (apnea-hypopnea index, oxygen desaturation index, mean oxygen saturation, lowest oxygen saturation) (p = 0.05). In morning hypertension group, nighttime blood pressure and morning surge were higher. For correlation analysis between MBP and sleep parameters, morning SBP was positively correlated with sleep latency (r = 0.183, p = 0.028) and not with sleep breathing parameters. Morning DBP was positively correlated with total sleep time (TST) and sleep efficiency (%) (r = 0.215 p = 0.01; r = 0.216 p = 0.01, respectively). Multiple regression analysis took morning BP as the dependent variable, when no adjusted for nighttime blood pressure and morning surge, morning BP was affected by sleep latency (β = 0.082, P = 0.044) and blood glucose (β = 1.640, P = 0.002. Futher added nighttime BP and
moring surge into equation, nighttime BP, morning sugar and blood glucose became the main factor influencing morning SBP. For morning DBP, whether or not to add nighttime BP and morning surge into equation, total sleep time and sleep efficiency were excluded. Parameters that were related to carotid-femoral pulse wave velocity (cfPWV) were entered into multiple regression analysis. arousal index (β = 0.038, P = 0.046), age (β = 0.075, P = 0.001) and nighttime SBP (β = 0.055, P = 0.003) were main factors influencing arterial stiffness, not include morning BP.

Conclusions: Sleep architecture and sleep-related breathing disorders had no direct effect on MBP, which may indirectly play a role on MBP by increased nighttime BP. Sleep breathing disorder, age and nocturnal SBP were the main factors influencing arterial stiffness.

P-27
The Effect of Intermedin on Cholesterol Efflux and the Possible Mechanism
Shixi Wan, Xiaoping Chen
Department of Cardiology, West China Hospital, China

Objective: Through in vitro experiment, explore IMD's effect on cholesterol efflux and the possible mechanism using mice mononuclear macrophage leukemic cell lineage (RAW 264.7) and phorbol myristate acetate (PMA) induced human acute monocyte leukemic cell lineage (THP-1). (2) Using in vivo experiment to verify the effect of IMD on AS. (3) Use reverse transcription-polymerase chain reaction to detect ABCA1 mRNA expression (4) Use western blot to detect ABCA1 protein expression levels. (5) Detect cholesterol efflux rate using scintillation counting method. (6) Use PKA inhibitor H-89 with IMD to stimulate cells, and repeat the experiments mentioned above to verify the inhibition function of PKA on related pathways. (7) Feed apo E–/– mice with high fat diet to build AS model. Place subcutaneous osmotic micro pump in the mice. Give continuous IMD pump infusion for 6 weeks for different groups. Draw blood from the mice eyeball and detect total cholesterol, triglyceride, low density lipoprotein cholesterol (LDL-C) and high density lipoprotein cholesterol (HDL-C) using automatic biochemical analyzer. (8) Peel mice heart with the start of aorta, and use hematoxylin and eosin staining frozen section to detect the lipidoses of aortic sinus.

Results: (1) IMD increased intracellular cAMP concentration in a dose-dependent manner. (2) IMD increased cholesterol efflux rate in RAW 264.7 and THP-1. In this process, RAW 264.7 could be inhibited by PKA, while in THP-1, PKA could not inhibit IMD caused cholesterol efflux increase. (3) IMD increased ABCA1 mRNA and protein expression in RAW 264.7 and THP-1 cells. This effect could be inhibited by PKA in RAW 264.7, while in THP-1, PKA could not inhibit IMD caused ABCA1 mRNA and protein over expression (4) IMD decreases mice serum TC and LDL-C, and increase serum HDL-C level. (5) IMD decreases mice atherosclerotic plaque area in a dose-dependent manner.

Conclusions: (1) IMD can up regulate macrophage ABCA1 gene and protein expression to increase apoA1-mediated cholesterol efflux. (2) IMD can regulate RAW 264.7 ABCA1 partly through cAMP/PKA pathway and up regulate THP-1 ABCA1 expression through an independent cAMP/PKA pathway. (3) IMD may regulate AS mice lipid metabolism and delay AS mice atherosclerosis development process by increasing cholesterol efflux.
Objective: To investigate the prevalence of hypertension and other cardiovascular risk factors in Tibetan Buddhist monks and general Tibetan residents living in Sichuan Province, and explore the significance of unique lifestyle of Tibetan Buddhist monks for the prevention and treatment of hypertension.

Design and Method: In the cross-sectional study, a total of 1384 Tibetan Buddhist monks older than 18 years (male: 48%, age 45.1 ± 15.6 years) were recruited by random sampling method from the Larung Gar Five Sciences Buddhist Academy and Yaqing Temple in Garze Tibetan Autonomous Prefecture in Sichuan Province. In the same area, 798 general Tibetan resident elder than 18 years (male: 46%, age 45.8 ± 15.4 years) were randomly collected from several villages/towns. Each participant received a standardized questionnaire, physical examination, and laboratory tests.

Results: 1. The prevalence of hypertension among adult Tibetan residents in Sichuan Province, was high (33.2%), the rates of awareness, treatment and control were low (52.9%, 41.5%, 3.7%, respectively). 2. Compared with general Tibetan residents, adult Tibetan Buddhist monks had a lower prevalence of hypertension (20.0% versus 33.2%, p = 0.001), diabetes (3.2% versus 9.0%, p = 0.001), abdominal obesity (29.3% versus 43.5%, p = 0.0). 3. After adjusting for confounding factors, male, age, BMI/WC, dyslipidemia, diabetes, family history of hypertension were all independent risk factors for hypertension in Tibetan, with the value of OR were 1.49, 2.11 (per 10 years), 1.64 (overweight/obesity), 1.71, 1.69, 4.84, respectively (all P = 0.05). 4. After adjusting for sex, age, BMI/WC, TC, TG, glucose, family history of hypertension, Tibetan Buddhist monks was associated with a -40% decrease in the risk of hypertension (OR = 0.62, 95% CI: 0.39–0.98, p = 0.041) when compared with general Tibetan residents. 5. The unique lifestyle of Tibetan Buddhist monks may exert a positive effect for hypertension: vegetarian diet (OR = 0.65, 95% CI: 0.42–0.99, p = 0.049), longer Buddhist activities participation time (OR = 0.11, 95% CI: 0.03–0.40, p = 0.001) were both associated with lower blood pressure and lower prevalence of hypertension.

Conclusions: The prevalence of hypertension among adult Tibetan residents was higher than national level, but the control rate was extremely low. Tibetan Buddhist monks, which had lower prevalence of cardiovascular risk factors than general Tibetan residents, was an independent protective factor for hypertension. The unique lifestyle of Buddhist monks (vegetarian diet, Buddhist activities participation) may exert a positive effect.
**Design and Method:** A total of 109 pregnant women with CHT and proper office blood pressure records was included for the study. Visit-to-visit BPV was assessed with office blood pressures of more than 3 visits, three times around 10, 20, and 30 gestational week each, and presented as standard deviation (SD) and coefficient of variation (CV).

**Results:** Twenty-five patients finally developed sPIH. BPV showed gradual decrease during pregnancy in patients without sPIH (SD, 8.3 ± 4.8, 7.2 ± 4.4, 5.8 ± 3.7, p = 0.001; CV, 5.9 ± 3.1, 5.4 ± 3.2, 4.3 ± 2.6, p = 0.002) whereas BPV of patients developed sPIH did not (SD, 9.5 ± 5.2, 7.7 ± 4.6, 8.8 ± 4.9, p = 0.430; CV, 6.7 ± 3.5, 5.5 ± 3.0, 6.3 ± 3.5, p = 0.462). BPV around 30 week was significantly greater in patients with sPIH than those without (SD, p = 0.001; CV p = 0.002) and predicted development of sPIH with area under the curve of 0.678 by CV. Sensitivity and specificity for sPIH with CV ≥5.5 was 60% and 71%. Patients with adverse pregnancy outcome showed greater 30 week BPV among patients with sPIH (SD, 6.7 ± 3.4 vs. 10.7 ± 5.3, p = 0.041; CV, 5.0 ± 2.7 vs. 7.5 ± 3.9, p = 0.067).

**Conclusions:** Thirty week BPV was significantly greater in patients developed sPIH and in patients with complications of sPIH. BPV around 30 week can be a good parameter for pregnancy outcome in patients with CHT.

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**P-31 Blood Pressure Variability in Pregnant Women and Development of Pregnancy Induced Hypertension**

Su A. Kim, Jeong Bae Park

Department of Cardiology, Dankook University Medical College, Republic of Korea

**Objective:** Hemodynamic change during pregnancy accompanies blood pressure change. And, pregnancy induced hypertension (PIH) develops as the adverse effect of that process. We evaluated the relationship of blood pressure variability (BPV) of pregnant women and development of PIH and pregnancy outcome.

**Design and Method:** A total of 4211 pregnant women who showed normal blood pressure before 20 weeks of gestation with proper blood pressure data was included for the study. Visit-to-visit BPV was assessed with blood pressures of more than 3 times of hospital visit around 10, 20, and 30 gestational week and represented as standard deviation (SD) and coefficient of variation (CV). Maternal complication of preterm labor, placenta abruption, anemia, and pulmonary edema was evaluated.

**Results:** BPVs were gradually decreased during pregnancy in women who showed normal blood pressure during pregnancy (7.2 ± 4.2, 6.8 ± 3.9, 6.3 ± 3.6 by SD; 6.4 ± 4.4, 6.0 ± 3.3, 5.5 ± 3.2 by CV). However, BPVs of patients diagnosed as PIH were not decreased during pregnancy and were significantly greater compared to normotensive women (8.2 ± 5.7, 7.6 ± 5.1, 8.2 ± 5.2 by SD; 6.7 ± 4.4, 6.4 ± 4.3, 6.4 ± 4.0 by CV, p 0.001 in all). There was no significant difference of BPV between patients with pre-eclampsia and gestational hypertension. BPV around 30 gestational week was greater in patients who are affected by maternal complications due to PIH among patients with PIH (7.6 ± 4.9 vs. 9.1 ± 5.5, p = 0.001 by SD; 6.0 ± 3.8 vs. 7.0± 4.1, p = 0.001 by CV).

**Conclusions:** BPV was significantly greater in patients with pregnancy induced hypertension and in patients who developed maternal complication of pregnancy among patients with PIH. Fluctuating blood pressure during pregnancy might be another sign of pregnancy complications.
**P-32**

**Comparison between the Effects of Hydrochlorothiazide and Indapamide on the Kidney in Hypertensive Patients Inadequately Controlled with Losartan**

Si Wang  
Department of Cardiology, West China Hospital, China

**Objective:** The aim of the study is to compare the effects of hydrochlorothiazide and indapamide on the kidney in hypertensive patients inadequately controlled with losartan.

**Design and Method:** 140 hypertensive patients meted the criteria and inadequately controlled with losartan 50 mg/d for 2 weeks were randomized to administered with hydrochlorothiazide 12.5 mg/d (n = 70) or indapamide (sustained release) 1.5 mg/d (n = 70) in combination with losartan 50 mg/d. Except for the baseline characteristics, the office blood pressure (BP) were collected at baseline and each follow up visit. Creatinine, urine albumin creatinine ratio (ACR), urine neutrophil gelatinase-associated lipocalin (NGAL) and renal resistive index (RRI) were also collected at baseline and the 24 weeks of follow up.

