WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 11, Issue 16, 635-657. Review Article ISSN 2277– 7105

MODERN AND AYURVEDIC PRESPECTIVE OF CERVICAL SPONDYLOSIS – A LITERARY REVIEW

[1]*Dr. S. Ranjani, [2]Dr. Pradeep Kumar Moharana and [3]Dr. S. Swaminathan

[1]PG –Scholar, Final Year, Kayachikitsa, Sri Jayendra Saraswathi Ayurveda College and Hospital.

[2]Professor, M.D (Ayu), Ph.D. (Ayu) Guide, Sri Jayendra Saraswathi Ayurveda College and Hospital.

[3]Professor, HOD Samskrt Samhita Siddhant, Sri Jayendra Saraswathi Ayurveda College and Hospital.

Article Received on
06 October 2022,

Revised on 27 Oct. 2022,
Accepted on 17 Nov. 2022

DOI: 10.20959/wjpr202216-26265

***Corresponding Author**
Dr. S. Ranjani
PG -Scholar, Final Year, Kayachikitsa, Sri Jayendra Saraswathi Ayurveda College and Hospital.
IEC No – IEC/SJSACH/05/2021
CTRI NO – CTRI/2021/07/034968
drranjanisairam2910@gmail.com

ABSTRACT

The wear and tear of the spine related disorder is on the rise now, especially more on the cervical vertebrae, where there is an abnormal damage to the cartilage and bones of the neck. The normal adult skull weighs around 4.5 – 5 kg and it continuously exerts a pressure on the cervical spine during the sitting posture and in standing erect for humans. Factors like occupational stress, improper sitting postures, sitting in air conditioners and adopting continuously one posture, over exertion causes pressure over cervical spine with a damage to the flexibility of the surrounding tissues, cushion structures called the discs protecting the vertebrae from friction and acting as shock absorbers leading to the cause of cervical spondylosis. This causes chronic neck pain and symptoms of root compression are usually associated with pain radiating to the arms, numbness in fingers and motor weakness. Prevalence of *Vāyu mahābhuta* as per Ayurveda is said to be the primary cause for these damages to occur. **Materials and Methods:** literature of present study has been reviewed from various Samhita, textbooks, and published journal articles etc. **Conclusion –** Is drawn based on the anatomical review, etiological factors, pathogenesis, clinical signs and symptoms, treatment aspect of both modern and ayurvedic view of cervical spondylosis.

KEYWORDS: Cervical spine, Intervertebral disc, dehydration, *Vāyu mahābhuta*, Cervical spondylosis.

INTRODUCTION

Cervical spondylosis is a degenerative condition of the cervical spine commonly called as "Osteoarthritis of the neck ". As the disc dehydrate and shrink it causes protrusion and bony projections along the edges of the bone (bone spurs) of adjacent ventral bodies leading to narrowing of vertebral canal and intervertebral foramina.[1]

STATEMENT OF PROBLEM

- The prevalence of cervical spondylosis is about 13% in the third decade of males rising to 100% by age 70 years and in females the prevalence ranged from 5 % in the fourth decade to 96% in women older than 70 years. The radiographic changes are more severe in men than women.[2]
- A survey conducted in young adults from South India revealed the prevalence of cervical spondylosis. About 62% of males, 36% of females are facing cervical spondylosis. Cervical spondylosis is a degenerative condition of the cervical spine producing changes in the intervertebral discs along with protrusion and bony overgrowth of adjacent vertebral bodies.[3]
- Research studies reveal that long lasting work on computers, long bending of head puts undue pressure on the cervical spine and the muscles of the neck, shoulder and upper limb becomes overloaded and finally injured.
- A study conducted among the group of computer users and non – computer users, results reveal that cervical spondylosis was statistically significant among those who use computers and long term with bad posture without break time increases the liability for developing cervical spondylosis.
- Study conducted among computer users result showed that 73% respondents had neck and shoulder pain considered as one of the risk factors for the development of cervical spondylosis.
- Research report says that rise in number of professionals confined to desk or in front of computers working for long hours in one posture is one of the major causes for early degeneration of cervical spine causing cervical spondylosis.[4]

CERVICAL SPONDYLOSIS – MODERN PRESPECTIVE

Cervical spondylosis is a degenerative condition that occurs in the cervical spine and leading to changes in the intervertebral discs with disc degeneration, osteophyte and spur formation, ligamentous hypertrophy, vertebral subluxation, decreased in the height of disc and facet joint arthropathy all these contribute to narrowing of spinal canal and intervertebral foramina. It is defined as "vertebral osteophytosis secondary to the degenerative disc disease "mainly due to the osteophytic formations that occur with progressive degeneration of spinal segment.

INCIDENCE

- ✓ Degenerative disease of the cervical spine its cartilaginous and ligamentous structures is considered to be the most common cause of cervical cord and root compression in patients older than 40 years of age.[5]
- ✓ Women are more affected due to hormonal changes like deficiency of oestrogen.[6]
- ✓ Cervical spondylosis occurs in middle- aged or elderly patients and may cause neck pain, radiculopathy, or myelopathy symptoms.
- ✓ Spondylotic changes in cervical spine it occurs at solitary disc space levels in 15 to 40 % of patients and it occurs in multiple levels in 60 – 85% of patients and the disc between third and seventh cervical vertebra (C3 – C7) most affected area.
- ✓ Repeated occupational trauma contributes to the development of cervical spondylosis with greater incidence noted in patients who carried heavy loads on their heads and shoulders.
- ✓ Presence of a congenitally narrow spinal canal diameter of 10 – 13 mm is considered as predisposing factor in spondylotic myelopathy patients.

ETIOLOGICAL FACTORS[7]– Several factors contribute to the formation of cervical spondylosis these include –

1. **AGING –** over 40 - 50 years of age more people tend to develop degenerative conditions and are likely to present with spondylosis changes in the cervical spine. It gradually restricts the movements and there is a symmetrical loss of cervical side bending of spine.
2. **OCCUPATIONAL CAUSE** – Carrying heavy loads, sitting in front of computers for longer duration, repeated mechanical stress all these factors lead to the production of oxidative stress in the body by which free radicals are developed and that has an action up to the level of mitochondria. Free radicals are continuously generated due to aging and oxidative stress causes damage to cell membrane.

