Editorial

"Water, fat, bone" in the spinal canal-all protective and all indicators of spinal instability

The presence of more than normal cerebrospinal fluid (CSF) within the spinal canal (syringomyelia) or outside the spinal canal (external syringomyelia) and inside the brainstem (syringobulbia) or outside the brainstem (external syringobulbia) has been identified to be pathological collections and simulate tumors or space-occupying lesions.[1-3] Hosts of surgical treatment modalities have been advocated to surgically remove or reduce the excessive CSF collection and restore the neural volume. Similarly, the presence of abnormal bone tissue within the spinal canal in the form of osteophytes and ossification of posterior longitudinal ligament has been identified to be compressive pathological factors that affect neural function. To surgically excise these compressive bone encroachments or make space to accommodate the intrusion by decompressive removal of bone by laminectomy or laminoplasty from posterior surgical route and by corpectomy and discoidectomy by anterior surgical route forms the basis of surgical treatment. In the same light, the presence of excessive amount of fat seen in the spinal canal in cases with Hirayama disease has been identified as a pathological feature that suggests the need for surgical treatment. Obviously, the presence of fat, water, and bone related to tumors, infections, or trauma form a separate group and cannot be included in the present discussion.

Our recent studies have identified that Chiari formation and syringomyelia are both protective maneuvers instituted by nature to protect neural structures from instability at the most unstable joint of the body, namely the atlantoaxial joint.[4-6] A number of musculoskeletal alterations that include basilar invagination, assimilation of the atlas, C2-3 fusion, bifid anterior and posterior arches of atlas, Klippel-Feil abnormality, platybasia are frequently associated and all have the same primary or nodal point of the pathogenesis of atlantoaxial instability.[7-9] Short neck, torticollis, short head, and short spine are the hallmarks of basilar invagination. Chronic or long-standing atlantoaxial instability allows natural protective measures to establish. The symptoms are relatively subtle but are relentlessly progressive. The identification of instability and treating it appropriately by strong atlantoaxial fixation results in an immediate neurological recovery and eventual reduction in the size of the syrinx and restoration of the positions of the tonsils and reversal of all secondary and protective musculoskeletal alterations are possible in the early postoperative period.

Osteophytes, ligamentum flavum hypertrophy, and disc space reduction related to "loss" of its water content have been identified by us as secondary natural and "protective" events in the face of spinal instability. Muscles that are responsible for standing human posture weaken due to disuse, abuse, or injury and result in vertical spinal instability that leads to telescoping of the spinal segments at single or multiple levels.[10] The instability is manifested at the facets that are the fulcrum of all spinal movements and where all the major spinal muscles focus their activity. The instability at the level of facets is poorly recognized on profile imaging due to their lateral location that is away from neural structures. However, the secondary effects of vertical instability in the form of buckling of intervertebral ligaments, osteophyte formation, and reduction in the disc height and its bulge posteriorly into the spinal canal, resulting in neural compression is relatively easily identified on modern computer-based imaging. Our recent observation is that it is not neural compression or deformation, but it is subtle and repeated micro-injuries to the neural structures as a result of instability that is the cause of symptoms and deficits.[11] Our several related articles have identified the validity of "only fixation" as treatment and futility of resection of naturally protective agents such as disc, osteophytes, and buckled ligaments.[12] We also observed that after surgery that involves only spinal fixation, all secondary features such as ligamentous buckling, osteophyte formation, and disc-related changes have the potential to normalize.

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Our studies identify that spinal deformities that include torticollis, spinal kyphosis, and scoliosis are a result of spinal instability.[13-16] Identification of the level of spinal instability and stabilization of the affected spinal segment is the treatment. Decompression by resection of the part of the bone may have negative consequences.

It is unclear if arachnoid cysts, synovial cysts, and similar such "water-collection" are primary pathological entities or are secondary and protective processes and related to spinal instability.

The presence of extra "fat" in the extraneural space in the cervical spine as seen in Hirayama disease had been identified as a pathological fat collection and a neural compressive agent.[17] Our observations suggest that this fat collection is a natural protection in the presence of multi-layered spinal instability. Stabilization of the spine is the treatment. No direct surgical attack on the fat is necessary.

The exact decision as to how nature selects bone, fat, or water introduction in the face of spinal instability cannot be comprehended. The site of primary spinal instability, duration and extent of instability, and its character probably determines the response by nature.

Water has a prominent place in the basic four elements of life that include air, water, fire, and earth. Water is inside the brain, outside the brain, and through the brain. Our studies over several years have identified that water that is essential for beginning and nurturing of life also has a big life and function protective role. A new-conceived human embryo averages 97% water, a newborn baby 77% and a grown man 60%."[18] Since neuraxial development dominates early embryogenesis, it pays to generalize that it is water that gets configured as our neurons and neuroglia. Essentially, the observation is that "water," fat and bone can never go wrong.

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