**Results:** None of the baseline characteristics was statistically significantly different between the two groups. After excluding those patients with office BP uncontrolled in the 4/12 weeks, 46 patients in the hydrochlorothiazide group (45.7% males, 61.5 ±10.8 years) and 44 patients in the indapamide group (38.4% males, 61.5 ±10.9 years) were analyzed. There were insignificant change in creatinine and significant decrease in ACR, NGAL and RRI compared to which at baseline in the two groups. The decrease in ACR (3.8 (0.28,7) vs. 4.2 (0.4,64.8) mg/g) were not significant different between the two groups. The decrease in NGAL (14.92 (-1.68,48.40) vs. 28.40 (-0.43,48.32) ng/ml) and RRI (0.04 (-0.005,0.06) vs. 0.08 (-0.100,0.1250)) were more significant in indapamide group than in hydrochlorothiazide group.

**Conclusions:** Indapamide is superior to hydrochlorothiazide to improve renal tubular injury and renal hemodynamics in combination with losartan in hypertensive patients with BP controlled.

**P-33**

**Measures of Muscle and Fat Mass to Identify Metabolic Abnormalities in Older Korean Adults**

Ji Hye Park, Hyeon Chang Kim, Song Vogue Ahn, Yumie Rhee, Chang Oh Kim  

aDepartment of Public Health, Yonsei University College of Medicine, Republic of Korea; bDepartment of Preventive Medicine, Yonsei University College of Medicine, Republic of Korea; cDepartment of Preventive Medicine, Yonsei University Wonju College of Medicine, Republic of Korea; dDepartment of Internal Medicine, Yonsei University College of Medicine, Republic of Korea

**Objective:** We investigated the sex-specific associations of muscle mass and fat mass with metabolic abnormalities in an older Korean population.

**Design and Method:** We conducted a cross-sectional analysis of baseline data from 2012 and 2014 in the Korean Urban Rural Elderly study. This analysis enrolled 1124 older persons (380 males and 744 females) aged 65 years or older who were free from cancer and cardiovascular disease. Based on bioelectrical impedance analysis, participants were classified as four groups: normal muscle, normal fat (NMNF); low muscle, normal fat (LMNF); normal muscle, high fat (NMHF); low muscle, high fat (LMHF). Metabolic syndrome was based on a harmonized definition with Asian criteria for waist circumference. The associations between muscle mass and fat mass with metabolic syndrome were assessed by logistic regression models, adjusting for age, smoking, drinking, and physical activity.

**Results:** The odd ratios (95% confidence intervals) for metabolic syndrome were 1.72 (0.73 to 4.08), 5.49 (2.46 to 12.25), and 7.49 (4.45 to 12.61) for men in the LMNF, NMHF, and LMHF groups, respectively, compared to men in the NMNF group. In women, the corresponding ORs (95% CIs) for metabolic syndrome were 1.28 (0.74 to 2.21), 3.64 (2.10 to 6.34), and 2.56 (1.82 to 3.61), respectively.

**Conclusions:** Having normal muscle and high fat is associated with metabolic syndrome in older men and women. Low muscle and high fat is more closely associated with metabolic syndrome than normal muscle and high fat only in men.
Harmonization of Laboratory Results by Data Adjustment in Multicenter Clinical Trial

Eun Hee Lee, Sang Gon Lee, Jeong Bae Park, Hyosoon Park

Objective: This investigation was carried out to evaluate CV of laboratory results produced by various measuring methods and to see if mathematical data adjustment could achieve harmonization among methods.

Design and Method: We choose ten representative clinical laboratories for measurement of total cholesterol, HDL-cholesterol, LDL-cholesterol, triglyceride, creatinine and glucose. Serum panel was made with patient samples referred to Green Cross Laboratories (GCLabs). Twenty serum samples for each analyte were prepared, sent frozen and analyzed by each participating laboratory.

Results: All methods for above 6 analytes used by participating laboratories had traceability by reference materials and methods. When results of 6 analytes from 9 laboratories compared with those measured by the methods of GCLabs as reference laboratory, mean CVs. for total cholesterol, HDL-cholesterol, LDL-cholesterol, and glucose that were analyzed by same method in all ten laboratories were 1.7%, 3.7%, 4.3% and 1.7%, respectively, and those for triglyceride and creatinine analyzed by two kinds of methods were in 10 laboratories 4.5% and 4.48%. After adjusting data using linear regression between results of central laboratory and those of each laboratory, each mean CV of 6 analytes decreased 58.6%, 49.0%, 53.5%, 67.8%, 59.3 and 48.3% for total cholesterol, HDL-cholesterol, LDL-cholesterol, triglyceride, creatinine and glucose respectively.

Conclusions: In a multicenter clinical trial, we found better comparable results can be produced by laboratory data harmonization using commutable samples. Therefore, harmonization efforts on laboratory data should be made for the right data analysis.

The Opposite Role of Pin1 and DAPK1 in High Glucose-Induced Vascular Endothelial Senescence

Byeong Mo Kim, Sungha Park

Objective: Given that Pin1 deficiency has been known to be involved in hypertension and that endothelial senescence aggravates hypertension, we aim to study the possible role of Pin1 and DAPK1 in high glucose-induced vascular endothelial senescence.

Design and Method: Human umbilical vein endothelial cells (HUVEC) and human pulmonary aortic endothelial cells (HPAEC) were pre-treated with two Pin1 inhibitors (PiB and AG17724) or DAPK1 inhibitor (DAPK1-i) before high glucose (33 mM) treatment. Effects of inhibitors of Pin1 or DAPK1 on the high glucose-induced endothelial cell growth retardation were measured by MTT and trypan-blue exclusion tests. To investigate the effects of inhibitors of Pin1 or DAPK1 on the high glucose-induced endothelial cell senescence, senescence-associated beta-galactosidase (SA-β-gal) activity was measured. Because cellular senescence is accompanied by G1 phase arrest, cell cycle analysis was also performed. To verify the effects of inhibitors, the functional effects of si-RNAs specific for Pin1 or DAPK1 were assessed using the same experiments.

Results: While PiB and AG-17724 as well as two si-RNAs against Pin1 significantly promoted high glucose-induced growth retardation and senescence, DAPK1-i and si-RNA against DAPK1 attenuated high glucose-induced growth retardation and senescence in both HUVEC and HPAEC. In the matter of the cell cycle analysis, Pin1 inhibition using the pharmacological inhibitors or si-RNAs augmented high glucose-induced G1 phase arrest, but DAPK1 inhibition using the inhibitor or a si-RNA had inhibitory effects.

Conclusions: Together with previous findings that DAPK1 inhibits Pin1 function by phosphorylating Ser71 of Pin1; our results suggest that DAPK1 might be implicated in high glucose-induced vascular senescence through Pin1 inhibition.
P-36
Relation between Exercise Cardiac Power and Arterial Stiffness

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Sae Young Jea
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Objective: Low exercise cardiac power (ECP), defined as a ratio of peak oxygen consumption with peak systolic blood pressure during exercise, is associated with an increased risk of cardiovascular events and mortality, but the underlying mechanisms remain unclear. Arterial stiffness as a surrogate marker of subclinical atherosclerosis is associated with an increased risk of cardiovascular outcomes. We examined whether the low ECP is related to arterial stiffening, independent of coronary risk factors.

Design and Method: We evaluated 823 Korean men (age 53 ± 6 yrs, range 40–72 yrs) who participated in a health screening program that included measures of arterial stiffness and peak or symptom-limited cardiopulmonary exercise testing. We measured brachial ankle pulse wave velocity (baPWV) using a volume-plethysmographic apparatus and advanced baPWV was defined as dichotomous variable of baPWV 75th percentile. ECP was calculated by a ratio of peak oxygen consumption with peak systolic blood pressure and classified into quartiles.

Results: ECP was negatively correlated with baPWV (r = -0.44, p < 0.001). The advanced baPWV was inversely associated with ECP quartiles (Q1 (lowest, 16) 50.5%, Q2 26.4%, Q3 17.2%, and Q4 (highest, 20.1) 8.6%; P < 0.001 for trend). Participants in the lowest quartile of ECP were 4.71 times (95% CI: 2.52–8.81; P < 0.001) more likely to have advanced baPWV than their counterparts in the highest quartile of ECP after adjusting for age, BMI, SBP, TC, HDL-C, TG, hsCRP, glucose, heart rate, smoking, hypertension and diabetes. Each ECP unit increment as a continuous variable was associated with 19% (OR 0.81, 95% CI 0.75–0.87) decreased advanced baPWV after adjusting for potential confounders.

Conclusions: Our findings demonstrate that lower levels of ECP are associated with arterial stiffening, which could contribute to increased risk of cardiovascular events.

P-37
Dietary Acid Load Is Associated with the Increased Risk of Cardiovascular Disease Independently of Obesity and Insulin Resistance: Nationwide Surveys (KNHANES 2008–2011)

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Objective: A western diet is associated with the increased prevalence of cardiometabolic diseases. Dietary patterns determine acid-base status, which recently has been reported to increase hypertension and diabetes incidence. However, the association between dietary acid load and cardiovascular (CVD) risk in general population has not been fully investigated.

Design and Method: This was a population-based, cross-sectional study using 11,601 subjects from the KNHANES 2008–2011. Individual’s CVD risk was evaluated using atherosclerotic cardiovascular disease (ASCVD) risk equations. Acid-base status was assessed with both the potential renal acid load (PRAL) and the dietary acid load (DAL) score derived from nutrient intakes.

Results: Individuals with the highest PRAL tertile had a significant increase in ASCVD risks (10.1 vs. 8.3, P = 0.01) and tended to belong to the high risk group compared to those with the lowest PRAL tertile (OR = 1.43, 95% CI = 1.30–1.58). Higher PRAL was linked to greater hypertension prevalence (OR = 1.16, 95% CI = 1.05–1.29). After stratification, non-obese subjects with higher PRAL had similar ASCVD risks in that of obese group with the lowest PRAL tertile. In addition, the lowest PRAL individuals who did not exercise showed comparable ASCVD risks with higher PRAL group who regularly exercised. The association between PRAL and ASCVD risk was stronger among non-sarcopenic subjects (OR = 1.17, 95% CI = 1.06–1.30). This association was still significant in multiple logistic regression models (OR = 1.37, 95% CI = 1.08–1.74). Similar trends were observed with the DAL scores.

Conclusions: Diet-induced acid load was associated with increased risks of CVD independent of hypertension or diabetes. In addition, the effect of dietary pattern on CVD risk was maintained after stratification with the status of obesity and exercise, but not sarcopenia.
P-38
Sleep Duration and Chronic Kidney Disease
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Objective: Sleep duration can have diverse health effects. However, only a few studies have suggested that sleep quantity could influence on kidney function. The objective of this study was to investigate the association of sleep duration with chronic kidney disease (CKD) in middle-aged Korean population.