3. **POSTURE** – Bad posture, using hard pillows and uneven surfaces that are hard while lying down, incorrect positioning of head on bed especially while lying down on tummy with head turned to one side are all considered to be the cause for cervical spondylosis to manifest.
4. **TRAUMATIC** - Trauma can occur due to exertion, regular travelling, or prolonged car or two – wheeler driving for long distances on bad roads. Accidental whiplash injuries of the cervical spine are familiar cause, athletic and sports injuries, acute spinal cord injury may occur from neck extension when cord is pinched between anterior osteophytes and infolding ligamentum on posteriorly. Neural ischemia due to repetitive minor contusion occur due to trauma and vascular comprise due to stenosis also contribute to cervical spondylosis.
5. **GENETIC** – In about 10 % of patients it is due to congenital bony anomalies like blocked vertebrae, malformed laminae this produces undue pressure or stress over the intervertebral discs. Congenital spinal stenosis occurs sporadically within families and in achondroplasia dwarfs Variations in the HLA – B gene (human leukocyte antigen) plays an important role.
6. **CIGARETTE SMOKING AND ALCOHOL** – has a detrimental effect on bone density it increases the risk of developing osteoporosis by reducing the blood supply to bones, slow the production of bone – forming cells, impair the absorption of calcium. Due to the reduction in blood supply to intervertebral disc proper nourishment to the disc is blocked there by it undergoes anoxia state and leads to cell – death and inflammation.
7. **HORMONAL CHANGES** – oestrogen deficiency at menopause results in an unbalanced increase in bone turnover, bone resorption exceeds bone formation thereby leading to rapid bone loss accompanied by destruction of bone microarchitecture.
8. **MEDICAL CONDITIONS** - vitamin D deficiency, underlying medical health conditions like hyperparathyroidism, diabetes mellitus, coeliac diseases, Crohn's disease, Cancer, BMI less than 19, high dose of steroid medications.

BIOMECHANICS OF CERVICAL SPINE

Cervical spine has a wide range of motion in various directions and it supports the sensory platform it moves and orientates it in three – dimensional space. The type of movements of head possibly depends on the shape and structure of cervical vertebrae.[8]

- ✓ The atlanto – occipital joint helps in flexion and extension whereas the atlanto – axial joint help in rotation of the spine. The cervical spine can rotate up to 180 degrees.

- ✓ 50% of flexion and extension happens in upper cervical area and 50 % of rotation happens in the level of C1 – C2 and lateral flexion mostly on the middle part of cervical spine
- ✓ Uncovertebral joints support approximately 20% of the axial load in flexion.

PATHOLOGY OF CERVICAL SPONDYLOSIS

Facet joint arthropathy, bony and the ligamentum hypertrophy occurs typically in the mobile cervical spine and all the changes are most prominent where there is maximum motion and it is not directly proportion to the degree of weight bearing.

The unique properties of bone and soft tissue are that it has ability to regenerate and remodel the tissue along the lines of loading and stress by which it regains its structural integrity.

Since the osteophyte or bony spur formation occur in response to both axial and more on eccentric loads, in the areas which undergo greater stress new bones are formed and areas where there is less stress, they get resorbed.

The sagittal diameter of the cervical canal at different levels predisposes to spondylotic changes. From C1 to C3 it is about 16 – 30 mm and from C4 – C6 it is 14 – 23 mm. The sagittal diameter of the cord at C1 level is 11 mm and gradually decreasing downwards.

Encroachment of the intervertebral foramina due to osteophytic formation can compress the vertebral artery leading to vertigo.

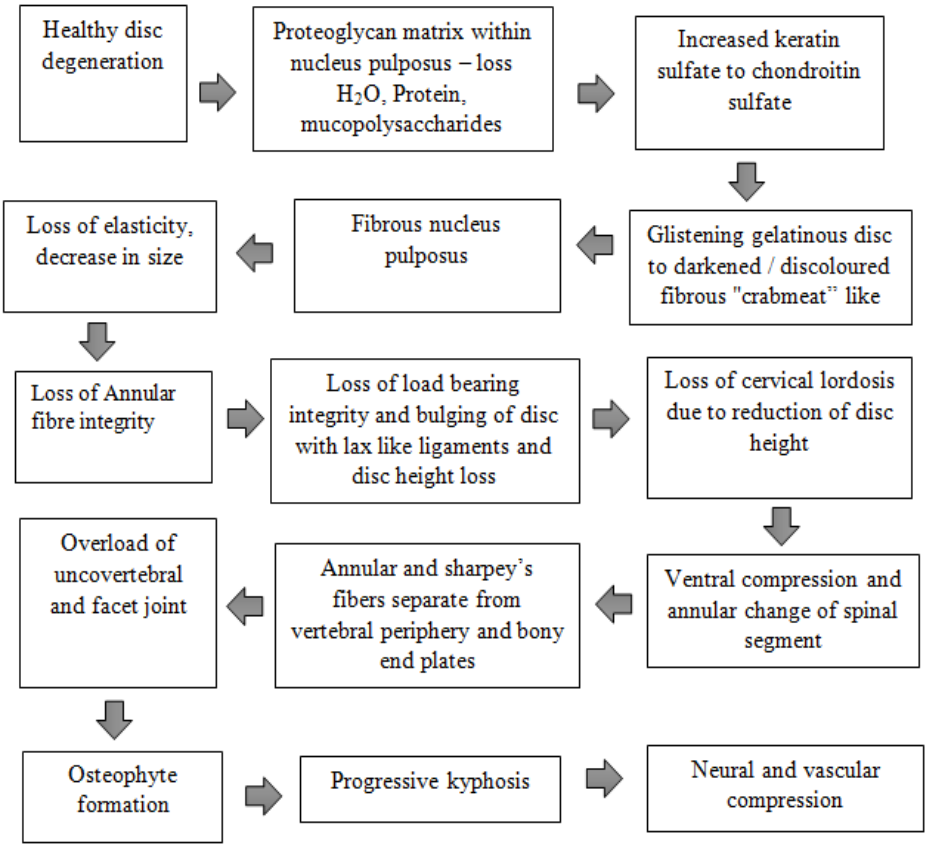
BIOMECHANICAL PATHWAYS LEADING TO CERVICAL SPONDYLOSIS[9]

1. During birth the intervertebral discs are healthy contain proteoglycan matrix inside the nucleus pulposus that maintains 70 – 90 % of water content and it declines with aging. Due to the changes in the proteoglycan matrix causes an increase in the ratio of keratin sulfate to chondroitin sulfate resulting in loss of water content within disc.
2. When the water content of nucleus pulposus decline the healthy glistening gelatinous appearance changes to darkened and discolored fibrous “crabmeat” consistency (loss of H_2O content and structural integrity)
3. Disc desiccation causes the nucleus pulposus to lose its elasticity and ability to bear axial loads and shrink in size and result in ventral and dorsal margin of disc bulge. The dorsal fibers of annulus are thinner than the ventral aspect there is a least resistance path through annulus for a nucleus pulposus to herniate.

4. Annular fibers become mechanically compromised with further disc desiccation and cannot effectively maintain the axial loads hence causing buckling of spinal ligaments and eccentric loads like cervical range of movement gives additional stress to that area leading to further degeneration.
5. The reduction in the structural and mechanical integrity of supportive soft tissues all along the cervical segment causes the disc to bulge, the ligamentous tissue become buckle and lax like appearance causing ventral aspect of cervical spine to compress
6. Transfer of axial loads to uncovertebral joints (Luschka's joint) located on each side of the four cervical disc (between C3 – C7) gives load to the facet joint.
7. Facet joint excessively loaded result in hypertrophic facets along with long term ossification of posterior longitudinal ligament
8. Due to the degeneration the cervical spine is being altered and disrupted. The remaining functional and supportive structures of cervical column absorbs the added stress that is being transferred to the surrounding structures and adjacent levels along the spine.
9. All these structures undergo excessive stress and strain result in cascade of events leading to further degeneration and tissue adaptation.
10. Overload to the soft tissues and bone causes osteophytes to form with end result of kyphosis of cervical spine.

