

Poor sleep is bad for the heart

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People who get poor quality sleep develop more atherosclerotic plaques within their arteries and thus are at greater risk of cardiovascular problems. This phenomenon is a consequence of the excessive production of inflammatory cells by the bone marrow.

Several studies have reported that people who get little sleep (< 6 hrs nightly) or who sleep poorly (fragmented sleep) are at greater risk of developing a number of health problems, notably cardiovascular issues. For example, a meta-analysis of 15 prospective studies (474,684 participants in total) showed that people with short duration sleep (6 hours nightly or less) had a 50% greater risk of experiencing coronary disease (heart attack) and a 15% greater risk of a stroke¹.

To better understand the link between sleep quality and the risk of cardiovascular problems a recent study examined whether a lack of sleep or fragmented sleep was associated with an increased level of atherosclerotic plaques within the arteries². The researchers recruited 3974 volunteers and evaluated their sleeping habits via actigraphy by having them wear at their waist a triaxial accelerometer for 7 consecutive days. These devices enable objectively recording of movements during sleep and thus permit quantification in a reliable manner of the duration and quality of sleep. In parallel, the participants in the study were examined by 3-Dimensional Vascular Ultrasound (3DVUS), a method which permits quantification of the degree of atherosclerotic plaque affecting the femoral and carotid arteries.

This approach allowed the researchers to show that people who slept very little (less than 6 hours nightly) or who had a fragmented sleep had about 30% more atherosclerotic plaques within their arteries than did those who slept normally for 7 to 8 hours each night.

This is the first demonstration of a direct link between poor sleeping habits and the health of the blood vessel walls.

Since the development of atherosclerotic plaques can lead, with time, to an obstruction to blood flow and can cause a heart attack or stroke, these observations thus suggest that bad sleep habits could be considered as a risk factor for a cardiovascular event.

IS BONE MARROW THE CAUSE?

People who sleep poorly often have, in parallel, other bad lifestyle habits (obesity, poor diet and excessive consumption of alcohol) which can contribute to the increased risk of cardiovascular diseases associated with poor sleep. However, a very interesting study recently published in *Nature* suggests that the lack of sleep could exert a direct effect on the development of atherosclerotic plaques by influencing the formation of immune cells within the bone marrow³.



By using a genetic mice model predisposed to the formation of atherosclerotic plaques (Apoe -/-), researchers at Harvard Medical School observed that fragmented sleep led to a significant increase in the size of atherosclerotic lesions within the aorta.

This acceleration of the atherosclerotic process by poor sleep was caused by an immune imbalance: when the sleep was perturbed, the levels of a neurotransmitter (hypocretin) secreted by the hypothalamus within the brain was diminished, leading to overproduction of certain inflammatory white blood cells (monocytes) by the bone marrow. These white blood cells then accumulate within the atherosclerotic lesions and lead to local inflammation which favours plaque development.

The crucial role for sleep in the maintenance of good health is thus not only a question of rest and the recuperation of energy. By preventing the excessive production of inflammatory cells by the bone marrow, quality sleep can prevent the development of atherosclerotic plaques and thus diminish the risk of cardiovascular diseases.

- (1) Cappuccio FP et al. Sleep duration predicts cardiovascular outcomes: a systematic review and meta-analysis of prospective studies. *Eur. Heart J.* 2011; 32: 1484-92.
- (2) Domínguez F et al. Association of sleep duration and quality with subclinical atherosclerosis. *J. Am. Coll. Cardiol.* 2019; 73: 134-144.
- (3) McAlpine CS et al. Sleep modulates haematopoiesis and protects against atherosclerosis. *Nature* 2019; 566 : 383-387.