Design and Method: This cross-sectional analysis was conducted for total of 1360 participants (544 men and 816 women aged 36–88 years) who completed baseline health examination for the Korean Genome and Epidemiologic Study (KoGES)-Kangwha study in 2010–2011. Sleep habits were measured by interviewer-assisted questionnaire. Sleep duration was calculated based on the number of hours per day participants had slept over the past 1 year. CKD was defined as either proteinuria or the estimated glomerular filtration rate (eGFR) 60 mL/min/1.73 m². Multiple logistic regression models were used to examine independent association between sleep duration and CKD.

Results: Women with very long sleep duration (≥9 hours/day) had significantly increased odds for having high serum creatinine (odds ratio 2.936, 95% confidence interval 1.176–7.326), low eGFR (3.320, 1.372–8.034), and CKD (3.112, 1.315–7.363) compared those with usual sleep duration (7–8 hours/day) after adjusting for socio-demographic status, socio-economic status, health behaviors, comorbidities, and sleep quality. For one hour increase of sleep duration per day, there was a 24.6% increment for women in the presence of CKD (1.246, 1.019–1.523). However, among men, sleep duration was not significantly associated with CKD before and after adjustment for covariates.

Conclusions: Very long sleep duration was independently associated with higher prevalence of CKD among middle-aged Korean women. In addition, gender may influence this association.

P-39
Association between Vitamin D Status and Asymmetric Dimethylarginine (ADMA) Level in the Korean Elderly Population
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Objective: Vitamin D deficiency has been reported to be associated with the risk of cardiovascular disease. We aimed to investigate the relationship between vitamin D status and endothelial dysfunction, evaluated by asymmetric dimethylarginine (ADMA) level, among the Korean elderly population.

Design and Method: This cross-sectional study was conducted for 269 men and 382 women, aged 45 to 95 years old, living in a rural community of Korea. The data was from the Korean Social Life, Health, and Aging Project (KSHAP) which is a population-based longitudinal study of health determinants among elderly Koreans. All participants completed a baseline health examination. We divided vitamin D status into three groups by measuring serum 25-hydroxyvitamin D [25(OH)D] levels; normal (≥30 ng/mL, n = 25), insufficiency (10≤–30 ng/mL, n = 110), deficiency (10 ng/mL, n = 110). As a marker of endothelial dysfunction, ADMA level was assayed by high-performance liquid chromatography. The association between vitamin D status and ADMA was analyzed by multiple linear regression.

Results: Mean ADMA level was significantly higher in people with vitamin D insufficiency (0.665 μmol/l, p = 0.001) and vitamin D deficiency (0.734 μmol/l, p = 0.001), compared to normal vitamin D group (0.589 μmol/l). Even after adjusting for age, sex, body mass index, blood pressure, fasting glucose and insulin, total cholesterol, HDL cholesterol, eGFR, smoking, and drinking, ADMA levels were higher in vitamin D insufficiency (β = 0.0749 μmol/l, p = 0.001) and deficiency (β = 0.1431 μmol/l, p = 0.001) compared to normal vitamin D group. In a sex-stratified analysis, vitamin D deficiency was associated with higher ADMA level both in women (p = 0.001) and men (p = 0.007) while vitamin D insufficiency was associated with higher ADMA level only in women (p = 0.001) but not in men (p = 0.632).

Conclusions: Our findings suggest that low serum 25(OH)D levels may be associated with the risk of endothelial dysfunction in elderly Korean people.
P-40
Prognostic Impact of Corrected Qt Interval in Acute Heart Failure Patients: An Analysis from the Korean Acute Heart Failure (KorAHF) Registry
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Objective: Prolonged corrected QT (QTc) interval has been reported as poor prognosticators in various populations. This study sought to investigate the predictive value of QTc interval in patients hospitalized due to acute heart failure syndrome.

Design and Method: In this prospective cohort study, we consecutively recruited 5,625 hospitalized patients who diagnosed with acute heart failure from January 2011 to February 2014. Of these, 5,113 subjects were analyzed whose QTc interval was measured as ≥350 msec in 12-lead electrocardiogram and who had no history of malignant neoplasm. QTc interval was classified as follows: normal (350–439 msec), prolonged (440–479 msec), and longest (≥480 msec) group.

Results: Baseline characteristics were similar among the groups. In Kaplan-Meier survival analysis, longest QTc group showed significantly higher mortality than prolonged group (p = 0.008). In contrast, there were no significant difference between normal group and longest group (p = 0.355) and between normal group and prolonged group (p = 0.206). Interestingly in multivariate Cox regression analysis, mortality was significantly greater not only in longest group (adjusted hazard ratio [HR] 1.122, 95% CI 1.004–1.253), but also in normal group (HR 1.156, 95% CI 1.09–1.323) when compared to prolonged group. This U-shaped association was also observed when evaluated by multivariable fractional polynomials analysis.

Conclusions: In patients admitted to hospital diagnosed with acute heart failure syndrome, QTc interval was an independent predictor of overall death. In multivariate analysis, patients with QTc interval between 440–479 msec showed better prognosis, while patients whose QTc interval were longer or shorter demonstrated higher mortality.

Fig. 1. (for Abstract P-40).

P-41
The Association between Parameters of Socioeconomic Status and Hypertension in Korea: The Korean Genome and Epidemiology Study
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Objective: We investigated the association between socioeconomic status and hypertension in Korea, a country that has experienced a dynamic socioeconomic transition.

Design and Method: We analyzed participants of a prospective cohort study the Korean Genome and Epidemiology Study enrolled between 2001 and 2003. We recruited 7,089 subjects who underwent a 4-year follow up till 2007. Education and income levels, which are important parameters for socioeconomic status, were stratified into 4 groups. Education level was defined as short (≤6 years), mid-short (7–9 years), mid-long (10–12 years), and long (≥12 years). Social monthly income level was stratified as low (<500,000), mid-low (>500,000–1,499,999), mid-high (>1,500,000–2,999,999) or high (>3,000,000).
Results: At baseline, 2,805 subjects (39.5%) were diagnosed with hypertension. Education and income levels were inversely associated with the prevalence and incidence of hypertension (P 0.001). In multivariate analysis, a shorter duration of education was significantly associated with a higher prevalence of hypertension (P 0.001), but income level was not (P = 0.305). At follow-up, 605 subjects (14.2%) were newly diagnosed with hypertension. In multivariate adjusted analysis, the hazard ratios (95% confidence interval) for incident hypertension across the longer education groups were 0.749 (0.544–1.032), 0.639 (0.462–0.884), and 0.583 (0.387–0.879), compared with the shortest education group. There was no significant association between incident hypertension and income across higher income groups: 0.988 (0.714–1.366), 0.780 (0.542–1.121), and 0.693 (0.454–1.056), compared with the lowest income group.

Conclusions: In conclusion, education and income levels were associated with the prevalence and incidence of hypertension; however, only education was an independent prognostic factor.

Fig. 1. (for Abstract P-41).

P-42
A Prospective Study of Sleep Duration and Incident Hypertension in Korean Adults: KoGES-ARIRANG Study
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Objective: Several large studies have demonstrated that sleep duration is an important risk factor for elevating blood pressure. Among them, few are cross-sectional in nature and other showed inconsistent results. Therefore our aim of this prospective study was to evaluate sleep duration as a potential risk marker for the development of hypertension after 2.6 years of follow-up.

Design and Method: Our study participants comprised of 1,726 Korean adults aged 40–70 years. The participants were without hypertension at baseline (2005–2008) and follow-up (2008–2011) to determine the incident cases of hypertension. Based on a self-reported questionnaire, the individuals were stratified according to their total sleep duration (6 h, 6–7.9 h,
Hypertension was defined according to the Eighth Joint National Committee (JNC-8) guidelines.

Results: After an average of 2.6 years of follow-up, 164 (9.5%) participants developed hypertension. Participants with incident cases of hypertension had significantly higher baseline age, weight, waist circumference, body mass index, systolic blood pressure, diastolic blood pressure, mean arterial pressure, triglyceride, total cholesterol, low-density lipoprotein than participants who did not develop hypertension. Higher income participants were a lower risk of developing hypertension compared to the low-income group. In multivariate adjusted models, the odd ratio for new onset hypertension was 1.712 (95% CI: 1.014–2.890) in participants with short sleep duration when compared to 6 to 7.9 h of sleep. Long sleep hours did not show any significant difference for incident hypertension.

Conclusions: Short sleepers were independently associated with higher risk of developing hypertension in middle-aged and elderly Korean adults.

P-43
Reactive Hyperemia Index Using Cuff Volumetric Method as a Parameter Representing Endovascular Dysfunction and Cardiovascular Risks
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Objective: Either peripheral or coronary microvascular dysfunction is associated with cardiovascular risk factors and a poor cardiovascular prognosis. Whereas coronary microvascular dysfunction has unclear and complex diagnosis, peripheral vascular dysfunction can be evaluated by simple and non-invasive methods. We investigated peripheral vascular function with Reactive Hyperemia Index (RHI) using newly devised pulse volume plethysmography (Multitab, Unetix, USA) in general population and compared the results with flow mediated dilatation (FMD).

Design and Method: A total of 35 participant (38.3 ± 10.4 years) underwent reactive hyperemia test and FMD. Pulse volume changes were evaluated using radial cuff at baseline and after brachial artery occlusion for 5 minutes in the non-dominant arm and amplitudes were analyzed by off-line software. RHI was defined as the ratio of two mean amplitudes. FMD was evaluated during the reactive hyperemia test at the same time on the same arm.

Results: Mean RHI was 1.42 ± 0.73. It was not different between men and women (0.98 ± 0.37 vs. 1.49 ± 0.75, p = 0.088) and presence of hypertension under medical intervention (1.22 ± 0.48 vs. 1.44 ± 0.79, p = 0.465), however, obese patients showed significantly lower RHI (1.14 ± 0.44 vs. 1.57 ± 0.81, p = 0.040). And, RHI was not related with age (r = 0.033, p = 0.821) and systolic blood pressure (r = −0.200, p = 0.158), however, FMD showed significant correlation with RHI (r = 0.436, p = 0.004) and such relation was not changed even after sex, age, systolic blood pressure and body mass index were adjusted (beta = 0.428, p = 0.008, 95% confidence interval 0.013–0.081).

Conclusions: Although RHI was not sensitively decreased with the cardiometabolic risk factors, it showed numeric change in small population with low cardiovascular risk. And, RHI was significantly related with the parameter representing endothelial dysfunction. Larger scale study with high cardiovascular risk may support its possibility as a parameter evaluating endothelial function and cardiovascular risks.

P-44
Low Levels of Low Density Lipoprotein Cholesterol and Mortality Outcomes
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Objective: The effect of low concentrations of low density lipoprotein-cholesterol (LDL-C) on cancer and cardiovascular mortality is controversial. In a large, young, well characterized, relatively healthy occupational cohort, we tested associations between low levels of LDL-C concentration, and CVD, cancer and all-cause mortality.

Design and Method: All subjects treated with any lipid lowering therapy were excluded. Six groups were defined according to baseline LDL-C concentration (70, 70–100, 100–130, 130–160, 160–190, 190 mg/dl). The third LDL-C group, was the reference group and hazard ratios (HR and 95% CIs) for CVD, cancer and all-cause mortality were estimated using Cox proportional hazards models.