If this condition is not reversed then kyphosis continue to progress leading to annular and sharpey's fibers will separate from the vertebral periphery and bony endplates resulting in reactive bone formation.

Bony spurs are formed along the dorsal or ventral margin in response to altered biomechanical loads causing compression to the neural and vascular structures.



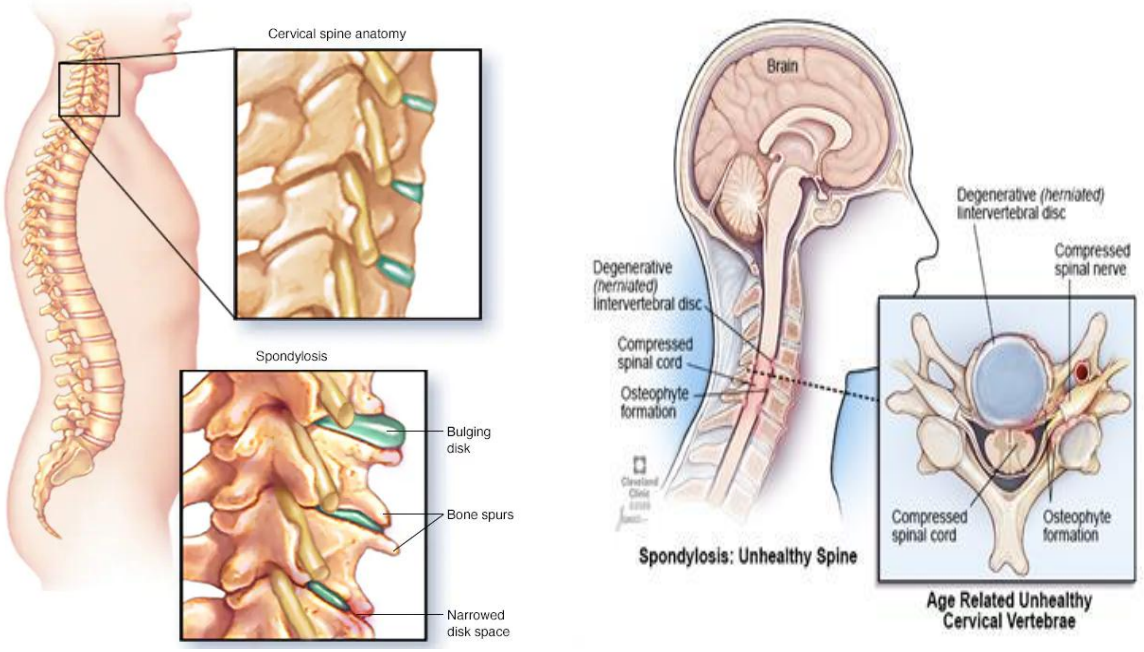


Fig 1.1 shows cervical spondylosis with disc level changes.

ETIOPATHOGENESIS OF CERVICAL SPONDYLOSIS[10]

Degeneration of the disc occurs within thinning and protrusion of nucleus pulposus either laterally or posteriorly by tearing away the annulus fibrosus.

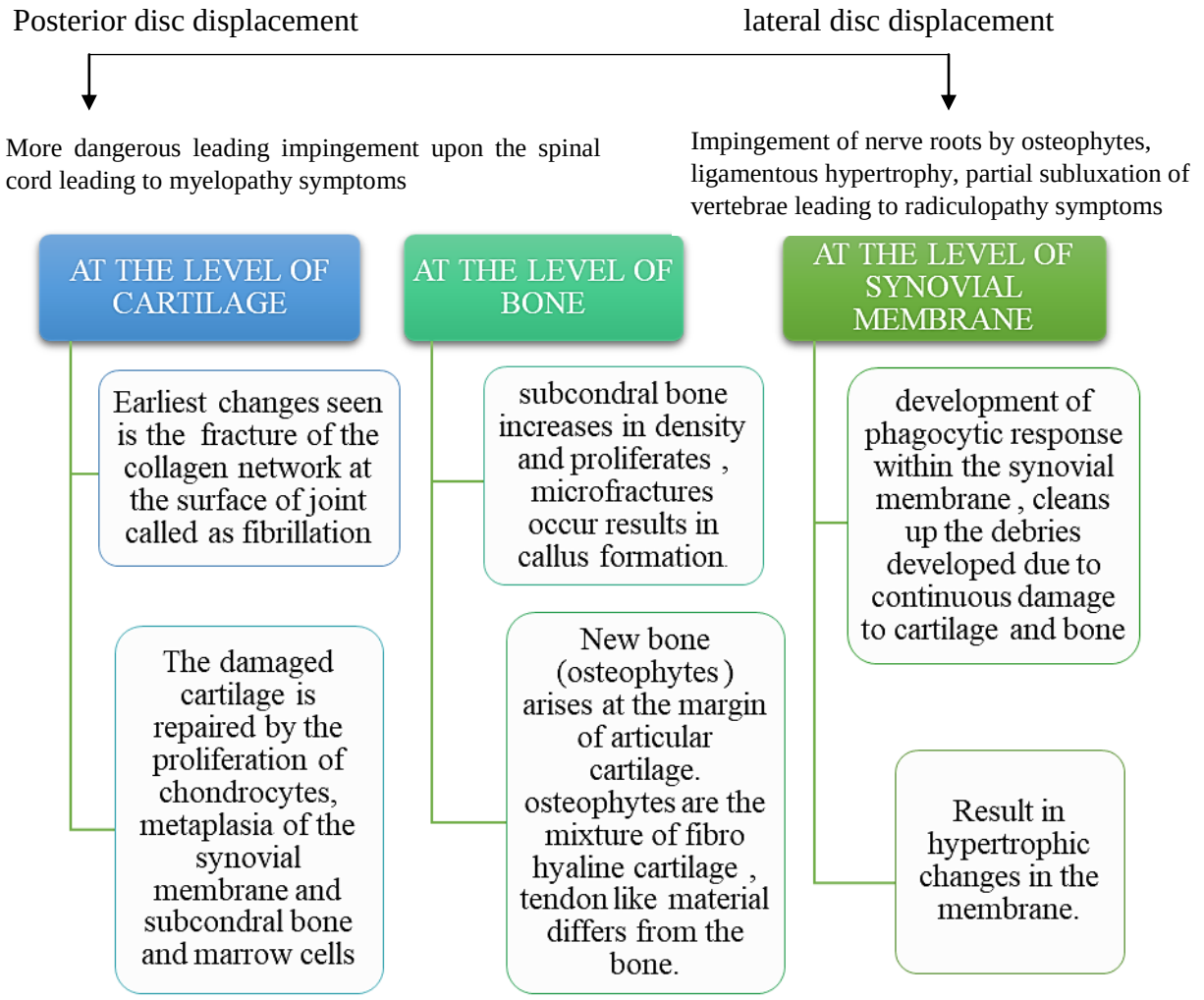


Fig. 1.2: Shows the pathological changes occuring at the level of cartilage, bone and synovial membrane in cervical spondylosis.

