



Progress on the Impact of Climate Change on Cardiac Arrest

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Abstract: Climate change is a global public health problem. With the improvement of the industrialization level of various countries, the problem is becoming more and more serious. The mortality and disability rates of cardiac arrest are very high. Climate change affects the occurrence of cardiac arrest, and extreme weather such as high temperature are the risk factors for cardiac arrest. Previous studies have explored the effects of climate change and cardiac arrest, however the study design and exposure assessment of these studies differ, and the outcome associations are inconsistent. This paper aims to review the relationship between climate change and the onset of cardiac arrest and provide a theoretical basis for the prevention and treatment of cardiac arrest.

Keywords: climate change, cardiac arrest, human health, dose effect, health strategy

1. Introduction

Climate change is widely recognized as one of the most important health threats of the 21st century, and its health damage to the world is continuing to deteriorate. Cardiac arrest is a health problem that cannot be ignored, and its disability and mortality rates remain high. Existing epidemiological studies show that the changes of climate factors, such as temperature, humidity, and air pressure, can influence the occurrence of cardiac arrest through various complex pathophysiology, and are the risk factors for their pathogenesis. This paper will review the above problems.

2. Temperature and cardiac arrest

Temperature change is a key factor affecting human survival and reproduction. If extreme high temperature, low temperature or rapid temperature fluctuations exceed the adaptive range of the human body, it will have a negative impact on health. Currently, when studying temperature associated with the risk of sudden cardiac death, extensive epidemiological studies have shown the presence of the J or U type between temperature and the occurrence of OHCA[1, 2], Suggesting that either too high or too low temperatures can raise the risk of OHCA. A single Israeli case-crossover study of temperature and cardiac arrest showed that[3], High temperature and low humidity are the risk factors for OHCA. In a study of 29,671 OHCA patients in China, high temperature, heat wave, cold temperature and cold wave were all associated with the risk of OHCA, and the effect of low temperature on OHCA was significantly higher than high temperature[4]. In the onset population, the effects of cold and heat on OHCA were more pronounced in those with hypertension, diabetes or heart disease[2, 5]. At the age of onset, older people are more likely to be affected by these two extreme weather[2, 6]. In terms of pathophysiological mechanisms, it is generally believed that the effects of high temperatures and heat waves on OHCA are pathophysiological due to dehydration[7], Dehydration can lead to electrolyte disorders, cardiomyocyte dysfunction, induce cardiac arrhythmias, and high temperature can also lead to peripheral vascular dilatation and reduced coronary blood flow[8], And cause arrhythmia and heart failure and other cardiovascular diseases. Low temperature can cause vasoconstriction, lead to myocardial blood supply, cause myocardial ischemia lead to sudden death, low temperature can also cause blood components, blood concentration and redistribution of thrombosis factor, at the same time, low temperature can lead to sympathetic nervous system and parasympathetic nervous system activation at the same time, the nervous system may lead to arrhythmia, so that the risk of OHCA increased.

3. Relative humidity and cardiac arrest

As temperatures continue to rise, the future climate situation is predicted to be more extreme. In such cases, the humid climate may further aggravate the negative effects of the heat. The risk of death increases in extreme heat or humid heat. In a prospective study from Germany in out-of-hospital cardiac arrest, results indicated an association between relative humidity and OHCA for cardiac cause, especially in dry air[9]; And a national case-crossover study in hot countries in Israel showed that OHCA was more likely to be exposed with higher humidity conditions[3]; In a large time series study in South

Korea, relative humidity was an important meteorological factor in the occurrence of OHCA and was negatively associated with OHCA in the effect of exposure lag[10]. There are few studies on the impact of relative humidity on the risk of sudden death, and humidity is susceptible to temperature changes. Because water vapor is ubiquitous in the atmosphere, it can cause fluctuations in relative humidity, which can evaporate the blood from the skin surface, and this change may increase the risk of disease[11]; Moreover, higher relative humidity may slow the body's ability to emit metabolic heat, while low humidity has the potential to cause body dehydration, increasing the likelihood of disease. However, the pathological mechanism of cardiovascular events has not been well established. In general, studies analyzing the effects of heat and humidity on older adults are scarce and underpowered. Then the study of population aging under the threat of global warming.

4. Atmospheric pressure and cardiac arrest

Atmospheric pressure describes the vertical forces exerted by the atmosphere on objects on the surface or on the ground. Meteorological changes may lead to fluctuations in atmospheric pressure, which may affect the physiological function of the human body. A German study investigating out-of-hospital cardiac arrest (OHCA), found that OHCA decreased at moderate atmospheric pressure (1000 hPa 1020 hPa), while OHCA increased at 1020 hPa ($P=0.023$) and below 1000 hPa ($P=0.035$) [9]. Regarding its pathogenic mechanisms, studies suggest that changes in atmospheric pressure may affect atherosclerotic plaques, thus leading to plaque rupture[12]. In addition, atmospheric pressure can also affect the mean skin temperature, heart rate, systolic, diastolic blood pressure, blood oxygen saturation and water loss rate[13], Make the body metabolism function disorder.

5. Wind speed and cardiac arrest

The study found that after a comprehensive analysis of temperature, humidity and other factors, the probability of OHCA occurrence continuously increased with the increasing wind speed[9]. There is no other study on the single factor of wind speed and the risk of OHCA. When the temperature fluctuates violently, the air pressure rises and the wind increases, the body releases more adrenaline due to the stress reaction, resulting in tight blood vessels, soaring blood pressure and accelerated heart rate, which then makes the heart increases oxygen consumption. At the same time, the aggregation tendency of platelets is enhanced, resulting in a higher risk of thrombosis, which leads to adverse health events such as cardiovascular and cerebrovascular health events.

6. Conclusion

Based on the available data, there is insufficient discussion on how global climate change contributes to cardiac arrest, and the current findings have not reached a consensus. And for different populations, individuals are less sensitive to climate change. Therefore, it is urgent to develop a precise individual climate change and a detailed epidemiological research framework, so as to deeply reveal how climate change causes cardiac arrest and death events, identify vulnerable groups, and provide scientific support for preventive measures to deal with climate change and cardiac arrest.

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