Results: 2028 deaths (897 from cancer and 282 from CVD) occurred during follow-up. In the lowest LDL-C group, the HR (95% CIs) for men and women respectively were: for CVD mortality HR 2.06 (1.14,3.74) and HR 2.36 (0.87,2.69); cancer mortality HR 2.26 (1.62,3.15) and HR 1.40 (0.74,2.64); and for all-cause mortality HR 2.15 (1.72,2.69) and HR 1.54 (1.01,2.35), adjusted for age, body mass index, alcohol intake, regular exercise, educational level, high density lipoprotein cholesterol, concentration, history of hypertension, diabetes and CVD. Sensitivity analyses showed that if the following subjects were excluded (with diabetes, prior evidence of CVD, or dying within the first three years of follow up), the results were very similar.

Conclusions: Low levels of LDL-C concentration are strongly and independently associated with increased all cause mortality in men and women; and CVD and cancer mortality in men with similar trends in women.
P-45
Mortality and Obesity Without Baseline Metabolic Syndrome Components in Korean Cohorts

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Objective: Increasing evidence suggests that underweight and obesity are associated with increased and decreased mortality, respectively. The aim was to investigate associations between underweight, overweight and obesity (defined by BMI categories) and all cause, cancer and cardiovascular disease (CVD) mortality, excluding subjects with known cardiovascular disease (CVD), diabetes, hypertension and components of the metabolic syndrome (MetS) at baseline.

Design and Method: The study population consisted of examinees participating in a health screening in Korea. The outcomes were all cause mortality, cancer and cardiovascular disease (CVD) mortality (International Classification of Diseases, 10th revision). Cox proportional hazards models were used to estimate adjusted hazard ratios (HR), 95% confidence intervals (CIs), for mortality outcomes, comparing the BMI categories with the normal weight BMI reference group. Fine and Gray proportional sub-distribution hazards regression analysis was also used to model CVD- and cancer-mortality while treating any other causes of death as a competing risk.

Results: The mean age at baseline was 36.9 years. There were 436 deaths during follow up. Mean (SD) age at baseline of subjects who died during follow up was 46.3 (13.1) years. For men and women together, the fully adjusted HR for underweight and all cause mortality was 1.53 (95% CIs 1.06–2.20). In contrast, the fully adjusted HR for overweight/obesity combined and all cause mortality was 0.77 (95% CIs 0.63–0.95). The association between overweight/obesity and all cause mortality was similar for men and women considered separately and for overweight and obesity as separate BMI categories. Smoking did not explain the increased HR in the underweight BMI category. Subgroup analyses showed that in the underweight BMI category, smoking did not explain the increased HR. For cancer and CVD mortality, there were not significant associations between BMI group and mortality.

Conclusions: In a young metabolically healthy adult cohort, underweight was associated with increased all cause mortality and overweight/obesity was associated with decreased all cause mortality if cardiovascular disease (CVD), diabetes, hypertension and components of the metabolic syndrome (MetS) are excluded.

P-46
High Cardiorespiratory Fitness Attenuates Carotid Arterial Stiffening in Women with the Metabolic Syndrome

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Objective: To test the hypothesis that high cardiorespiratory fitness is associated with slower progression of early carotid arterial stiffening in women with the metabolic syndrome (Mets).

Design and Method: This study was analyzed using the 2014–2015 adults (aged 19–64 years) samples of Korea. Table 1. Mean carotid arterial stiffness markers according to cardiorespiratory fitness categories in women with and without the metabolic syndrome (for Abstract P-46)

<table>
<thead>
<tr>
<th>Table 1. Mean carotid arterial stiffness markers according to cardiorespiratory fitness categories in women with and without the metabolic syndrome (for Abstract P-46)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metabolic syndrome</td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td>unfit fit</td>
</tr>
<tr>
<td>n</td>
</tr>
<tr>
<td>cIMT (mm)</td>
</tr>
<tr>
<td>β</td>
</tr>
<tr>
<td>bPWV (cm/s)</td>
</tr>
<tr>
<td>AC (mm²/kPa)</td>
</tr>
</tbody>
</table>

Unfit = Under cut-off value; Fit = over cut-off value; cIMT = carotid intimal-media thickness; β = β stiffness parameter; bPWV = brachial-ankle pulse wave velocity; AC = arterial compliance.

1 Adjusted for age and systolic blood pressure. * Significantly different from unfit/Mets. ** Significantly different from fit/Mets. †Significantly different from unfit/healthy. ††Significantly different from fit/healthy.
P-47
Association between HbA1c and Carotid Atherosclerosis among Elderly Koreans with Normal Fasting Glucose
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\textsuperscript{a}Department of Public Health, Yonsei University Graduate School, Republic of Korea; \textsuperscript{b}Department of Preventive Medicine, Yonsei University College of Medicine, Republic of Korea; \textsuperscript{c}Department of Internal Medicine, Yonsei University College of Medicine, Republic of Korea

Objective: We examined whether glycated haemoglobin (HbA1c) was associated with carotid atherosclerosis in a community-dwelling elderly Korean population with normal fasting glucose.

Design and Method: Using data from the Korean Urban Rural Elderly study, we conducted a cross-sectional analysis of 1,133 participants (335 men and 798 women) with a mean age of 71.8 years. All participants had a fasting blood glucose less than 100 mg/dl (5.6 mmol/l) and a HbA1c level below 6.5% (48 mmol/mol). They were also free from a history of cardiovascular disease, known diabetes or use of anti-diabetes medications. Carotid atherosclerosis was assessed by intima-media thickness (IMT) and number of plaques using ultrasonography. The relationship of HbA1c with carotid IMT and plaques was investigated using multiple linear regression analysis.

Results: HbA1c levels were independently and positively associated with carotid IMT ($\beta = 0.02$, $p = 0.042$) and number of plaques ($\beta = 0.81$, $p = 0.021$) after adjusting for sex, age, body mass index, systolic blood pressure, diastolic blood pressure, triglyceride, LDL cholesterol, smoking and alcohol intake. However, fasting insulin and glucose levels were not associated with carotid IMT or plaque number.

Conclusions: HbA1c levels were positively associated with carotid atherosclerosis, as measured by carotid IMT and plaques, in an elderly population with normoglycemia. Our study suggested that higher HbA1c levels may contribute to carotid atherosclerosis among older adults with normal fasting glucose.

P-48
The Clinical Significance of Arterial Stiffness and Cardiovascular Risk Factors in Vestibular Neuritis
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Objective: To investigate the clinical significance of cardiovascular factors, including arterial stiffness and metabolic syndrome score in the development of vestibular neuritis.

Design and Method: Fifty two adult patients with vestibular neuritis and 45 age- and sex-matched controls were evaluated between January 2015 and January 2016. Arterial stiffness was assessed from brachial-ankle pulse wave velocity (baPWV), and other cardiovascular markers including metabolic syndrome scores, blood pressure, body mass index, and lipid profiles were determined. Patients completed the dizziness handicap inventory (DHI) and underwent vestibular function tests including caloric test and video head impulse test. The correlation between cardiovascular factors and clinical parameters had been assessed.

Results: BaPWV, metabolic syndrome scores and blood pressure were higher in the vestibular neuritis group than in...
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P-47

Effect of Cardiovascular Risk Factors on Vestibular Neuritis and Metabolic Syndrome Score

the control group (p = 0.002, p = 0.001, p = 0.001, respectively), whereas comorbidity, anthropometric characteristics, and lipid profiles did not show the significant difference. In addition, baPWV or metabolic syndrome score were not correlated with clinical parameters of DHI scores, canal paresis and spontaneous nystagmus duration.

Conclusions: Higher baPWV, representative of arterial stiffness and higher metabolic syndrome score were associated with the development of vestibular neuritis, which explains the hypothesis of a vascular etiology of this disease. However, cardiovascular risk factors had limited value in predicting the clinical course of vestibular neuritis.

Table 1. Association of HbA1c and carotid IMT or number of plaque (for Abstract P-47)

<table>
<thead>
<tr>
<th></th>
<th>Carotid IMT, mm</th>
<th></th>
<th>Plaque, number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>unadjusted β</td>
<td>p value</td>
<td>β*</td>
</tr>
<tr>
<td>Total (n = 1,133)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex, male</td>
<td>-0.03</td>
<td>&lt;0.001</td>
<td>-0.03</td>
</tr>
<tr>
<td>Age, 10 years</td>
<td>0.04</td>
<td>&lt;0.001</td>
<td>0.02</td>
</tr>
<tr>
<td>BMI, kg/m²</td>
<td>&lt;0.01</td>
<td>0.006</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>HbA1c, %</td>
<td>0.03</td>
<td>0.009</td>
<td>0.02</td>
</tr>
<tr>
<td>Systolic blood pressure, 10 mm Hg</td>
<td>0.01</td>
<td>&lt;0.001</td>
<td>0.02</td>
</tr>
<tr>
<td>Diastolic blood pressure, 5 mm Hg</td>
<td>&lt;0.01</td>
<td>0.527</td>
<td>-0.01</td>
</tr>
<tr>
<td>Triglyceride, g/dl</td>
<td>0.13</td>
<td>0.011</td>
<td>0.12</td>
</tr>
<tr>
<td>LDL cholesterol, g/dl</td>
<td>0.29</td>
<td>0.007</td>
<td>0.35</td>
</tr>
<tr>
<td>HOMA-IR (logarithmic)</td>
<td>&lt;0.01</td>
<td>0.794</td>
<td>-0.01</td>
</tr>
<tr>
<td>Mean (n = 335)</td>
<td></td>
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<tr>
<td>Age, 10 years</td>
<td>0.05</td>
<td>&lt;0.001</td>
<td>0.04</td>
</tr>
<tr>
<td>BMI, kg/m²</td>
<td>&lt;0.01</td>
<td>0.065</td>
<td>0.01</td>
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<tr>
<td>HbA1c, %</td>
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<td>0.012</td>
<td>0.03</td>
</tr>
<tr>
<td>Systolic blood pressure, 10 mm Hg</td>
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<td>0.01</td>
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<tr>
<td>Diastolic blood pressure, 5 mm Hg</td>
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<td>0.049</td>
<td>-0.01</td>
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<tr>
<td>Triglyceride, g/dl</td>
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<td>0.217</td>
<td>0.10</td>
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<tr>
<td>LDL cholesterol, g/dl</td>
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<td>0.449</td>
<td>0.16</td>
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<tr>
<td>HOMA-IR (logarithmic)</td>
<td>&lt;0.01</td>
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<td>-0.02</td>
</tr>
<tr>
<td>Women (n = 798)</td>
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<tr>
<td>Age, 10 years</td>
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<td>&lt;0.001</td>
<td>0.02</td>
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<tr>
<td>HbA1c, %</td>
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<td>Systolic blood pressure, 10 mm Hg</td>
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<td>Diastolic blood pressure, 5 mm Hg</td>
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* Adjusted for smoking, alcohol consumption and other variables in the table.

P-49

Effect of Heavy Metals Exposure during Gestation on Behavior and Neurotransmitter Content of Rat Offspring Brain

Mridul Mishra, Versha P.