CLINICAL FEATURES OF CERVICAL SPONDYLOSIS

Common symptoms - Neck pain, pain in medial scapular region and shoulder it arises from the degenerated discs and vertebral bodies.

Spinal root compression – the spinal roots, most commonly involved are C5, C6 and C7. Compression of the nerve root due to herniated disc material or degenerative disc initially affects the pressure sensitive fibers resulting in the symptoms of cervical radiculopathy. It is defined as neurological deficit in a nerve root distribution. Discomfort and numbness in the root distribution are often noted symptoms with pain in neck region and gets worsen during the cervical range of motion. Moving or extending the neck reproduces the arm pain. Motor loss, sensory abnormalities and reflex changes are noted.

Course of pain - Radiating pain in the trapezius ridge (C4), tip of the shoulder (C5), anterior part of arm (C6), radial forearm (C6), the thumb (C6) or other fingers (C6 – C8) are noted in

cases of C4 – C8 sensory root compression in the intervertebral foramina by the osteophytes and worsens with the movement of neck while coughing, sneezing, straining are done. Muscle wasting and motor weakness are also seen depending on the site of root compression. Lhermitte's sign or barber's chair sign positive when flexion of the neck performed electric shock like feeling or tingling sensation in all the four limbs are elicited.

Table 1.1: Describes the nerve root compression and pain distribution sites with motor and sensory changes in cervical radiculopathy.

Nerve root	Interspace	Pain distribution	Motor	Sensory	Reflex
C4	C3 – C4	Lower neck, trapezius	NA	Lower neck and upper shoulder gridle	NA
C5	C4 – C5	Neck shoulder, lateral arm	Deltoid, elbow flexion	Lateral arm	Biceps reflex
C6	C5 – C6	Neck dorsal, lateral (radial) arm, thumb	Biceps, wrist extension	Lateral forearm, thumb	Brachioradialis
C7	C6 – C7	Neck dorsal lateral forearm, middle finger	Triceps, wrist flexion	Dorsal forearm, middle finger	Triceps reflex
C8	C7 – T1	Neck medial forearm, ulnar digits	Finger flexors	Medial forearm, ulnar digits	NA

Cervical spondylotic myelopathy – less frequent, patient usually has a congenital narrow canal (canal stenosis) present with progressive spastic paraparesis, later stages sensory impairment along with sphincter disturbances.

Combined nerve root and cord compression – (Cervical myeloradiculopathy)

Few cases both radiculopathy and myelopathy symptoms are seen. In such a combined lesion occurring at the level of C5, the nerve root compression by lateral protrusion and the cord below this level is compressed by medial lesion. Reflexes are asymmetrical, with absent or decreased supinator and exaggerated triceps jerks are noted.

Vascular insufficiency – Vertebro – basilar insufficiency may produce an intermittent or perpetual vertigo commonly seen in compression of vertebral artery by osteophytes growing in the vertebral column.

DIFFERENTIAL DIAGNOSIS

- **Spastic quadriparesis** may occur due to number of reasons and age onset, temporal profile of the disease and associated clinical symptoms and signs helps to differentiate cervical spondylotic myeloradiculopathy from other conditions.
- **Motor neuron disease** – starts in 5^{th} or 6^{th} decade of life and is accompanied by fasciculation or bulbar features, it has no sensory features.
- **Tumours of the spinal cord** in the cervical region present with the features of multiple tract involvement and nuchal pain is not considered as prominent feature.
- **Syringomyelia** presented with lower motor neuron signs in upper limbs and upper motor signs in the lower limbs displays characteristic dissociated sensory loss and involvement of earlier sphincter. Sometimes accompanied by Horner's syndrome.
- **Craniovertebral anomalies** present with short neck and abnormal neck – body ratio and are often associated with high cervical lesion, like downbeat nystagmus and Horner's syndrome.
- **Amyotrophic lateral sclerosis** – Absence of sensory symptoms, speech and swallowing deficit are noted. **Multiple sclerosis** occurs in earlier age, cerebellar signs are prominent but accompanied with wasting of muscles.

INVESTIGATIONS

- **X – ray of cervical spine -** A lateral view shows the loss of normal lordosis, reduced disc space and growth of osteophytes. Sometimes canal stenosis can also be visualized. An oblique view shows osteophytic protrusion into the intervertebral foramina. Antero posterior view is most common used for the diagnosis of cervical spondylosis.
- **Contrast myelogram** – shows multiple disc protrusion into thecal sac like negative shadow with total extradural obstruction.
- **CT Myelogram and MRI-** demonstrates the indentation of the thecal sac, hardening of the intervertebral discs, foraminal narrowing and facet joint arthropathy. In severe cases compression of the cord may also be visualized.
- **Discography-** typical pain is provoked on injection into the intervertebral disc and it is then relieved by local anaesthetics. Helps in the precise identification of the offending disc.

TREATMENT ASPECT

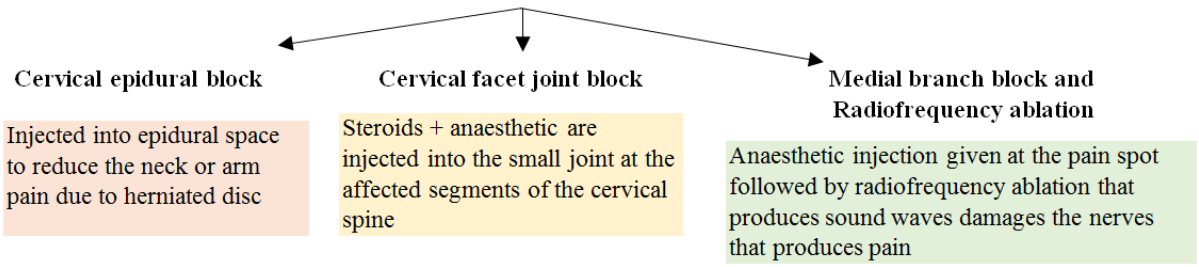
Cervical spondylosis can be effectively managed through conservative treatments by prescribing analgesics, nonsteroidal anti-inflammatory drugs (NSAID's), physiotherapy in majority of cases. In later stages cervical traction, short wave diathermy, ultrasonic radiation, static and dynamic neck exercise, ice, heat and massage therapies, cervical soft collar or brace, injection therapy are adopted. In severe cases with cervical myeloradiculopathy surgeries are recommended.

Cervical traction – helps in reducing the muscle spasm, increases the disc space and reduces the tension of nerve roots.

Neck exercise- helps to gain the mobility of the stiff neck and strengthen the neck muscles. It is of two types – **Mobilization exercise-** focus on the range of motion, gradual active mobilization of the neck. **Strengthening exercise** -resistance offered by the patient by other hand to all the active movements of the neck. These are self- resistance exercises that helps to strengthen the neck muscles recommended to perform for about 15 – 20 minutes every day.

Cervical collar – advised during acute exacerbation of chronic spondylosis and only used for short duration. It can limit the neck movement and strengthen the strained muscles.

