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WHAT CAUSES THE PAINFUL, INFLEXIBLE SPINE?

Relevant for: Science & Technology | Topic: Biotechnology, Genetics & Health related developments

Widespread: Ankylosing spondylitis is accompanied by a lower back pain. It hurts the jaw, the ribcage, or even the heels. | Photo Credit: Getty Images

The vertebral column is important to the structure of your body, allowing you to stand erect, and to do yoga. This flexibility comes from 33 interlocked vertebrae. It is a marvel of evolutionary and engineering design, seeing us humans through feats involving stress and strain. Olympic-grade javelin throwers, 20 years after retiring from the grind of training and competitions, have no more back-related problems than the rest of us (*Bone & Joint Journal*).

A chiropractor will tell you that there are 364 joints in the vertebral column — there are many possible ways in which things could go wrong, resulting in back problems that cover the whole pain spectrum, from niggling to crippling.

An inflammation of the bones in the spine is called spondylitis. One severe, arthritic form of spondylitis is called ankylosing spondylitis (AS). The term ‘ankylosing’ refers to new bone formation leading to the cementing together of a set of adjacent vertebrae, usually in the lower back. Spondylitis is different from spondylosis, which is the wearing away of the vertebral column.

Ankylosing spondylitis is accompanied by the kind of lower back pain that worsens when you rest (which means the sufferer may wake up from sleep in pain). X-rays show clear signs of damage to the spine or to the joints that link the spine to the pelvis. Other parts of the body — the jaw, the ribcage, or even the heels — may hurt too. AS affects about 0.2% of the world’s population.

Your immune system responds to trouble — be it a bacterial infection or be it a fresh wound — by sending out inflammatory cells to the problematic site. This initiates an aggressive reaction aimed at overwhelming the bacteria, or starting the healing process. The acute response causes short-term pain and swelling, which subsides when the foreign invaders are overcome (or the wound is healed).

An important immune system component, the human leukocyte antigen (HLA) complex, helps distinguish self from non-self — normal proteins that are part of your body versus proteins that are from invasive organisms, or even damaged or deformed versions of your own normal proteins. The HLA complex achieves this by showing a particularly ‘foreign’-looking piece of a bacterial molecule (the antigen) to other immune system components that will hunt down anything resembling this piece. As an analogy, if there were a gang of thieves in your town who wear red-and-white checked shirts, the HLA complex shows this checked shirt to a police patrol.

The precise trigger for AS is not known. It has a genetic component, as it is known to run in families, but not everyone in these families is equally affected. Some variants of the HLA gene (e.g., HLA-B27) are predisposed to AS and other conditions that cause chronic inflammation of the joints of the spine. These variant HLA proteins are not ‘manufactured’ correctly, leading to a change in their shapes and contours such that they appear to be ‘foreign’.

Going back to our thieves analogy, this sentinel molecule itself appears to be wearing a similar checked shirt. The immune system decides that this HLA variant has to be disposed off by any means possible, including the destruction of cells that carry this protein. The consequences are

disastrous — the immune system remains in the activated mode, even in the absence of real danger. The result is chronic inflammation.

Molecules that play key roles in maintaining healthy bone mass and in the repair of fractures are also involved in cementing vertebrae together in AS (*Science Advances*).

The HLA-B27 variant is itself very polymorphic, meaning that it has many sub-variations. Probing into the perplexing differences in the severity of AS in people having the disease, the group of Manni Luthra-Guptasarma, working at the Postgraduate Institute of Medical Education and Research in Chandigarh, has shown that mild forms of AS are caused by HLA variants that are easily cleared by the body's machinery for breaking down worn out proteins. Other misshapen HLA variants accumulate as aggregated masses inside cells, and the body's inability to clear them out results in severe forms of AS. (*Frontiers in Immunology*).

Pain-relieving drugs, immune system-modifiers and sometimes surgery are used to manage this chronic affliction. Individual management strategies — exercise routines, firm and flat pillows, and the avoidance of 'trigger' foods such as artificial sweeteners, are of great help.

(*The article was written in collaboration with Sushil Chandani who works in molecular modelling. sushilchandani@gmail.com*)

dbala@lvpei.org

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