Department of Pharmaceutical Sciences, SBS PG Institute of Bio-Medical Sciences, India

Objective: This study was to study the effects of various heavy metals exposure during the gestation on the behaviour and the brain neurotransmitter content in rat offspring. Nervous system is a target for heavy metals. Aluminium, arsenic, lead, mercury, and etc are well known for their neurological and behavioral effects. Developing nervous system is extremely susceptible to damage by heavy metals.

Design and Method: Experimental Female rats were treated with sublethal doses of heavy metals (Aluminium, Mercury, Cadmium, Lead) in drinking water during gestational period (3 weeks) while control group were given tap water throughout the experiment. In this study, 10 male
offspring of each group were used. After open field-test and elevated plus-maze test (17-weeks old), the rats were sacrificed. The brains were micro dissected, and each region was deproteinized. The content of neurotransmitters (acetylcholine) was measured by HPLC.

**Results:** In an open field-test, the group of heavy metal treated offspring showed low nocturnal motor activity. In addition, this group tended to spend longer time on the open arm in the elevated plus-maze test. The content of noradrenaline and serotonin increased in the frontal cortex.

**Conclusions:** Our results indicate that exposure to heavy metals during gestation and lactation leads to an imbalance of neurotransmitters and may affect behaviour in the brain of offspring.

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**P-50**

**The Association of Personality Traits with Dipping or Non-Dipping Blood Pressure Patterns during Nighttime in the Patients with Suspected Hypertension**

Batzaya Shinebayar, Sang Min Park, Kyung Soon Hong

Department of Cardiology, Chuncheon Sacred Heart Hospital, Republic of Korea

**Objective:** It is well known that the relationship between blood pressure variability such as dipping or non-dipping pattern during night time on 24-hour ambulatory blood pressure (BP) monitoring (ABPM) and associated cardiovas-
cicular events. However, scarce data are available on the influence of psychological aspects on dipping patterns during night time. This study aimed to evaluate the affecting factors on dipping or non-dipping pattern systematically. Especially, we intended to identify association of personality traits or characteristics between patients with dipping and non-dipping pattern using self-reporting symptom checklist called Symptom Checklist (SCL)-90-R in this study.

Design and Method: From April 2013 to April 2014, consecutive four hundred twenty eight patients (216 men and aged with 54.89 ± 13.36 years) who are suspected to have hypertension in office BP (WatchBP Home, Microlife, Swiss) were completed to ABPM (Mobil-O-Graph, IEM GmbH, Germany) and enrolled to Hallym University Chuncheon Sacred Heart Hospital ABPM registry. Dipping pattern during night time were classified to dipping, non-dipping, reverse dipping, and extreme dipping according to the % difference of systolic average BP between the day- and nighttime. All comers who underwent ABPM were also completed the SCL-90-R which consist of questionnaires about Anxiety and eight personality factors.

Results: Of 428 patients, the number of patients with dipping, non-dipping, reverse dipping, and extreme dipping was 155 (36.2%), 194 (45.3%), 40 (9.3%), and 39 (9.1%) respectively. Non-dipping patterns are more frequently observed in the patient with advanced age (p = 0.011), extreme low weight or normal weight than overweight or obesity (p = 0.003), and uncontrolled daytime systolic hypertension estimated by ABPM (p = 0.040) despite of nighttime BP. However, there is no difference of distribution of non-dipping pattern according to sex, smoking, tranquilizer medication, and underlying medical history including diabetes, dyslipidemia, kidney, and lung disease. In addition, the personality traits estimated by SCL-90R are not significantly associated with dipping or non-dipping pattern as follows: somatization (score: 7.80 ± 7.12, p = 0.97), obsessive-compulsive (7.04 ± 5.98, p = 0.40), interpersonal sensitivity (4.66 ± 5.02, p = 0.79), depression (8.73 ± 8.88, p = 0.54), anxiety (5.11 ± 6.12, p = 0.60), hostility (2.54 ± 3.44, p = 0.51), phobic anxiety (1.64 ± 2.73, p = 0.68), paranoid ideation (1.88 ± 2.77, p = 0.93), and psychoticism (2.66 ± 4.05, p = 0.94).

Conclusions: Our study shows that there is no significant relationship between personality traits and dipping or non-dipping BP patterns during night time in the patient with suspected hypertension.

Effect of Syzygium Cumini (Jambolan) Extract on Spatial Learning and Memory of Aging Rats
Vinod Kumar

Indian Institute of Maize Research, Research and Development, India

Objective: Antioxidants help to inhibit oxidative damage caused by free radicals, a process that occurs in numerous brain related diseases. Jambolan extract have been extensively studied for a broad range of antioxidative activities. Therefore, the effects of the jambolan extract on learning and memory of aging rats were investigated.

Design and Method: 18 months old male wistar rats (n = 32) were orally administered with vehicle, jambolan extract (JE) treated (500 mg/kg/day) or vitamin E (40 mg/kg; positive control) for 28 days. The learning and memory performance were monitored using Morris water maze (from day 21 to 30). All rats received four trials per day. On the last training day, all rats were tested in the probe trial.

Results: Vitamin E and the JE exhibit significant enhancement in memory, as shown by decrease in escape latency time, compared with day 1 (p 0.05). The number of entries to the target quadrant of vitamin E and the JE group were higher, but not significantly different, than the control. Furthermore, Vitamin E and the JE (500 mg/kg) increased, but not significantly different, the time spent in the target quadrant during probe trial, indicating retention of spatial memory of the location of a previously placed platform in the target quadrant.

Conclusions: These findings indicate that JE has potential to improve age-related spatial memory impairment, which might be by virtue of its antioxidative activities. The exact mechanism of action remains unknown and need further extensive study.

NAFLD Hepatic Steatosis and Significant Liver Fibrosis Are Associated with Incident Chronic Kidney Disease Over 10 Years in the Korean Genome and Epidemiology Study (KoGES)
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Department of Internal Medicine, Yonsei University Wonju College of Medicine, Republic of Korea

Objective: Accumulating evidence suggests that non-alcoholic fatty liver disease (NAFLD) is linked to an increased risk for chronic kidney disease (CKD). However, a long-term follow up data for showing the association between hepatic steatosis, liver fibrosis and incident CKD is lacking. We investigated whether NAFLD, as assessed by the fatty liver index (FLI), could predict the development of CKD in a 10-year popu-
lation-based longitudinal study. In addition, we also assessed whether significant liver fibrosis is associated with incident CKD.

**Design and Method:** Data of 6,238 adults aged 40 to 69 years without baseline CKD from the Ansan – Ansung cohort examined. An equation was used to calculate fatty liver index and classify patients as follows: fatty liver index ≥30, NAFLD; fatty liver index ≥60, NAFLD; and 30≤ fatty liver index 60, intermediate fatty liver index. Degree of liver fibrosis was assessed by NAFLD fibrosis score (NFS), FIB-4, BARD score and Forns index. Incident CKD was defined as eGFR 60 ml/min per 1.73 m².

**Results:** During an average of 10 years of follow-up, 765 subjects (15.57%) developed CKD. After adjustment for confounding factors, the odds ratio [95% confidence interval] for the incident CKD increased in a graded manner with FLI increased (30 vs. 30–59 vs. ≥60= 1 vs. 1.16 [0.94–1.43] vs. 1.48 [1.12–1.95], respectively, P for trend = 0.0188). In subjects with NAFLD (assessed by FLI≥30), significant liver fibrosis assessed in fibrosis prediction models (NFS, FIB-4, BARD score and Forns index) was associated with incident CKD (odds ratio = 1.55–5.64, all P 0.05).

**Conclusions:** Hepatic steatosis and liver fibrosis assessed by noninvasive models were independently associated with incident CKD.

**P-53**

**Significant Association of Arterial Stiffness with Coronary Calcification**

Satoru Sakuragi, Kenta Ichimiya
Department of Iwakuni Clinical Center, Cardiovascular Medicine, Japan

**Objective:** Coronary artery calcification (CAC), which is a marker of coronary artery disease, is associated with incidence of cardiovascular (CV) event. In this study, we evaluated the association of CAC with pulse wave velocity (PWV), which is a marker of arterial stiffness.

**Design and Method:** 758 patients (68 years, 364 males) without history of CV disease were enrolled in this study. All patients underwent MDCT and CAC score was calculated with Agatston method. PWV was measured between brachial and ankle (baPWV). Patients were divided into four groups according to CAC score (0–10, 10–100, 100–400, over 400).

**Results:** The baPWV increased with CAC score (p 0.0001). In univariable linear regression analysis, baPWV was associated with log (CACscore+1) (r = 0.396, p 0.0001). In multivariable linear regression analysis, baPWV was significantly associated with log (CACscore+1) (β = 0.001, p = 0.0027). Age, gender and HbA1c were also associated with CAC score. The association between baPWV and CAC score was still significant when we analyzed limited to elderly patients over 65 years of age (p = 0.0003), whereas there was no significant association between baPWV and CAC score in non-elderly patients below 65 years.

**Conclusions:** Arterial stiffness was associated with coronary artery calcification; however this association was different between age groups.

**P-54**

**Assessment of Serum Vitamin D Levels in Patients with Acute Multiple Sclerosis**

Vikas Sharma, S. Sharma
Department of Biochemistry, UCMS, India

**Objective:** Multiple sclerosis (MS), a demyelinating disease has Vitamin D deficiency as one of the risk factors. Vitamin D plays important role in both immune and nervous system. Our objective is to estimate the level of vitamin D in serum of patients suffering from acuteMultiple sclerosis.

**Design and Method:** Patients with definite MS following acute relapse within 10 days of attack or clinically isolated syndrome following the first attack were included. The diagnosis of Multiple sclerosis was done based on Mcdonald criteria. Those patients with duration ofillness more than 10 days and those who had steroid therapy or Vitamin D or calcium supplements earlier were excluded. Serum vitamin D level was measured by electrochemiluminescence immune assay method. Results obtained were compared using statistical analysis.

**Results:** The study group included 29 patients with 21 definite MS and 8 CIS patients; Meanage 35; 17 females and 12 males. The control group included 19 patients with Mean age35.29; 12 females and 7 males. Serum Vitamin D levels in study group ranged between 4.2 ng/dl to 28 ng/dl with a Meanlevel of 10.2 ng/dl. Vitamin D levels in controls specimens was between 4.5 ng/dl and 29.6 ng/dl with a Mean level of 21.3 ng/dl. Hence a significant difference in Vitamin D levels was observed.

**Conclusions:** Significantly lower levels of serum Vitamin D is found in patients sufferingfrom with Acute Multiple Sclerosis. Further detailed studies are needed.

**P-55**

**Correlation among DNA Methylation Status and Line-1**

Somnath Mukherjee, Deepak Sharma, K.C. Upadhyaya
SLS, JNU, India

**Objective:** LINE 1 is an autonomous, non-LTR retrotransposon and the L1 retrotransposons constitute around 17%, of the human, mouse and rat genomes respectively. Under normal physiological conditions, the retroelements remain by
Rolipram, a specific inhibitor of the phosphodiesterase IV (PDE IV), has recently been shown to exert neuroprotective effects in patients with essential hypertension (EHT), idiopathic hyperaldosteronism (IHA), and experimental Parkinsonism (EPT). In the present study, we tested neuroprotective effects of rolipram against dopaminergic neuron degeneration, suggesting that PDE IV inhibitors might be a potential treatment for Parkinson’s disease.