Injection therapy- steroids are injected at the site of damage in the cervical spine and there are 3 common steroid injection procedures –



Surgical intervention – in severe cases includes Anterior cervical discectomy with inter body fusion for single- or two-level disc involvement. Larger size osteophytes can be removed through this route.

- ✓ Corpectomy and strut graft or cages are done for multiple level disc involvement. Laminectomy and foraminotomy combined with osteophytes excision.

- ✓ Surgical decompression in cases of intractable root pain or in compressive myelopathy. Two approaches like anterior decompression with actual removal of offending bones and posterior decompression associated with fusion.

ROLE OF FREE RADICALS IN CERVICAL SPONDYLOSIS[11]

Oxidation is a natural process that happens in all the cells but due to repeated oxidative stress that a human body undergo ultimately leading to the production of free radicals. Repeated or prolonged exposure to ROS (Reactive oxygen species) they increase the risk of degenerative diseases and causing damage to the immune system.

Research studies prove that 70 – 80 % of the degenerative diseases are caused due to the generation of free radicals in the body and cervical spondylosis is one among them. Since the cervical spine undergoes various stress and overload to the spine causes the degenerative changes in disc making it to lose its elasticity, size and texture.

Cervical spondylosis is said as osteoporosis of cervical spine where there is deterioration of bone tissue, loss of bone mass leading to enlarged bone fragility and risk of fracture. It is due to the change in the balance between osteoblasts and osteoclasts. The activities of bone cell are influenced by a lot of cellular and nutritional factors includes supply of oxygen, nutrients, endocrines, cytokines, growth factor and free radical formation.

Effect of ROS (reactive oxygen species) at the level of bone

ROS induces apoptosis of osteoblasts and osteocytes cells localized in bone matrix leading to osteoclastogenesis. Excessive osteocytes apoptosis correlates with oxidative stress causing imbalance of osteoclastogenesis leading to increase in bone remodelling and bone loss.

- ✓ Recent research evidences / clinical studies have shown that ROS and antioxidant systems are involved in the pathogenesis of bone loss
- ✓ Several factors mainly produced by osteoblast and osteocytes that regulate osteoclast and osteoblast activity and then bone remodelling. Most important are ligand of receptor activator of NF-κB (RANKL) and osteoprotegerin (OPG).

Due to oxidative stress, it blocks the activation of osteoclast by this bone remodelling process increases and regulation of RANKL/OPG ratio levels (which is responsible for maintaining balance between bone resorption and formation) are increased resulting in inadequate and

proper bone formation leading to various bone diseases, various skeletal diseases mainly degenerative conditions of bone.

A very important factor underlying the pathogenesis of osteoporosis is receptor activator of NF- κB ligand. RANKL plays a crucial role in osteoclast differentiation and activation. The ROS are involved in the regulation of RANKL dependent osteoclast differentiation. It acts as intracellular signalling compounds have cytotoxic effects, including lipid peroxidation and DNA damage.

Role of RANKL receptor in osteoporosis- Recent activator of nuclear factor – kappa B (RANK) is a member of tumour necrosis factor family expressed by osteoclasts and their precursor. Interaction of RANK with its ligand (RANKL) it has been identified as the first common pathway through which bone resorption is regulated and overall bone density is maintained. RANKL binding with OPG (osteoprotegerin) controls differentiation, proliferation and survival of osteoclasts and overall control of bone remodelling is maintained. Variation in concentration levels of RANKL reconfirms the importance of RANKL in bone tissue growth and immune functions. RANKL also has function in immune system expressed by T- helper cells and help to regulate T-cell dependent immune responses. T-cell activation induces RANKL expression and lead to increase of osteoclastogenesis and bone loss. Recent research studies prove that inhibition of RANKL receptor appears to be promising new treatment of osteoporosis condition.

CERVICAL SPONDYLOSIS - AYURVEDIC VIEW

In Ayurveda in the text book of *Astānga hridaya* while explaining the *stāna* of *tridoshas vagbhatācharya* quotes that though the *tridoshas* are present everywhere in the body the primary locations of *Vāta, pitta* and *kapha* are below the navel, in between the heart and umbilicus and above the heart respectively.[12]

When we look into the predominance of qualities on the basis of this theory, we preciously understand that the properties like *snigdha* (unctuous), *Śīta* (cool), *guru* (heavy), *ślakṣṇa* (fine), *sthira* (stable) are placed on the top of the body and lighter qualities like *tīkṣṇa* (sharp), *Uṣhṇa* (hot), *laghu* (light), *Rūksha* (dry), *Sūkshma* (subtle), *cala* (mobile) of *pitta* and *Vāyu* are occupying the lower portion of the body!

This concept when we take it into the *panchaboutika Siddhanth* we can conclude that *Prithvi* and *jala mahābhuta* occupy the upper portion of the body and *Agni, Vāyu* and *ākāsha* take the position of lower parts which is a miracle to observe as normally lighter substances are supposed to be on the lower portion by nature![13]

The above concept could be due to supply of nutritive elements are all the time required from the top to bottom with the help of metabolism for the substance of life.

Due to *ativyāyāma* (excessive physical strain), *adyayana* (studying – table work), *prapatana* (falling down), *pradāvana* (excessive running), *prapēdana* (pressure- neck pressure/ strain), *ratrijāgarana* (waking up night/ night duties), *atibhāraharana* (lifting heavy weights), excessive travel, intake of *katu* (pungent), *kashāya* (astringent), *Tikta* (bitter), *Rūksha* (dry), *laghu* (light), *shītavirya shuskha āharas* (cold and dried type of diet intake), *adyasana* and *vishamāshana* (eating fast/ irregular, eating during indigestion), *vēgadhārana* (suppression of natural urges) all these factors leading to aggravation of *Vāta.*[14]

The intrinsic factors either on metabolism or due to the activity design of the individual may get altered with the property enhancement from bottom to top where in the *amsāmsha Kalpana* of the qualities of *tridoshas* may get exchanged and this reverse attack may end up with the fast deterioration of *Prithvi* (earth) and *jala* (water) element there by leading to destruction of the centres which are primarily meant for the depots for nutrition supply.

This change of the destruction is exhibited in the form of clinical signs and symptoms like *kārṣṇya* (blackish discoloration – disc dehydration), *Balāhāni* (weakness), *nidrāhāni* (loss of sleep), *indriyabramśha* (sensory and motor impairment), *brahma* (giddiness), *asthishūla* (pain in bones), *majjāshōsha* (decrease of bone marrow) are manifested.[15]

***Vāta vikriti* vitiated *lakshanas*[16]**

Cervical disc level changes - *Sraṃsa* (disc prolapse), *pāruṣya* (roughness / loss of elastic and spongy texture of disc), *saukṣīrya* (porosity / osteophytes formation), *śyāva-aruṇa varṇatva* (smoky blackish discoloration – disc dehydrative changes observed using radiological evidence)

Signs and Symptoms – vyāsa, saṅkōcha (spasticity – Restricted CROM), *svāpa* (numbness), *vyadha* (piercing type of pain), *sāda* (fatigue), *stambha* (neck stiffness), different types of characteristics of pain like *vyadha* (piercing pain), *ruk* (continuous pain), *tōda* (intermittent /

colicky pain), *bhēda* (stabbing pain), *aṅgabhaṅga* (muscle splitting pain), *varta* (localized ache), *spandana* (pulsating pain), *vēstana* (compressing pain) are produced. This is what we normally observe in case of cervical spondylosis.

