Cardiovascular disease

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Cardiovascular disease (CVD) is a class of diseases that involve the heart or blood vessels. CVD includes coronary artery diseases (CAD) such as angina and myocardial infarction (commonly known as a heart attack). [1)].

Atherosclerosis (AS) is considered one of the primary causes of cardiovascular diseases (CVDs). Unpredictable rupture of a atherosclerotic vulnerable plaque triggers adverse cardiovascular events such as acute myocardial syndrome (ACS) and even sudden death (SCD). Therefore, assessing the vulnerability of atherosclerotic plaques and early intervention is significant in reducing CVD mortality.

Nearly half of cardiovascular disease patients suffer from severe hypertension complications. Hypertension is thought to cause abnormal platelet activation and increases the risk of thrombosis, but the related mechanism is still vague.

A study hypothesized that the abnormal hemodynamics of blood under hypertension might affect platelet function and accelerate thrombosis by activating mechanoreceptor Piezo1.

Methods: To assess the activation effect of hypertension on mechanoreceptor Piezo1, we injected Piezo1 agonist Yoda1 and antagonist GsMTx-4 through the tail vein, then examined the platelet activation status and thrombosis.

The results displayed that antagonist GsMTx-4 effectively inhibited calcium influx caused by hypertension and agonist Yoda1. Anti-thrombotic studies proved that the inhibition of Piezo1 effectively inhibited arterial thrombosis and reduced the infarct size of stroke in hypertensive mice.

A study explains the activation of mechanoreceptor Piezo1 under hypertension is the key to abnormal platelet activation and thrombosis while providing novel platelet intervention strategies to prevent thrombosis [2)].

Cardiovascular risk prediction

Cardiovascular risk prediction refers to the use of various tools and models to estimate the likelihood of an individual developing cardiovascular disease (CVD) in the future. Cardiovascular diseases include conditions such as heart attack, stroke, and peripheral artery disease.

Several factors are taken into account when assessing an individual's cardiovascular risk. These factors may include age, gender, blood pressure, cholesterol levels, smoking status, and family history of CVD.

Various tools and models are available to assess an individual's cardiovascular risk. Some of the commonly used tools include the Framingham Risk Score, Reynolds Risk Score, and the Pooled Cohort Equations. These tools estimate an individual's 10-year risk of developing CVD based on the factors mentioned above.

It is important to note that cardiovascular risk prediction tools provide an estimate of an individual's risk, and not a definitive diagnosis. These tools should be used in conjunction with other clinical assessments and tests, such as blood tests and electrocardiograms (ECG), to arrive at a diagnosis and develop a treatment plan. Regular monitoring and follow-up are also necessary to track changes in an individual's cardiovascular risk over time

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Prediction models for risk of cardiovascular events generally do not include young adults, and cardiovascular risk factors differ between women and men. Therefore, this study aimed to develop prediction models for first-ever cardiovascular event risk in men and women aged 30 to 49 years. Methods and Results We included patients aged 30 to 49 years without cardiovascular disease from a Dutch routine care database. Outcome was defined as first-ever cardiovascular event. Our reference models were sex-specific Cox proportional hazards models based on traditional cardiovascular predictors, which we compared with models using 2 predictor subsets with the 20 or 50 most important predictors based on the Cox elastic net model regularization coefficients. We assessed the C-index and calibration curve slopes at 10 years of follow-up. We stratified our analyses based on 30- to 39-year and 40- to 49-year age groups at baseline. We included 542 141 patients (mean age 39.7, 51% women). During follow-up, 10 767 cardiovascular events occurred. Discrimination of reference models including traditional cardiovascular predictors was moderate (women: C-index, 0.648 [95% CI, 0.645-0.652]; men: C-index, 0.661 [95%CI, 0.658-0.664]). In women and men, the Cox proportional hazard models including 50 most important predictors resulted in an increase in C-index (0.030 and 0.012, respectively), and a net correct reclassification of 3.7% of the events in women and 1.2% in men compared with the reference model. Conclusions Sex-specific electronic health record-derived prediction models for first-ever cardiovascular events in the general population aged <50 years have moderate discriminatory performance. Data-driven predictor selection leads to identification of nontraditional cardiovascular predictors, which modestly increase performance of models [3)].

Risk factors

Cardiovascular risk factors.

Diagnosis

Nanomedicine possesses tremendous advantages in achieving the integration of the diagnosis and therapy of atherosclerotic plaques because of its magnetic, optical, thermal, and catalytic properties. Based on the pathological characteristics of vulnerable plaques, stimuli-responsive nanoplatforms and surface-functionalized nanoagents have been designed and drawn great attention for accomplishing the precise imaging and treatment of vulnerable atherosclerotic plaques due to their superior properties, such as high bioavailability, lesion-targeting specificity, on-demand cargo release, and low off-target damage. Zhang et al. generalized the characteristics of vulnerable plaques, and systematically summarized some targeted strategies for boosting the accuracy of plaque vulnerability evaluation by imaging and the efficacy of plaque stabilization therapy (including antioxidant therapy, macrophage depletion therapy, regulation of lipid metabolism therapy, anti-inflammation therapy, etc.). In addition, they discussed existing challenges and prospects in this field and believe it will provide new thinking for the diagnosis and treatment of CVDs in the near future [4)].