**Results:** There was no significant change in the expression of L1Rn in various brain regions of 2 month old and 18 month old rats except cerebral cortex.

**Conclusions:** In conclusion, the degree of hypomethylation in promoter CpGislands in LINE-1 repetitive sequences do play essential role in LINE-1 element expression. Besides tissue specific factors do play pivotal role in LINE-1 expression.

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**Objective:** Parkinson’s disease (PD) is a neurodegenerative disease and a movement disorder characterized by loss of dopaminergic neurons in the substantia nigra causing dopamine depletion in the striatum. The disease progresses slowly and may ultimately produce complete akinesia. Rolipram, a specific inhibitor of the phosphodiesterase IV (PDE IV), has recently been shown to exert neuroprotective effects in an Alzheimer transgenic mouse model and in hypoxic-ischemic damage in the rat brain. It activates the cAMP-dependent protein kinase (PKA)/cAMP regulatory element-binding protein (CREB) signaling pathway and it inhibits inflammation. The cAMP mediated signaling is regulated by the activity of cyclic nucleotide phosphodiesterases (PDE) that cleave the second messenger. In the present study, we tested neuroprotective effects, if any, of rolipram drug, a specific inhibitor of the phosphodiesterase IV in 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP)-induced parkinsonism in mice.

**Design and Method:** Experimental animal is muscular weighing 25–30 g of 4–5-month-old. The drug was given four times at 12 h intervals by gavage (25–100 mg/kg) in animals made parkinsonian following two doses of MPTP (30 mg/kg, i.p.). Control mice were injected with the same volume of pure DMSO. MPTP-induced striatal dopamine depletion was significantly attenuated by higher dose of rolipram. MPTP-induced catalepsy and akinesia, as well as loss in swim ability, were blocked dose-dependently by rolipram.

**Results:** Present study further shows that rolipram can dose-dependently attenuate both in vitro hydroxyl radical production in a Fenton-like reaction, and also ex vivo 1-methyl-4-phenylpyridinium (MPP+) -induced hydroxyl radical generation in isolated mitochondria. These results indicate that the observed neuroprotective effects of rolipram stem from its significant antioxidant action.

**Conclusions:** The preliminary results suggest that rolipram is a neuroprotector, and mechanism other than lipid lowering action could be the basis of this effect. Present data show a neuroprotective effect of the PDE IV specific inhibitor rolipram against dopaminergic neuron degeneration, suggesting that PDE IV inhibitors might be a potential treatment for Parkinson’s disease.

**Objective:** Recent studies have shown that aldosterone-producing adenoma (APA) impairs endothelial function. However, there is little information on the relationship between idiopathic hyperaldosteronism (IHA) and grade of vascular function. The purpose of this study was to evaluate vascular function and Rho-associated kinases (ROCKs) activity in patients with IHA.

**Design and Method:** Vascular function, including peripheral arterial tonometry (PAT) and flow-mediated vasodilation (FMD), and ROCK activity in peripheral leukocytes were evaluated in 20 patients with aldosterone-producing adenoma (APA), 24 patients with idiopathic hyperaldosteronism (IHA), and 22 age-, sex-, and blood pressure-matched patients with essential hypertension (EHT).

**Results:** Log RHI was significantly lower in the IHA and APA groups than in the EHT group (0.60 ± 0.24 and 0.59 ± 0.16 versus 0.82 ± 0.24; P = 0.01, respectively), whereas there were no significant differences in log RHI between the IHA and APA groups. FMD was significantly lower in the APA group than in the IHA and EHT groups (3.5 ± 1.8% versus 3.9 ± 2.6%, P = 0.05, respectively), whereas there was no significant difference in FMD between the IHA and EHT groups. ROCK activity was higher in the APA group than in the IHA and EHT groups (1.26 ± 0.46 versus 1.13 ± 0.39 and 0.89 ± 0.32; P = 0.05, respectively), whereas there were no significant differences in ROCK activity between the IHA and EHT groups. After adjustment for age and sex, the associations...
remained significant between log RHI and plasma aldosterone concentration (PAC) \( t = -2.27; P = 0.027 \), ROCK activity and PAC \( t = 2.28; P = 0.027 \), and ARR \( t = 2.05; P = 0.046 \), but the association was not significant between FMD and PAC \( t = -1.79; P = 0.079 \), and ARR \( t = -1.35; P = 0.18 \).

**Conclusions:** APA has endothelial dysfunction and increased ROCK activity compared with EHT. IHA were also associated with endothelial dysfunction, especially peripheral endothelial dysfunction, compared with EHT. Risk of future cardiovascular events may be higher in IHA than in EHT.

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**P-58**

**Impact of Arterial Stiffening on Cardiovascular Markers and Incidence of Cardiovascular Event in Normotensive Patients Without History of Cardiovascular Disease**

*Kenta Ichimiya, Satoru Sakuragi*

Iwakuni Clinical Center, Cardiovascular Medicine, Japan

**Objective:** Arterial stiffness has been proposed as an important predictor of cardiovascular (CV) event in various groups, such as end-stage kidney disease and hypertensive patients. Although, blood pressure (BP) is one of the most important determinants of arterial stiffening, there are some cases who have a discrepancy between BP and arterial stiffness. In this study, we evaluated the impact of arterial stiffening on impairment of cardiac parameters and incidence of CV event in patients with normal blood pressure.

**Design and Method:** A total of 320 outpatients with normal BP defined as systolic BP less than 140 mm Hg were enrolled. At baseline, all subjects underwent echocardiography and MDCT. Coronary artery calcification (CAC) was evaluated with Agatston method and CAC score (CACs) was calculated. Arterial stiffness was also assessed with pulse wave velocity (PWV) between brachial and ankle. The subjects were divided into two groups according to the PWV: high PWV group (PWV ≥18 m/sec, n = 89) and low PWV group (PWV < 18 m/sec, n = 231).

Cardiac parameters as well as incidence of CV events during the follow-up period were compared between the two groups.

**Results:** In linear regression analysis, PWV was significantly associated with CACs and NT-proBNP after adjustment for confounding factors. In multivariate logistic regression analysis, PWV over 18 m/sec was significantly associated with CACs over 400 with a hazard ratio of 2.466 (95% CI: 1.012–6.009, \( p = 0.047 \)). Kaplan-Meier analysis showed that high PWV group had higher rate of CV event during the follow-up period of 575 days (20% vs. 6%, \( p = 0.0003 \)). In multivariate Cox regression analysis, PWV over 18 m/sec was an independent predictor for future CV events with an odds ratio of 2.534 (95% CI: 1.045–6.146, \( p = 0.040 \)).

**Conclusions:** Arterial stiffening assessed by PWV is a strong determinant of impairment of cardiac parameters as well as future CV event in normotensive patients.

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**P-59**

**Effects of Green Tea Extract (GTE) on Ca2+ ATPase and Lipid Peroxidation in Brains of Aging Male Rats**

*Sumit Rajput, S. Sinha*

School of Biotechnology, Guru Gobind Singh Indraprastha University, India

**Objective:** The most active green tea constituent is called epigallocatechin gallate. This unique flavonoid favorably alters pathways underlying pathological processes such as cancer, cardiovascular disease, diabetes, obesity, and Alzheimer’s and Parkinson’s diseases. All of this points to green tea as a broad-spectrum nutrient that may promote long life. Aging is characterized by a progressive decline in function and a decrease in the body’s ability to maintain homeostasis. This study aimed to examine the effect of green tea extract (GTE) on Ca2+ ATPase activity and lipid peroxidation levels in aged rats.

**Design and Method:** A total of 20 Albino male rats of 24 months old were divided into two groups of 10 rats each. Rats in the first group were administered 300 mg/kg bwt. GTE daily for 14 weeks and the second group was kept as a control.

**Results:** Control group aged rats exhibited a significant decrease in brain functions, increase in lipid peroxidation and decrease in Ca2+ ATPase activity. Treatment of aged rats with GTE caused a significant increase in levels Ca2+ ATPase activity in brain and a significant decrease in levels of lipid peroxidation product, malondialdehyde (MDA) compared to control rats.

**Conclusions:** In conclusion, GTE treatment was able to reverse the impairment in brain with aging in rats so it could be recommended as an anti-aging phytochemical and drug study for neurodegenerative disease.

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**P-60**

**Role of Vanadium, Trigonella and Vitamin C on Defensive Enzymes of Red Blood Cells of Diabetic Animals**

*Bihari Gupta*

Zoology Department, L.N. Mithila University, J.K. College, India

**Objective:** Sodium orthovanadate has anti-diabetic properties and is helpful in restoring blood glucose levels. It has not been used till now for human diabetics due to its toxic effects. To lower the toxic effects it was proposed to use Trigonella and Vitamin C in combination with vanadium salt in diabetic animals. To know the efficacy and toxicity lowering effects of vanadium it was proposed to use different age group animals so that effects on young and old diabetic animals could be compared.
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Abstracts: The Pulse of Asia 2016 Seoul

**Design and Method:** The diabetic animals which were mostly used of 190–200 gms weight and 3–4 months old. The ageing animals used was (a) young diabetics –150–160 gms (b) middle aged 190–200 gms and (c) old diabetics –240–250 gms. The treatment groups of sodium orthovanadate with Trigonella and Vitamin C were designed as follows: (i) 0.2 mg/ml sodium orthovanadate in drinking water/0.5% NaCl for 3 days (ii) 0.4 mg/ml sodium orthovanadate in drinking water/0.5% NaCl for 3 days (iii) 0.6 mg/ml sodium orthovanadate in drinking water/0.5% NaCl for rest of the treatment. 0.6 mg/ml sodium orthovanadate has been reported to be optimal potential amount to normalize the diabetic glucose levels. The amount of trogonella was designed to be most effective and widely used was 5% in the solid feeds of animals. The amount of Vitamin C used was 0.2 mg/ml in drinking water. Rats were sacrificed 21 days after withdrawal from insulin. All the enzymes activities were measured as described by Gupta and Baquer, 1998. The other metabolites like GSH, GSSG and GHb were assayed by Bergmeyer et al, 1974.

**Results:** In diabetic animals catalase activity did not change but SOD and GPx decreased whereas GR and GST increased. Insulin though normalized these enzymes activities, but trigonella also normalized the enzymes activities except SOD. Vanadate in combination with Vitamin C normalized all the defensive enzymes studied. The different age groups of diabetic animals showed lowest recovery of enzymes like CAT, SOD and GPx in old diabetic animals whereas GR and GST were reversed to normal levels. Vanadate with NaCl also could not recover CAT recovered SOD, GPx, GR and GST that shows vanadate with NaCl is more in comparison to Vanadate in water. GHb% and GSSG levels increased in diabetics whereas GSH level went down in this condition. Vanadate normalized GHb%, GSH and GSSG to some extent. Trigonella and Vitamin C in combination with vanadate normalized these metabolites levels.