It is further quoted in the *asrayāsrayē bhāva* in *Astānga hridaya* that "*tatrāsthinisthithōvāyu*" meaning *Vāyu* located in the *asthi dhātu* and they adjust with each other by getting there share from the food based on *nyāya* called *"kedāra kulya nyāya"* and "kshēra *dadhi nyāya*" even though they do not match with each other in any of their aspects but still they stay together.

Even a slight alteration in their existence with the increase of one out of two will land with the reduction of other one (i.e.) to say in increase of *Vāyu* will lead to the destruction of *asthi dāthu* which can be compared to osteoporotic formation, loss of bone mineral density and structural integrity of bone.

The properties of *Vāyu* along with its vitiated *lakshanas* have an important role in the destruction of *asthi dhātu*.[17]

The term *avalambaka kapha* mentioned in this juncture in *Astānga sangraha* says that the *kapha* that resides in the chest, helps the areas around shoulders, arms, and neck by its own capacity, remaining in its own place provides supportive functions to all other *kapha* by contributing properties of water.

Here based on the site, function, and qualities of this *kapha* can be compared to nucleus pulposus of the disc that contain high water content due to the dominance of *Vāyu mahābhuta* the functions such as *sandhisanśleshaṇa, snehana, ropaṇa, pūrana, Balā, sthairya* properties of *kapha* gets decreased leading to degeneration of disc and osteoporosis conditions to occur as (these functions are very much significant in the intervertebral disc (symphysis joint) as well as facet joints.[18]

Āyurveda and modern medicine are derived from different school of thoughts. Therefore, the approach to the diagnosis of diseases as well as nomenclature also differs. It is quite impossible to make one to one correlation or pick up equivalent terms. However, Acharya suggested that if specific nomenclature is not distinguishable, in such a situation, one must treat the condition based on involvement of *dosha & dūshya*.

The clinical features related to Cervical Spondylosis have the broad ranging signs & symptoms like neck pain, stiffness of neck muscles, radiating pain to arm due to involvement of different nerve root hence cannot be compared with single Ayurvedic disease.

Table 1.2: List of diseases similar to cervical spondylosis mentioned in various classical textbook.

VYADHI	*LAKSHANA*	*C.S*	*S. S*	*A.H*	*Bh. Pa*	*C.D*	*V.S*	*B. S*	*M.N*	*Y. R*
Grēva Hunda[19]	*Grēva Hunda* at *Shirō Nāsa Akshi and Jathrūrdhwam* (stiffness and restricted neck movements)	+	-	-	-	-	-	-	-	-
Grēva Stambha[20]	*Stambha* in neck region (stiffness and restricted CROM)	+	-	-	-	-	-	-	-	-
Bāhushīrsag ata Vāta[21]	Radiating pain to *bāhu (*arms*)* and *siras* (head)	+	-	-	-	-	-	-	-	-
Asthigata Vāta[22,23 ,24]	*Sandhi Shūla* (piercing pain)	+	+	-	-	-	-	-	+	-
	Māmsa Balākshaya (wasting of muscles)	+	-	-	-	-	-	-	+	-
	Aswapna (insomnia)	+	-	-	-	-	-		+	-
	Santatā Ruk (constant pain)	+	-	-	-	-	-	-	+	-
	Asthi Shōsham (degeneration -porous formation)	-	+	-	-	-	-	-	-	-
	Prabēdam (cracking) loss of BMD	-	+	-	-	-	-		-	-
	*Shōpha (*localized swelling)	-	+	-	-	-	-	-	-	-
	*Asthi Parvāna Sandhi shūlam (*splitting type of pain in bones and joints)	+	-	-	-	-	-	-	+	-
	Sparśamasthnā vṛte tūṣṇaṃ pīḍanaṃ cābhinandati (liking for hot touch and pressure)	+	-	-	-	-	-	-	-	-
	Saṃbhajyate sīdati (breaking type of pain)	+	-	-	-	-	-	-	-	-
	Sūchībhiriva (pricking type of pain)	+	-	-	-	-	-	-	-	-
Asthi Majjāgata vāta	*Sandhi Sūla* (pain in bones and joint)	-	-	+	--	-	+	-	-	+
	Ruksthimita Athyartam	-	-	-	-	-	-	-	-	+
	Vināma (bending – kyphosis)	+	-	+	-	-	-	-	-	-

	Jrumbha (yawning)	+	-	+	-	-	-	-	-	-
	Parivēshtanam (shooting type of pain)	+	-	+	-	-	-	-	-	-
	Sanāta Ruk (constant pain)	-	-	-	-	-	+	-	-	-
	Suptatvam (reduced / loss of sensation) neurological deficit	-	-	-	-	-	+	-	-	-
	Mamsabala Kshayam (wasting of muscles)	-	-	-		-	+	-	-	-
Viswāchi[25,26,27]	*Talam Prathyangulinam Kantarā Bāhuprishtatha Bāhuchesta Apahārane* (Constriction of tendons of palms and fingers, radiating pain over the back of arm leading to loss of function)	+	-	+	-	-	+	-	+	-
	Karma Kshaya (restricted ROM)	-	-	-	-	-	+	-	+	-
	Bahya Karma Kshaya	-	-	-	-	-	-	-	+	-

The theory of Ayurveda in the treatment of diseases is primarily based on *panchaboutika siddhāntha* and based on *Guna – karma vikalpa* of any substance-

"*Panchabhūtātmakhe dehey aharaha panchabhowthikaha | vipakwam panchadhā samyak swan gunān abhivardhayēth* "

The above *sloga* gives us the clue that human body is a frame constituted by the five gross elements and each of these elements gets its share of nourishment from the food consumed which is also made of *panchamahābhutas.*

This theory clearly indicates that the action of the *tridośhas* based on their properties end up with an increase or decrease of the visceral organs, in addition to the bone, bone marrow ends up with their destruction or reduction which finally lands up in the collapse of internal structures. So, the treatment of these collapsed structures can be repaired and brought back to normalcy, though with great difficulty is achieved by prescribing food, activity and medicine which are entirely opposite to the properties that have enhanced in the destructive process.

To say in brief replacement with the opposites is the basic concept of Ayurveda in the promotion of health when there is an increase of certain properties.

