Thoughts on Future Trends in Cardiology

Changsheng Ma1, Yaling Han2,*

Cardiovascular diseases (CVDs) have been recognized as the leading cause of death worldwide. It is estimated that CVDs led to 17.8 million deaths worldwide in 2017, increased by 21.1% from 2007.1,2 China is one of the countries that have the highest burden of CVDs with stroke and ischemic heart disease being the top two overall causes of deaths in China.2 The massive population with CVDs, the high mortality rate and disability rate, and the great burden to the society and the economy have significantly promoted investments in CVDs research globally, making it the fastest growing discipline in the medical field. Based on the recent major progress in CVDs prevention and treatment worldwide, with the changes brought by the COVID-19 pandemic, this article puts forward some ideas on the present situation and prospect of several key topics related to CVDs.

Close relationship between metabolic diseases and CVDs

It is well acknowledged that metabolic disorders are closely related to CVDs. Numerous data from animal experiments and clinical studies have demonstrated that metabolic disorders of many substances, including glucose, lipids, uric acid, and purines, are involved in the pathogenesis of CVDs. It is gratifying to note that some drugs for the treatment of metabolic diseases have demonstrated benefits to CVDs patients, which best explains the necessity to establish a new specialty, namely metabolic cardiology.

The EMPA-REG study in patients with diabetes and CVDs has confirmed the cardiovascular-protective effect of sodium-glucose cotransporter two inhibitor (SGLT-2i) for the first time.3 The DAPA-HF,4 EMPEROR-Reduced,5 and DAPA-CKD6 studies have also demonstrated that SGLT-2i could reduce the risk of CVD death in patients suffering from heart failure and chronic kidney disease with or without the presence of diabetes. This diabetes benefit of SGLT-2i seems to be attributed not only to the control of blood glucose but also to its direct effect on the cardiovascular system. On the other hand, the proprotein convertase subtilisin kexin 9 inhibitor has been a game changer in cholesterol management. Both the ODYSSEY7 and the OSLER8 studies have found decreases of 60% in low-density lipoprotein cholesterol level from the mean of 120 mg/dL, which reduced the composite CVD endpoints by half. Lately, a large-scale cohort study in gout patients demonstrated that urate-lowering therapy alone reduced risks of incident coronary artery disease and stroke by 30% and 32%, respectively, and this protective effect appeared to have a dose-response trend.9

As shown in the above studies, although the specific mechanisms remain unclear, the improvement of cardiovascular outcomes imposed by the treatment of metabolic disorders has proved the impact of metabolic disorders on the cardiovascular system. It confirms again the importance of risk factor control, lifestyle management, and upstream treatment. It is of greater significance from a population perspective, as large-scale population management of modifiable factors may help in changing the CVDs epidemic and bending the curve both in China and in similar countries experiencing the same process.

Healthcare delivery mode for CVDs prevention and management in the e-medicine era after COVID-19 pandemic

Artificial intelligence (AI) technology has already been tested in different subspecialties of CVDs healthcare with encouraging results. Pilot studies indicated that AI can identify pathological features of valvular disease and cardiomyopathy or identify arrhythmic events based on various kinds of machine learning of echocardiography or electrocardiograms.10,11 As a consequence, multiple wearable devices have been developed and shown to be effective in detecting and diagnosing arrhythmia or in monitoring heart failure patients.12,13 Big data analysis enables machine to be involved in the physician’s decision-making when they prescribe anti-coagulant to patients with atrial fibrillation.14 Although these smart health technologies are still far beyond routine clinical use, what they have brought to the cardiovascular field is the revolution of healthcare delivery mode. E-medicine allows patients to participate in their own CVDs’ management, fully interact with healthcare providers, and share their decision; then promotes the transformation of healthcare mode from doctor-centered to patient-centered.