**Conclusions:** Sodium orthovanadate prepared in saline water is more potent in recovering the enzymes and metabolites. Vanadate prepared in combination with Vitamin C was found to be more effective as diabetic animals survived for a longer time and found to be healthy and may be a good formulation for humans use.

**P-61**

**Protective Effects of Sodium Orthovanadate in Diabetic Reticulocytes and Ageing Red Blood Cells of Wistar Rats**

*Bihari Gupta*

Zoology Department, L.N. Mithila University, J.K. College, India

**Objective:** The reticulocytes and the ageing red blood cells (RBCs) namely young (Y), middle-aged (M) and old RBCs (O) of female Wistar rats from different groups such as control animals (C), controls treated with vanadate (C + V), alloxan-induced diabetic (D), diabetic-treated with insulin (D + I) and vanadate (D + V), were fractionated on a percoll/BSA gradient.

**Design and Method:** The following enzymes were measured – hexokinase (HK), glutathione peroxidase (GSH-Px), glutathione reductase (GSSG-R), glutathione-s-transferase (GST), alanine aminotransferase (AlaAT), aspartate aminotransferase (AsAT) and arginase in the hemolysates of all the RBCs fractions.

**Results:** Decreases in the activity of HK and AsAT by about 70%, arginase and GSH-Px by 30% in old RBCs were observed in comparison to reticulocytes of control animals. Increases in the activity of GSSG-R by 86%, AlaAT by more than 400% and GST by 70% were observed in old RBCs in comparison to reticulocytes of control animals. Alloxan diabetic animals showed a further decrease in the activities of HK in Y RBCs by 37%, M RBCs by 39% and O RBCs by 32%, GSH-Px activity in Y RBCs by 13%, M RBCs by 20% and O RBCs by 33% and GST activity in Y RBCs by 14%, M RBCs by 42% and O RBCs by 60% in comparison to their corresponding cells of control animals. An increase in the activity of all the enzymes studied was also observed in reticulocytes of diabetic animals in comparison to reticulocytes of control animals. The GSSG-R activity was found to be increased in Y RBCs by 37%, M RBCs by 39% and O RBCs by 32%, GSH-Px activity in Y RBCs by 13%, M RBCs by 20% and O RBCs by 33% and GST activity in Y RBCs by 14%, M RBCs by 42% and O RBCs by 60% in comparison to their corresponding cells of control animals. An increase in the activity of all the enzymes studied was also observed in reticulocytes of diabetic animals in comparison to reticulocytes of controls. The GSSG-R activity was found to be increased in Y RBCs by 49%, M RBCs by 67% and O RBCs by 64% as compared to the corresponding age-matched cells of control animals. The activity of arginase also decreased in Y RBCs by about 10%, M RBCs by 20% and O RBCs by 30% in comparison to the age-matched cells of control animals. A decrease in the activity of AsAT in Y and M RBCs by 25%, and O RBCs by 25% was observed in diabetic animals in comparison to the age-matched cells of control animals. The activity of AlaAT was found to be decreased by more than 10% in Y and M RBCs and 25% in O RBCs of diabetic animals in comparison to the age-matched cells of control animals.

**Conclusions:** Insulin administration to diabetic animals reversed the altered enzyme activity to control values. Vanadate treatment also reversed the enzyme levels except for that of GST in old cells.
P-63
Beneficial Role of Voice Inter-Relating Process and Om Mantra Enchanting in Parkinson’s Disease Patients in South Delhi Metro Population
Vinod Sharma
Department of Applied Sciences, Shri Maha Maya Vaishnav Devi Mandir Research Institute, India

Objective: According to World Health Organisation, a disease of the middle-aged and elderly, Parkinson’s disease has recently escalated in all age groups and is now being identified in young population, especially in high-risk Indian populations living in metro cities. Objective of present study to present new methods of controlling Parkinson’s disease complications by ‘OM Enchanting’ and ‘Brahma Muhurat Awakening’ in Parkinson’s disease patients in south Delhi metro population.

Design and Method: Using a cross-sectional design, which includes age, family history of Parkinson’s disease, exercise status and waist circumference, fasting glucose insulin, glucose tolerance test (GTT), and glycosylated hemoglobin (HbA1c) were recorded for 45 aging patients (subject) between 60–75 years old at Shri Mahamaya vaishnav devi mandir research institute, New Delhi, India. All patients were treated for one hour in Brahma Muhurat Awakening’ (time duration of 04:00–05:00 A.M.) early morning with my frequency tuning by voice inter-relating process and aged patients discuss their problem due to Parkinson’s disease and lifestyle and try to find their problem and provide them with positive corrective measures during one month.

Results: Present study by Brahma Muhurat Awakening’ and Om enchanting one’s physical and inner elements balance and a person is filled with the positive energy which makes him/her active enough to burn the required calories ultimately helping one to be fit without having any physical consumption of chemical salt. This process leads to a balanced energy level which in turn leads to a healthy life. After one month treatment there were significant changes in glucose, insulin and glycosylated haemoglobin levels compare to normal levels with changes in life style and increase concentration for study.

Conclusions: In conclusion, Parkinson’s disease complications can be controlled and regulate by treating patients with ‘OM Enchanting’ and ‘Brahma Muhurat Awakening’ in Parkinson’s disease without using any harmful drugs.

P-64
Long-Term Cardiovascular Outcomes in Patients with Polyvascular Disease and Obstructive Sleep Apnea with or Without Treatment with Continuous Positive Airway Pressure
Kazuki Shiina, Hirofumi Tomiyama, Yoshifumi Takata, Shunsuke Komatsu, Muneatsu Sekiya, Tasuku Yamaguchi, Akira Yamashina
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Objective: Polyvascular disease (PD) and obstructive sleep apnea (OSA) are strongly associated with an increased risk for cardiovascular mortality. However, the cardiovascular outcomes in patients with PD and OSA is not clear. We investigated the cardiovascular outcomes and the effects of continuous positive airway pressure (CPAP) treatment in patients with PD and OSA.

Design and Method: In this retrospective cohort study, we enrolled 72 patients (mean age 68.2 ± 9.8 yr) with PD and OSA...
(apnea-hypopnea index (AHI) 15/h) who underwent polysomnography. PD was defined as documented at least two atherosclerotic disease. Patients were divided into the CPAP group (n = 35) or untreated group (n = 37). The main outcomes measures were cardiovascular death and hospitalization due to cardiovascular disease.

**Results:** During the mean follow-up periods of 878 ± 605 days, 26 (36%) patients either died or were hospitalized. The Kaplan-Meier curves indicated that event-free survival was significantly lower in the untreated group than in the CPAP group (P = 0.05) (figure 1).

**Conclusions:** The overlap of PD and OSA was very high risk at cardiovascular event, and CPAP treatment reduced this risk.

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**P-65**

**Gender Difference in the Change of Augmentation Index after Treadmill Exercise**

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**Objective:** Although augmentation index (AIx), which measures the arterial stiffness, has been shown to be greater in women than men, height may influence AIx, and women is usually shorter than men. This study aimed to investigate the gender difference of AIx before and after treadmill exercise.

**Design and Method:** Forty-six subjects (22 women and 24 men), who underwent treadmill exercise test for the evaluation of chest pain, were enrolled in this study. The waveform of central aortic pressure was recorded before and after treadmill exercise using SphygmoCor®, and pulse rate-adjusted AIx (AIx@75) was measured.

**Results:** Age (W; 52.6 ± 16.1 vs. M; 51.8 ± 14.8 years), prevalence of hypertension, coronary artery disease, diabetes or hyperlipidemia, and medications were not different, but height was shorter in women (156.5 ± 6.3 vs. 168.4 ± 7.0 cm, p = 0.001). Baseline AIx@75 was greater in women (25.7 ± 13.0 vs. 18.0 ± 11.1%, p = 0.036). Total duration of exercise and maximal MET’s during treadmill test were not different. After exercise, AIx@75 was also greater in women (29.5 ± 10.7 vs. 19.2 ± 7.9%, p = 0.001), but changes of AIx@75 were not different between genders (W; 3.7 ± 9.5 vs. M; 1.2 ± 8.5%). AIx@75 was significantly correlated with height (baseline; r = −0.540, p = 0.001, after exercise; r = −0.550, p = 0.001). On multivariate logistic regression analysis including height, AIx@75 at baseline or after exercise was not significantly different between genders.

**Conclusions:** Gender difference of AIx before and after treadmill exercise was not observed. Height was the major determining factor of AIx.

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**P-66**

**The Impact of Inter-Arm Blood Pressure Differences to Coronary Intervention in Patients with Coronary Artery Diseases**

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**Objective:** Inter-arm blood pressure differences (IABPD) are related to vascular diseases including peripheral and cerebral vascular diseases, while the relationship between IABPD and coronary artery diseases is still controversial. We investigated the effect of IABPD in clinical outcomes of percutaneous coronary intervention (PCI) in patients with coronary artery diseases.

**Design and Method:** We retrospectively reviewed data of blood pressures measured simultaneously in both arms in 231 patients (155 males and 76 females) who underwent PCI for myocardial infarction or angina pectoris. IABPD was defined as the difference of blood pressures in both arms, while a modified parameter defined as IABPD divided by the mean blood pressure (mIAPBD) was also investigated to

<table>
<thead>
<tr>
<th>Table 1. (for Abstract P-65)</th>
<th>Univariate logistic regression</th>
<th>Multivariate logistic regression</th>
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<tbody>
<tr>
<td></td>
<td>OR</td>
<td>95% CI</td>
</tr>
<tr>
<td>Height</td>
<td>1.28</td>
<td>1.12–1.47</td>
</tr>
<tr>
<td>Baseline AIx@75</td>
<td>1.06</td>
<td>1.00–1.12</td>
</tr>
<tr>
<td>AIx@75 after exercise</td>
<td>1.13</td>
<td>1.04–1.23</td>
</tr>
<tr>
<td>Age</td>
<td>1.00</td>
<td>0.97–1.04</td>
</tr>
</tbody>
</table>

AIx@75 = Pulse rate-adjusted augmentation index, CI = confidence interval; OR = odds ratio.
adjust the effect of baseline blood pressure. The primary outcome was the presence of major adverse cardiac events (MACEs), composed of all-cause death, myocardial infarction, stroke, and target vessel revascularization.

**Results:** The mean age of included patients was 67.1 ± 10.9 years, with the mean follow-up period of 42.2 ± 21.9 months. MACEs occurred in 46 patients (19.9%), who revealed higher IABPDs than those without MACEs (systolic IABPD: 7.6 ± 9.0 mm Hg vs. 4.6 ± 5.7 mm Hg, p = 0.033; diastolic IABPD: 5.2 ± 10.1 mm Hg vs. 3.5 ± 4.1 mm Hg, p = 0.075). mIABPDs were significantly correlated with IABPDs (systolic mIAPBD: r = 0.910, p < 0.001; diastolic mIAPBD: r = 0.901, p < 0.001). The Kaplan-Meier survival analysis revealed a greater incidence of MACEs in patients with higher systolic mIAPBD (p = 0.058, Figure). The Cox proportional hazard analysis showed that systolic mIAPBD was an independent predictor for long-term MACEs (hazard ratio (HR): 1.03, 95% confidence interval (CI): 1.01–1.05, p = 0.045), along with diabetes mellitus (HR: 2.48, 95% CI: 1.34–4.6, p = 0.004).