In the case of cervical spondylosis, the site of lesion occurs in the *kapha stāna* with the arrival of *Vāyu* and *ākāsha mahābhuta* replacing the properties of kapha such as unctuousness with dryness, heaviness with lightness, smoothness with roughness, softness with hardness that is not conductive for the maintenance of the functional units related to *kapha* in that part of lesion.[28]

The arrival of *Vāyu* dosha with such a force to come into the *kapha stāna* and produce destruction is made possible by the metabolic activity of the digestion and by the wrongful posture that one adopts in the lifestyle of an individual. It is quoted in *Astānga sangraha* in the concept of "*Dosha sanchāra*" as-

"vyāyāmādūṣmaṇastaikṣṇyādahitācaraṇādapikoṣṭhācchākhāsthimarmāṇi drutatvānmārutasya ca | doṣā yānti, tathā tebhyaḥ srotomukhaviśodhanāt. vṛdhyā'bhiṣyandanāt* pākāt koṣṭhaṃ vāyośca nigrahāt "||

So, from the above theory it is understood that *Vāyu* becomes the *āgantu dosha* with *kapha* being the *stāni dosha*. It is because of the over dominance of the *āgantu dosha* over *stāni dosha* that the situation warrants with the prescription of drugs which will fight in Toto with the *āgantu dosha* and change its *mōdagamana* into an *adōgami avastha* back to its own seat "*pakvāshaya kati Shakti…."* which is famously addressed as *anulōmana* of the *vāta dosha.*[29]

For bringing back the aggravated *Vāyu, Snehana* both internally as well as externally is the best treatment. Hence the medicine that has *Prithvi* and *jala mahābhuta* predominance and having *vatānulōmana* qualities in it should be selected for the treatment of cervical spondylosis.

DISCUSSION

Cervical spondylosis is caused due to various etiological factors like ageing, occupation, posture, trauma, genetic, hormonal changes, cigarette smoking, alcohol intake, medical conditions and psychological factors like excessive stress leading to development of oxidative stress in the body. Due to continuous exposure to the above-mentioned factors it ultimately leads to the production of free radicals in the body. Repeated excessive stress and strain to the cervical spine result in cascade of events leading to the causes of degeneration of cervical spine and changes in the intervertebral discs which undergoes disc desiccation and lose of elasticity along with size reduction of nucleus pulposus with a decline in the water content and gelatinous appearance changing to darkened and discoloured fibrous consistency, loss of ability to bear axial loads, bulking and lax like appearance of the ligamentous tissue

with facet joint hypertrophy. This reduction in the structural and mechanical integrity along the cervical segment causes the disc to bulge and herniate leading to nerve root compression. Symptoms of cervical spondylosis comprises of spectrum which includes cervical radiculopathy, myelopathy and myeloradiculopathy symptoms such as neck pain, pain in medial scapular region and shoulder, radiation of pain from neck to upper extremities, motor and sensory abnormalities with reflex changes are noted. Muscle wasting, numbness, tingling sensation in all the four limbs, dizziness is also seen in later stages.[30]

Role of free radical (ROS) in cervical spondylosis and its effect on bone

Cervical spondylosis is said as osteoporosis of the cervical spine where there is a deterioration of bone tissue, loss of bone mass making the bone more fragile. It is mainly due to the change in the balance between osteoblasts and osteoclast. ROS induces apoptosis of osteoblast and osteocytes bone cells in bone matrix leading to osteoclastogenesis. Due to excessive oxidative stress that happens in cervical spondylosis causes an imbalance of osteoclastogenesis leading to an increase in bone remodelling and bone loss. Receptor activator of NF-κB ligand (RANKL) activates the differentiation and activity of osteoclasts by this bone remodelling process increases resulting in inadequate and proper bone formation leading to various skeletal diseases mainly degenerative conditions of bone. In Ayurveda cervical spondylosis cannot be compared with a single disease some diseases like *Grēva Hundana, Grēva Sthamba, Bāhushīrsagata vāta, Asthigata vāta, Asthimajjagata vāta and Viswāchi* can be considered based on similar symptoms to that of cervical spondylosis.[31]

***Nidāna* factors** – Dietary factors like- excessive/ regular intake of *katu* (pungent), *kashāya* (astringent*), Tikta* (bitter), *Rūksha* (dry), *laghu* (light), *shītavirya shuskha āharas* (cold and dried type of diet intake), *adyasana* and *vishamāshana* (eating fast/ irregular, eating during indigestion) Physical factors like- *ativyāyāma* (excessive physical strain*), adyayana* (studying – table work), *prapatana* (falling down), *pradāvana* (excessive running), *prapēdana* (pressure- neck pressure/ strain), *ratrijāgarana* (waking up night/ night duties), *atibhāraharana* (lifting heavy weights), excessive travel. Psychological factors like – *krodha* (anger), *bhaya* (fear), *shoka* (stress) are all the factors leading to aggravation of *vāta* dosha in the body.[32]

Pathogenesis–[33,34] Since the *Grēva pradesha* is considered to be the *kapha stāna* which is made up the properties like *snigdha* (unctuous), *Śīta* (cool), *guru (*heavy), *ślakṣṇa* (fine), *sthira* (stable) predominance of *pṛthvi and jala mahābhuta stāna* due to the above mentioned

factors the aggravated *vāyu* with its properties opposite to *kapha* causes fast deterioration of *pṛthvi and jala mahābhuta* leading to degenerative features of the cervical disc by exhibiting clinical signs and symptoms like *kārṣṇya* (blackish discoloration – disc dehydration), *Balāhāni* (weakness), *nidrāhāni* (loss of sleep*), indriyabramśha* (sensory and motor impairment), *brahma* (giddiness), *asthishūla* (pain in bones), *majjāshōsha* (decrease of bone marrow).

Sraṃsa (disc prolapse), *pāruṣya* (roughness / loss of elastic and spongy texture of disc), *saukṣīrya* (porosity / osteophytes formation), *śyāva-aruṇa varṇatva* - smoky blackish discoloration – disc dehydrated changes observed using radiological evidence.

Since the treatment of cervical spondylosis mainly focus on the reduction of oxidative stress and stopping/ breaking the chain of free radical formation in the body.[35] Recent research studies prove that inhibition of RANKL receptor activation, TNF-α expression is considered to be promising new treatment for degeneration of bone. This can only be possible through Antioxidant supplementation. Antioxidants acts as free radical scavengers that decreases the oxidative stress and prevent the harmful effect caused by free radicals to the body. The drug selected for the treatment of cervical spondylosis should have high antioxidant property and having predominance of *pṛthvi and jala mahābhuta* along with *Vātahara* quality should be considered. *Snehana* is the first line of treatment that should be done both internally and externally for bringing back the aggravated *vāta*.

CONCLUSION

Cervical spondylosis is not only a mechanical defect but also an anatomical fault which ends up with radiculopathy, myelopathy etc. If not treated in time as the wear and tear is so rapid to occur due to factors like skull weight, sedentary postures and due to occupation. Conditions like herniated disc, thinning of disc, nerve cord compression, hypertrophy of facet joints etc. need an immediate attention. In Ayurveda management the tissue repair and nutritional supply to the cervical spine can be made possible with the prescription of drugs having predominance of Prithvi and jala mahabhuta in the form of snehana will be the best choice for treatment. Further the drug should have rich "Antioxidant" to stop the chain of free radical and help to remove oxidative stress. Hence the right choice of herbal drug should have the following properties like Anti-inflammatory, Analgesic, Neuro protective, Anti – osteoarthritis, Antioxidants in order to treat cervical spondylosis.

