The so-called intervertebral disc: A 4-D reverie

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A Canadian physician had regretted that there is too much of “yes, sir-ring” in medical institutions. A spoken, more so a printed, word gets taken as gospel truth, an idee fixe, till ordinary logic compels you to question what has been taken for granted. The intervertebral disc (IVD) is a good example - semantically unjustified and begging for a redressal in the court of intellectual appeal.

Anatomic thinking-n-teaching, epitomized by Gray’s Anatomy, is osteocentric, a clear error of putting the cart before the horse. For bones, in phylogeny and ontogeny, arrive as a relaxed afterthought. The deltoid precedes the humerus in development, so that, if at all, it is the humerus that should seek ‘attachment’ to the muscle. The mandibular nerve does not, nor had ever to ‘pass’ through the foramen ovale which fashions itself round the preformed nerve. All the IVDs are well-formed and clearly delineated, before a spicule of bone has appeared in the so-called vertebrae. Moreover, each IVD represents the centre of a somite, a fact verifiable by the emergence of every pair of spinal nerves at the level of IVD. The humidity that each IVD shows by looking a radiological vacant space between two osseous prominences called the vertebrae has earned for itself the secondary status of being intervertebral. The fact is that each vertebra is interdiscal. The IVD is primary, the vertebrae playing a second fiddle to it. It may be safely generalized that, contrary to the continuing osteocentric anatomy, it is the soft tissues that lead and the bones follow - from womb to tomb, in health and disease, in situ and after surgery. Let us resolve to exile the irritating appellation ‘intervertebral’ once and for ever. Every so-called vertebra and every single bone, is a discrete island resting in an uninterrupted ocean of soft tissues, an ordinary fact good enough to justify the second place accorded to all bones.

Do the vertebrae deserve to be so called? The words vertebra-vertebrate are derived from Sanskrit- verten (hence pariverten) and Latin vertere meaning to turn, thus also connoting a joint. Therefore a vertebrae is one who can turn at a joint, thus making the millipede the greatest vertebrate of all. The error has been to equate static osseousness with dynamic vertebrateness. The most vertebrate part of an elephant is not the massive skull or spine, but the head-foot called the trunk that is powerful and versatile sans any bone, much like in the mollusc (= soft) octopus whose ten head-feet (hence the octopus is a cephalopod) match the vertebrate agility of the boneless elephanteine trunk. Vis-à-vis the human vertebral column, it is the discs that allow all the twists and turns, the vertebrae being incapable of the same and merely following whatever the discs dictate. But for the discs, there would be no ease of a ballerina nor of an ice-skater, nor the grace of the flamingo’s neck, nor the multiple circlings of the reptilian body. The marvel of the human and animal locomotion is through the munificence of the so-called IVDs.

Is IVD disc at all? The lexicons define a disc as ‘a circular plate, round and flattened’. In man, the IVDs contribute to more that one-third of the column length. Then what to talk of a giraffe (height 18-20 feet), whose neck is more than eight feet long, has only seven vertebrae and hence has to have some discs that are as tall as four to six inches! The human lumbosacral vertebra is two and a half times taller in front than behind and it is this height that determines the sharp lumbosacral curve that is at the root of the evolution of the erect posture. The curves of the human vertebral column are the courtesy of the varying anterior and posterior heights of the IVDs. It is a lordotic curve if the anterior height is greater and kyphotic if the posterior height of the IVDs is greater. An IVD is anything but a disc for unlike a disc, it is a three-dimensional (3-D) structure.