**Conclusions:** Taken together, IABPDs were associated with the long-term MACEs after PCI in patients with coronary artery diseases. When adjusted by highest blood pressure, IABPD may be considered as a clinical predictor of MACEs. This provides encouraging preliminary data for further evaluation of IABPDs as a prognostic factor in a prospective, randomized, double-blind trial.

**P-67**

**Comparison of the Clinical Significance of Single Cuff-Based Arterial Stiffness Parameters with That of the Commonly Used Parameters**

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**Objective:** We examined the following: 1) whether the new simple markers related to the arterial stiffness/central hemodynamics, (i.e., arterial pressure-volume index (API) and arterial velocity pulse index (AVI)) are clinically interchangeable with the commonly used markers (brachial-ankle pulse wave velocity (baPWV) and radial augmentation index (rAI)); 2) whether the new simple markers reflect vascular damage as reliably as the commonly used markers; 3) which cardiovascular risk factors are reflected by these new simple markers.

**Design and Method:** API, AVI, baPWV and rAI were measured simultaneously in consecutive patients admitted for the management of cardiovascular disease and/or cardiovascular risk factors (n = 322).

**Results:** The API was correlated with the baPWV (R = 0.492, p < 0.001) and the AVI correlated with the rAI (R = 0.462, P < 0.001). The API, AVI, baPWV and rAI were higher in the patients admitted for coronary angiography (CAG group: n = 152) than in those admitted for reasons other than coronary angiography (nonCAG group: n = 170). After adjustments for confounding factors, only the AVI was found to be higher in the CAG group than in the nonCAG group. Multivariate linear regression analysis revealed that age and the systolic blood pressure were independently associated with the API and AVI after adjustments.
Conclusions: In patients with cardiovascular diseases or cardiovascular risk factors, the new simple markers and the commonly used markers are not interchangeable for assessing vascular damage and/or cardiovascular risk. Further study is proposal to examine whether AVI is higher in subjects with cardiovascular disease than in those without a history of cardiovascular disease. Similar to the case for the commonly used markers, age and the blood pressure significantly influenced both the new markers, therefore, age and the blood pressure need to be taken into account while interpreting the changes in these new simple markers.

P-68

The Optimal Dose and the Timing of Treatment of Human Umbilical Cord Blood-Derived Mesenchymal Stem Cells in Monocrotaline Induced Pulmonary Hypertensive Rats

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Objective: Pulmonary arterial hypertension (PAH) is a fatal disease which is characterized by an increase in pulmonary arterial pressure leading to increases in right ventricular afterload. Human umbilical cord blood derived mesenchymal stem cells (hUCB-MSCs) have been previously shown to improve PAH by reversal treatment. However, the effective dose and optimum treatment timing for PAH have not been evaluated. The purpose of this study is to investigate the dose-dependent effect and transfusion timing of hUCB-MSCs on PAH.

Design and Method: This study was divided into two parts. First, for investigating the dose-dependent effect, hUCB-MSCs were administered into 3 groups (UA: 3×10⁶ cells, UB: 1.5×10⁶ cells, UC: 3×10⁵ cells) via the external jugular vein at week 1 after monocrotaline (MCT) injection. Second, for finding optimal treatment timing in 3×10⁵ cells dose, hUCB-MSCs were administered at day 1 (UD group), week 1 (UE group) or both (UF group).

Results: 3×10⁵ hUCB-MSCs administration was as effective as 3×10⁶ dose in decreasing mean RV pressure, RV hypertrophy and pulmonary pathological changes. Early treatment with hUCB-MSCs improved mean RV pressure, pulmonary pathological changes and decreased B cell lymphoma (Bcl)-2 protein expression in the lung tissues.

Conclusions: Low-dose early treatment is as effective as high dose treatment in improving PAH although dual or reversal treatment is still more effective.

P-69

Relationship between Heart Rate Recovery after Exercise and Coronary Artery Calcification in Men

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Objective: Slow heart rate recovery (HRR), an estimate of decreased parasympathetic reactivation, has been associated with increased risk of cardiovascular events and mortality. Coronary artery calcification (CAC) is associated with high risk of cardiovascular disease, but the association between HRR and CAC remain unclear. We examined whether slow HRR is related to CAC, independent of risk factors, in Korean men.

Design and Method: In this cross-sectional study, participants were 2088 men (age 53 ± 6 yrs, range 41–78 yrs) who participated in a health screening program that included measures of CAC and cardiopulmonary exercise testing. HRR was calculated as the difference between peak heart rate during exercise testing and the heart rate at 2 minutes after exercise cessation. We measured CAC using multidetector computed tomography with a calculation of Agatston coronary artery calcium score. Advanced CAC was defined as a score 75th percentile for each age group.

Results: HRR was correlated with CAC (r = –0.14, p<0.001). The advanced CAC was inversely associated with HRR quartiles (Q1 (lowest, 38 bpm) 31.5%, Q2 25.4%, Q3 22.6%, and Q4 (highest, 52 bpm) 18.6%; P < 0.001 for trend). After adjusting for conventional risk factors and resting heart rate and peak oxygen uptake, participants in the lowest quartile of HRR were 1.52 time (95% CI: 1.10–2.10; P = 0.011) more likely to have advanced CAC than participants in the highest quality of HRR. Each 1 SD increase in HRR was associated with 11% decreased advanced CAC after adjusting for established risk factors. (Odds Ratio 0.89, 95% CI 0.80–0.99; P = 0.047).

Conclusions: Slow HRR after exercise testing is associated with advanced CAC independent of risk factors included resting heart rate and peak oxygen uptake in men.
P-70
Effect of Intensive Periodontal Therapy on Blood Pressure and CD31+/CD42b– Endothelial Microparticles in Prehypertensive Patients with Periodontitis: A Randomised Controlled Trial
Jun Taoa, Qian-bing Zhoub, Wen-hao Xiac, Jing Renb, Xin-zhu Tongb, Yan-bin Chenb, Shan Chenb, Lei Fengc, Chensu, Jing Daic, Zhen Yanga, Jun-ying Yangc
aDepartment of Hypertension and Vascular Disease, Sun Yat-Sen University, China; bStomatology, Guangdong Pharmaceutical University, China; cStomatology, Sun Yat-Sen University, China

Objective: Although some studies show the positive association between periodontitis and blood pressure elevation, the data on the effect of periodontal treatment mediated declining in blood pressure levels without any antihypertensive management is lacking. Therefore, we conducted an intervention clinical trial to explore whether intensive periodontal therapy lowers blood pressure levels in prehypertensive patients with periodontitis.

Design and Method: A total 107 patients underwent randomization, of whom 95 (47 assigned to the Control-treatment group and 48 to the Intensive-treatment group) completed the trial. Participants received the intervention for four continued weeks and were followed up for 6 months. Periodontal conditions, blood pressure, endothelial microparticles were evaluated before intervention and 1, 3, 6 months after intervention.

Results: The periodontal conditions were significantly improved (P = 0.05) 6 months after intensive periodontal treatment. In parallel, the primary outcomes including systolic blood pressure, diastolic blood pressure, and endothelial microparticles were markedly reduced in the Intensive-treatment group than in the control, respectively (absolute difference, 12.57 mm Hg, 9.65 mm Hg, 581.59/μl; 95% confidence interval, 10.45 to14.69, 7.06 to 12.24, 348.12 to 815.06; P = 0.05). Reduction in blood pressure levels and endothelial microparticles were related to the improvement in periodontal depth, respectively (r = 0.358, 0.363 and 0.676 by Pearson’s product-moment correlation, P = 0.009, 0.008 and P = 0.001).

Conclusions: The present study demonstrates for the first time that intensive periodontal intervention may be an effective prevention strategy to retard the transition of prehypertension to hypertension in prehypertensive patients with periodontitis.

Table 1. Periodontal disease at baseline and 3 months and 6 months after periodontal therapy (for Abstract P-70)

<table>
<thead>
<tr>
<th>Extent</th>
<th>PD ≥ 4 mm (%)</th>
<th>Group I n = 54</th>
<th>Group II n = 53</th>
<th>absolute difference (95% CI)</th>
<th>Extent</th>
<th>CAL ≥ 3 mm (%)</th>
<th>Group I n = 54</th>
<th>Group II n = 53</th>
<th>absolute difference (95% CI)</th>
<th>BOP (%)</th>
<th>Group I n = 54</th>
<th>Group II n = 53</th>
<th>absolute difference (95% CI)</th>
<th>Total no. of loss teeth (0 to 3)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td>47.28 (18.55)</td>
<td>49.15 (21.61)</td>
<td>0.631 (–9.59 to 5.84)</td>
<td>Extent</td>
<td>37.65 (16.07)</td>
<td>41.53 (21.53)</td>
<td>0.293 (–11.55 to 3.39)</td>
<td>33.02 (16.21)</td>
<td>26.40 (13.83)</td>
<td>0.025 (0.83 to 12.40)</td>
<td>29.61 (13.22)</td>
<td>24.11 (14.45)</td>
<td>0.042 (0.19 to 10.80)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>44.22 (15.08)</td>
<td>34.62 (18.04)</td>
<td>0.003 (3.23 to 15.97)</td>
<td>Extent</td>
<td>0.77 (0.12)</td>
<td>0.76 (0.13)</td>
<td>0.997 (–0.05 to 0.05)</td>
<td>0.69 (0.13)</td>
<td>0.26 (0.11)</td>
<td>&lt;0.001 (0.38 to 0.47)</td>
<td>73 (0.12)</td>
<td>0.32 (0.14)</td>
<td>&lt;0.001 (0.36 to 0.46)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>41.54 (21.33)</td>
<td>27.19 (15.09)</td>
<td>&lt;0.001 (14.35)</td>
<td>Extent</td>
<td>0.77 (0.12)</td>
<td>0.76 (0.13)</td>
<td>0.997 (–0.05 to 0.05)</td>
<td>0.69 (0.13)</td>
<td>0.26 (0.11)</td>
<td>&lt;0.001 (0.38 to 0.47)</td>
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<td>0.32 (0.14)</td>
<td>&lt;0.001 (0.36 to 0.46)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.00 (0.12)</td>
<td>2.00 (0.13)</td>
<td>0.980 (–0.05 to 0.05)</td>
<td>Extent</td>
<td>0.77 (0.12)</td>
<td>0.76 (0.13)</td>
<td>0.997 (–0.05 to 0.05)</td>
<td>0.69 (0.13)</td>
<td>0.26 (0.11)</td>
<td>&lt;0.001 (0.38 to 0.47)</td>
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<td>2.00 (0.12)</td>
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<td>Extent</td>
<td>0.77 (0.12)</td>
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<td>73 (0.12)</td>
<td>0.32 (0.14)</td>
<td>&lt;0.001 (0.36 to 0.46)</td>
</tr>
</tbody>
</table>

Group I = Control-treatment group. Group II = Intensive-treatment group. Total no. of loss teeth are asymmetric distribution, they are expressed as median (inter-quartile range). The differences of the total no. of loss teeth between two groups before and after treatment compared with nonparametric tests.
Fig. 1. (for Abstract P-70).