High blood pressure may accelerate bone aging

September 7 2022

Credit: Pixabay/CC0 Public Domain

When high blood pressure was induced in young mice, they had bone loss and osteoporosis-related bone damage comparable to older mice, according to new research presented today at the American Heart

Association's Hypertension Scientific Sessions 2022 conference, held Sept. 7-10, 2022, in San Diego. The meeting is the premier scientific exchange focused on recent advances in basic and clinical research on high blood pressure and its relationship to cardiac and kidney disease, stroke, obesity and genetics.

High blood pressure and osteoporosis are prevalent diseases, and people may have both at the same time. In this study, researchers examined inflammation associated with high blood pressure in mice and found it may be connected to osteoporosis.

"Bone marrow is where both new bone and new immune cells are produced. We suspect that more pro-inflammatory immune cells in the bone marrow may be leading to damage of the bone and making it weaker," said lead study author Elizabeth Maria Hennen, a Ph.D.-candidate in biomedical engineering at Vanderbilt University in Nashville, Tennessee. "By understanding how hypertension contributes to osteoporosis, we may be able to reduce the risk of osteoporosis and better protect people later in life from having fragility fractures and a lower quality of life."

In the study, researchers compared young mice with induced hypertension to older mice without hypertension to assess the potential relationship of hypertension to bone aging. The human age equivalent was about 20-30 years old for the young mice and about 47-56 years old for the older mice, Hennen said. A group of 12 young mice (4 months old) were given angiotensin II, a hormone that leads to high blood pressure. The young mice received 490 nanograms/kilogram of angiotensin II for six weeks. A group of 11 older mice (16 months old) also received 490 nanograms/kilogram of angiotensin II for six weeks. Two control groups of 13 young mice and 9 old mice received a buffer solution that did not include angiotensin II, and these mice did not develop high blood pressure.

After six weeks, researchers analyzed the bones of mice from all four groups using micro-computed tomography, an advanced imaging technique. Bone health was determined by strength and density of the bone. Mathematical algorithms were used to estimate the potential effects of hypertension and aging on the microstructure and strength of the bone in the mice.

When compared to the young mice without hypertension, the young mice with induced hypertension had a significant 24% reduction in bone volume fraction, an 18% reduction in the thickness of the sponge-like trabecular bone located at the end of long bones, such as femurs and the spinal column, and a 34% reduction in estimated failure force, which is the ability of bones to withstand different types of force.

"Failure force translates into weaker bones. In the spine, bone weakness can lead to vertebral fractures later in life," Hennen said.

In contrast, the older mice who were given the angiotensin-II infusion did not exhibit similar bone loss. During the study, however, the old mice, with or without high blood pressure, exhibited a reduced bone quality similar to that of the hypertensive young mice.

"In these mice, being hypertensive at a younger age essentially aged bones as if they were 15-25 human years older," Hennen said.

To assess the impact of inflammation on bone health of the mice, researchers analyzed the bone marrow using flow cytometry. This tool allowed researchers to identify individual cells and to sort out specific immune cells. In the hypertensive young mice, they found an increase in the number of inflammatory signaling molecules, indicating an increase in inflammation in the bones when compared to the young mice that did not receive angiotensin II.

"This increase in active immune cells tells us that the older mice are more inflamed overall, and that a continued state of inflammation, whether they had high blood pressure or not, may have an impact on bone health," Hennen said. "It appeared that high blood pressure was adjusting the bone remodeling process toward bone loss, rather than bone gain or bone equilibrium, in the hypertensive young mice. As a result, bones will be weaker, leading to an increased risk for osteoporosis and fragility fracture. In humans, this might mean that we should screen for osteoporosis in people with high blood pressure."

Hennen adds that these findings may help researchers identify the immune cells and mechanisms that play a role in human bone health. This depth of knowledge may lead to new approaches to prevent osteoporosis in early adulthood.

The study limitations include that it is only descriptive, so additional research is needed to investigate how specifically the different types of immune cells may contribute to bone loss. In addition, it is unknown whether a similar link exists in humans, so similar research in humans is needed to confirm these findings.

More information: Conference: professional.heart.org/en/meet … /scientific-sessions

Provided by American Heart Association

provided for information purposes only.