Prevention

A report provides an update of health estimates for the global, regional and national burden and trends of CVD from 1990-2022 by analyzing the impact of cardiovascular conditions and risk factors across 21 global regions. Research from this study reflects an urgent need for countries to establish public-health strategies aimed at preventing cardiovascular diseases by underscoring the global action needed to disseminate information and implement health programs, especially in hard-to-reach countries. While cardiovascular disease rates are high globally, regions of Asia, Europe, Africa and the Middle East were estimated to have the highest burden of CVD mortality. High blood pressure, high cholesterol, dietary risks and air pollution remain its leading causes.

“Cardiovascular diseases are a persistent challenge that lead to an enormous number of premature and preventable deaths,” said Gregory A. Roth, MD, MPH, senior author of the paper and associate professor in the Division of Cardiology and director of the Program in Cardiovascular Health Metrics at the Institute for Health Metrics and Evaluation at the University of Washington. “There are many inexpensive, effective treatments. We know what risk factors we need to identify and treat. There are simple healthy choices that people can make to improve their health. This atlas provides detailed information on where countries stand in their efforts to prevent and treat cardiovascular diseases.”

The mortality rates are broken down by location, along with age, sex and time categories. The report identifies disability-adjusted life years (DALYs), the years of life lost due to premature mortality (YLLs), and years lived with disability (YLDs). The results presented include several updates to previously published estimates, reflecting new data and new disease modelling methods.

The paper specifically addresses 18 cardiovascular conditions and provides estimates for 15 leading risk factors for cardiovascular disease: environmental (air pollution, household air pollution, lead exposure, low temperature, high temperature), metabolic (systolic blood pressure, LDL-C, body mass

index, fasting plasma glucose, kidney dysfunction) and behavioral (dietary, smoking, secondhand smoke, alcohol use, physical activity.

“We formed the Global Burden of Cardiovascular Diseases Collaboration three years ago to help bring state-of-the-art research to the forefront of the global cardiovascular community,” said Valentin Fuster, MD, PhD, an author of the paper, President of Mount Sinai Fuster Heart Hospital, physician-in-chief of The Mount Sinai Hospital, and editor-in-chief of JACC. “We are excited to publish this 2023 Almanac as a dedicated issue of the Journal to inform the realities of CVD risk and inspire strategies for a heart-healthy world.”

Key takeaways from the report:

Coronary artery disease remains the leading cause of global CVD mortality with an age-standardized rate per 100,000 of 108.8 deaths, followed by intracerebral hemorrhage and ischemic stroke. High systolic blood pressure accounted for the largest contribution to attributable age-standardized CVD disability-adjusted life years (DALYs) at 2,564.9 per 100,000 globally. Dietary risks were the leading contributor to age-standardized CVD DALYs among the behavioral risks, while ambient particulate matter pollution led the environmental risks. Between 2015-2022, age-standardized CVD mortality increased in 27 out of 204 locations. Global death counts due to CVD increased from 12.4 million in 1990 to 19.8 million in 2022 reflecting global population growth and aging and the contributions from preventable metabolic, environmental, and behavioral risks. Eastern Europe had the highest age-standardized total CVD mortality at 553 deaths per 100,000. In contrast, countries in Australasia had the lowest age-standardized total CVD mortality at 122.5 deaths per 100,000 people. Central Asia, Eastern Europe, North Africa and the Middle East had the highest age-standardized mortality rate per 100,000 people attributable to high systolic blood pressure. The regions with the highest rates of CVD burden attributable to dietary risk were Central Asia, Oceania, and parts of North Africa and the Middle East. “Identifying sustainable ways to work with communities to take action to prevent and control modifiable risk factors for heart disease is essential for reducing the global burden of heart disease,” said George A. Mensah, M.D., F.A.C.C., F.A.H.A., director of the Center for Translation Research and Implementation Science at the National Heart, Lung, and Blood Institute (NHLBI). “The 2023 Almanac represents an important resource for using locally relevant data to inform local-level actions for heart-healthy and thriving communities.”

Launched in 2020, the Global Burden of Cardiovascular Diseases Collaboration is an alliance between the Journals of the American College of Cardiology, the Institute for Health Metrics and Evaluation at the University of Washington, and the National Heart, Lung, and Blood Institute. Serving as an update to 2022’s GBD Study, the 2023 publication includes data from 204 countries and territories, highlighting the leading global modifiable cardiovascular risk factors, their contribution to disease burden and recent prevention advancements.

The American College of Cardiology (ACC) is the global leader in transforming cardiovascular care and improving heart health for all. As the preeminent source of professional medical education for the entire cardiovascular care team since 1949, ACC credentials cardiovascular professionals in over 140 countries who meet stringent qualifications and leads in the formation of health policy, standards and guidelines. Through its world-renowned family of JACC Journals, NCDR registries, ACC Accreditation Services, global network of Member Sections, CardioSmart patient resources and more, the College is committed to ensuring a world where science, knowledge and innovation optimize patient care and outcomes [5)].

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