The COVID-19 pandemic has greatly impacted the global healthcare system and re-shaped all aspects of medical practice, including the modes of health services delivery, patient behaviors, and doctor-patient interaction. It has exposed many weaknesses of the global public health system, especially potential discrepancies in the allocation of healthcare resources. As a large number of COVID-19 patients are in urgent need of diagnosis and treatment, the healthcare resources have to be diverted, and the resource for diagnosis and treatment of many other acute and chronic diseases are reduced in efficiency and quality. Multiple
observational studies show that during the COVID-19 outbreak in different areas, there was a consistent decline in the admission rates for patients with acute coronary syndrome worldwide, due to the shortage of healthcare resources and lower willingness of patients to seek medical care who were self-quarantined at home. Patients who were eventually admitted to the hospital often had worse outcomes than those in the pre-pandemic period.\[15\] The number of patients hospitalized for heart failure and the number of elective cardiovascular interventions also decreased significantly compared with the same period in previous years.\[16\] Nevertheless, with the pandemic continuing, it is found that many patients with chronic CVDs who were “forced” to use telemedicine actually did well over time. For example, hypertensive patients or chronic heart failure patients can self-adjust their medical treatments under physicians’ virtual guidance, whereas pacemaker patients can report their devices’ performance from home without office visits.\[17–19\] These facts reflect that face-to-face consultation may not be necessary in many occasions, and the COVID-19 crisis allows the opportunity, unintentionally, to re-evaluate the cost-effectiveness of the conventional CVDs healthcare mode. On March 28, 2020, the Chinese Society of Cardiology (CSC) issued the “CSC Expert Consensus on Principles of Clinical Management of Patients with Severe Emergent Cardiovascular Diseases during the COVID-19 Epidemic”.\[20\] This document, based on the experiences of Chinese cardiologists and infectious disease specialists, emphasized the necessity of practicing telemedicine in the management of CVDs in response to the crisis. As more evidence is gathered, telemedicine has thrived and emerged worldwide as an indispensable resource to deliver a high-quality, timely healthcare to CVDs patients, which will consequently reduce the social and economic burden associated with unnecessary office visits. Apparently, the CVDs service capacity will be enhanced, and the cost of service will decrease with minimum pathogen exposure. This is probably paradoxical, and we should turn the crisis caused by COVID-19 pandemic into the opportunity of medical service improvement by promoting telemedicine.

**New hopes in “non-curable” CVDs**

With the development of basic research, we have gradually recognized the role of genetic background in the pathogenesis and progression of many CVDs, especially cardiomyopathy and arrhythmia. Driven by the need to improve the diagnosis and treatment of inherited CVDs, the CSC published “Guideline for the Genetic Diagnosis of Monogenic Cardiovascular Disease”\[21\] in 2019, which helps cardiologists to provide individualized risk stratification and disease management. However, these diseases are usually considered non-curable and non-preventable as they are caused by genetic variation. In the year 2019, a healthy baby was delivered at the First Affiliated Hospital of Zhengzhou University, Henan Province, China, the mother of whom is a hypertrophic cardiomyopathy (HCM) patient. This is the first case using the pre-implantation genetic diagnosis technique that successfully blocked the heredity of HCM. Mavacamten is a novel, first-in-class, small molecule, allosteric inhibitor of cardiac-specific myosin adenosine triphosphatase. It specifically reduces excessive cross-bridging with actin that is believed to be an important contributor to the pathological hypercontractility associated with HCM. In the phase II PIONEER-HCM study,\[22\] and phase III EXPLORER-HCM study,\[23\] Mavacamten treatment resulted in not only improvement of symptom, decrease of pressure gradient at LVOT, but most importantly, regression of myocardial hypertrophy. These achievements open a window to patients with inherited CVDs like HCM, making these diseases both curable and preventable.

**Traditional Chinese medicine (TCM) as an option of CVDs management**

As an important part of Chinese culture, TCM has a history of more than 2000 years. Based on theories about Qi and restoring the balance between Yin and Yang, TCM has been widely applied in clinical practice in Asia and is gaining worldwide acceptance, which is evidenced by the inclusion of TCM diagnosis in the International Classification of Diseases-11 published by the World Health Organization.

The role of TCM in preventing and treating CVDs has been explicit as more and more evidence becomes available. Basic researches exploring the pharmacological mechanism of TCM has proved that some bioactive ingredients have cardiovascular benefits such as lipid-modulation, immune-modulation, anti-oxidation, anti-inflammation, blood pressure lowering, and endothelial protection.\[24\] Practitioners are increasingly looking for proof of efficacy and safety of TCM in clinical trials. In a systematical analysis that includes 56 randomized clinical trials on TCM, Zhang et al\[25\] concluded that TCM might be a complementary and alternative approach to the primary and secondary prevention of CVDs including hypertension, dyslipidemia, and heart failure. Besides, TCM emphasizes a balanced lifestyle as well as a harmonic physiological and mental state, which is consistent with the modern concept of integrative medicine and may facilitate the rehabilitation of CVDs. With the standardization and modernization of TCM, it is expected that TCM will play a more important role in the management of CVDs.

In summary, CVD research and practice are changing drastically, and with it comes the unlimited opportunities and possibilities for even-better care to the CVDs patients in the post-COVID pandemic era.

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**Conflicts of Interest**

None.

**References**


[13] Ma and Han