This journal has defined an IVD as a pulvinot (from pulvinus = pillow/cushion and not from notos = back). An IVD is a series of your back-cushions that are a marvel of engineering design. Each pulvinot is a sphere of strong fibrous tissue, better called spherus (and not annulus) fibrosus, containing in its center a ball of mucoid connective tissue called nucleus pulposus. The two comprise a ball-within-ball joint that works on the same principle as does a pneumatic tire. The compression exerted on the nucleus pulposus makes it stretch the spherus fibrosus, the compression/stretch forces absorbing...
the weight impact and thus allowing a porter to carry a huge load on the head or the back without hurting either the pulvinot or the noton (the so-called vertebra). The nucleus pulposus belongs to the category of mucoid connective tissue that is also located at the root of each tooth, thus allowing a human or a hyena to exert a pressure as high as 500 pounds per square inch, without hurting the jaws. The enormity of the compression force that the mucoid connective tissue and the pulvinot can stand is rooted in its avascularity, an advantage the bony vertebra does not enjoy. Any pathology museum will have a specimen of an aortic aneurysm that had eaten into the centre of the vertebra (by impinging on its vascularity to make the bones ischemic), leaving the avascular and hence defiant discs, unmolested. What is true of a vascular tumor called aneurysm is true of cellular tumors, called neoplasms, as well.

Other examples of mucoid connective tissue are the vitreous of the eye and the Wharton’s jelly in the umbilical cord. A high-school on physics has rightly described a fluid as infinitely incompressible. Nucleus pulposus belongs to that class and hence the gymnastic feats at each Olympics, in terms of weights lifted. From hand-to-foot, Nature has put a series of fluids (synovial fluid, cerebrospinal fluid, blood, nucleus pulposus) as shock acceptors that render the human frame essentially weightless. The strongest part of the 70,000-Kg jumbo-jet is its nitrogen-filled tires whose combination of compression of the gas and stretch of the tire-fibers makes the monster essentially weightless as and when it lands on the tarmac to give you a cushioned landing, greatly aided by the 12-14 feet column of oil in its landing gears.

The journal had questioned the validity of the term spine/spinal as connoting vertebra/vertebral and had suggested that these appellations be replaced by notal/notonal. The whole back-column could be called the pulvinotal column, an etymological sequence in which the so-called disc enjoys primacy over the vertebra (or noton). The vertebrateness (versatility of movement) of the pulvinotal column resides in the pulvinots and not, in the intermediate bones.

Along Einsteinean lines, we need to accord the fourth dimension of TIME to each pulvinot (IVD). The body’s march from conception to cremation is recorded time-wise not only in each cell, but in every fiber too. It is interesting that the aortic collagen of a rat of three years, dog of 12 years, horse of 60 years and man of 100 years is identical in structural evolution and very closely comparable. The disc of one’s older time is not degenerate but merely evolved with the passage of time. Can we read aging as Time Instructed Morphological Evolution? That makes our aging innate, inevitable and essentially innocent. The lament that we have about our gray hair and opaque lenses is out of sync with the march of time in the warf and welt of our body. There is no need for any shame in one’s aging. What is needed is grace. The autumn of life is no less beautiful than the spring and the latter should know that it itself is heading for the inevitable autumn. Don’t call a pulvinot degenerate. Say, it is showing its fourth dimension, namely TIME.

No doubt that many a pulvinot ages enough to allow the escape of nucleus pulposus beyond the confines of its spheres fibrosus. But amongst innumerable such prolapses, an occasional one dis-eases the owner. Hence the essential innocence of the TIMEd pulvinot, like a TIMEd tooth. If some of us get hurt while cutting our teeth, some of us do get hurt while rotting them. Such incidental dis-easing does not sully the essential innocence of any aging process. Portmann has called the animal body as configured time, that must look disfigured in its temporal sojourn, but the anomaly lies not in the process but in the eyes of the beholder. Medical science’s role is to ease whatever the dis-ease that may accrue from pulvinotal evolution, dis-ease-far and no further. So often, the total loss of a disc approximates the adjacent notons (vertebrae) to merge with one another to create a solid bony unit that allows other pulvinotal joints to carry on life, as usual.

Lewis Thomas and Lyall Watson have observed that the greatest medical discovery in the last 100 years is of its profound ignorance. How little we know of a marvel called a pulvinot (IVD)? The realization of one’s cerebral limitations ushers in a sense of humility that begets a sense of wonder that spawns a reverie. Pulvinot, thou art great. No man-made disc-replacement can come anywhere near your genius.