REFERENCES

1. McCormack B, Weinstein P. Cervical spondylosis - An update. The Western journal of medicine, Nov 30, 1995; 165: 43–51.
2. BD Chaurasia's Human Anatomy, Garg K. 8th ed. Vol. volume 3. New Delhi: CBS Publishers and distributers Pvt Ltd.
3. Gray's Anatomy, Peter L, Williams, 38th edition, Skeletal system, 1995, Churchill Livingstone, New York.
4. Borhany T, Shahid E, Siddique WA, Ali H. Musculoskeletal problems in frequent computer and internet users. J Family Med Prim Care, 2018; 7(2): 337–9.
5. Brain WR, Northfield D, Wilkinson M: The neurologic manifestations of cervical spondylosis. Brain, 1952; 75: 187-225.
6. Riggs BL. The mechanisms of oestrogen regulation of bone resorption. J Clin Invest, Nov, 15, 2000; 106(10): 1203–4.
7. Shan.N. Siddharth, API Textbook of Medicine, 7th edition 2003, The association of physicians of India, 853-856.
8. David L. Hamblen, ADAMS'S Outline of orthopedics, Neck and Cervical spine, 14th edition, 2010, Churchill Livingstone, UK, 185-186.
9. PS Ramani, Surgical Management of cervical disc herniation, Clinical Biomechanics related to cervical disc degeneration and herniation 1st edition, 2012, Jaypee brothers Medical Publishers (P) Ltd, New Delhi, 15–16.
10. Ferrara LA. The Biomechanics of Cervical Spondylosis. Butler JS, editor. Advances in Orthopaedics, Feb 1, 2012; 2012: 493605.
11. Filip N, Cojocaru E, Filip A, Alexa BV and O. Reactive Oxygen Species and Bone Fragility Reactive Oxygen Species (ROS) in Living Cells. IntechOpen; 2017 [cited 2022 Aug 18]. Available from: https://www.intechopen.com/chapters/undefined/state.item.id
12. T. Sreekumar, Astangahridaya Vaghbhata (English transulation and Commentary) 2015th ed. Vol. 1, Publication Department Harisree Hospital; Kerala, Sutrastana 1/11 p. 34.
13. K.R Srikantha Murthy. Astanga Samgraha of Vagbhata. 3rd, 2000th ed. Vol. 1. Varanasi: Chaukahamba Orientalia; Sutrastana 20/1 , p: 367.
14. Priya Vrat Sharma, Susrutha Samhita with English translation and Dalhana's commentary). 2004th ed. Vol.2, Varanasi: Chaukhamba Visvabharati Sutrastana 21/19, p.- 231.
15. T. Sreekumar, Astangahridaya Vaghbhata (English transulation and Commentary) 2015th ed. Vol. 1, Publication Department Harisree Hospital; Kerala, Sutrastana 11/5,6 p. 248.

16. T. Sreekumar, Astangahridaya Vaghbhata (English transulation and Commentary) 2015th ed. Vol. 1, Publication Department Harisree Hospital; Kerala, Sutrastana 12/ 49-50, p. 277.
17. T. Sreekumar, Astangahridaya Vaghbhata (English transulation and Commentary) 2015th ed. Vol. 1, Publication Department Harisree Hospital; Kerala, Sutrastana 11/26 p. 254.
18. T. Sreekumar, Astangahridaya Vaghbhata (English transulation and Commentary) 2015th ed. Vol. 1, Publication Department Harisree Hospital; Kerala, Sutrastana 12/ 15,16, p. 269.
19. Sharma Ram Karan, Bhagawan Dash Vaidhya, Agnivesa's Caraka Samhita (based on Chakrapani Datta's Ayurveda Dipika). 2013th ed. Vol. 5. Varanasi: Chowkhamba Sanskrit Series Office; Chikitsasatana 28/22, p. -25.
20. Sharma Ram Karan, Bhagawan Dash Vaidhya, Agnivesa's Caraka Samhita (based on Chakrapani Datta's Ayurveda Dipika). 2013th ed. Vol. 1. Varanasi: Chowkhamba Sanskrit Series Office; Sutrastana 20/11, p. -363- 365.
21. Sharma Ram Karan, Bhagawan Dash Vaidhya, Agnivesa's Caraka Samhita (based on Chakrapani Datta's Ayurveda Dipika). 2013th ed. Vol. 5. Varanasi: Chowkhamba Sanskrit Series Office; Chikitsasatana 28/98, p. -50.
22. Sharma Ram Karan, Bhagawan Dash Vaidhya, Agnivesa's Caraka Samhita (based on Chakrapani Datta's Ayurveda Dipika). 2013th ed. Vol. 5. Varanasi: Chowkhamba Sanskrit Series Office; Chikitsasatana 28/66, p. -39.
23. K.R Srikantha Murthy, Vagbhata's Astanga Hridaya. 2019th ed. Varanasi: Chowkhamba Krishnadas Academy; Nidanastana 16/36, p. 165.
24. Kumari A, Tewari P. Yogaratnākara (A complete treatise on Ayurveda). 1st, 2010. Varanasi: Chaukhamba Visvabharati; 25/22, p. 574.
25. Saxena N. Vangasēna Samhita or Chikitsasatana Samgraha of Vangasēna. 2nd, 2014th ed. Varanasi: Chowkhamba Sanskrit Series Office;22, pg. no- 393.
26. Singhal GD. Madhava Nidāna (Rogaviniscaya) of Sri Madhavakhara. 2nd, 2008. New Delhi: Chaukhamba Sanskrit Pratishthan;22/57, p.- 86.
27. K.R Srikantha Murthy, Vagbhata's Astanga Hridayam. 2019th ed. Varanasi: Chowkhamba Krishnadas Academy; Nidanastana 15/44, p. 156.
28. T. Sreekumar, Astangahridaya Vaghbhata (English transulation and Commentary) 2015th ed. Vol. 1, Publication Department Harisree Hospital; Kerala, Sutrastana 1/28 p. 42.
29. K.R Srikantha Murthy. Astanga Samgraha of Vagbhata. 3rd, 2000th ed. Vol. 1. Varanasi: Chaukhambha Orientalia; Sutrastana 19/25-27, p.- 362-363.

30. Ferrara LA. The Biomechanics of Cervical Spondylosis. Butler JS, editor. Advances in Orthopaedics, Feb 1, 2012; 2012: 493605.
31. Domazetovic V, Marcucci G, Iantomasi T, Brandi ML, Vincenzini MT. Oxidative stress in bone remodelling: role of antioxidants. Clin Cases Miner Bone Metab, 2017; 14(2): 209–16.
32. Priya Vrat Sharma, Susrutha Samhita with English translation and Dalhana's commentary). 2004th ed. Vol.2, Varanasi: Chaukhamba Visvabharati Sutrastana 21/19, p.- 231.
33. T. Sreekumar, Astangahridaya Vaghbhata (English transulation and Commentary) 2015th ed. Vol. 1, Publication Department Harisree Hospital; Kerala, Sutrastana 11/5,6 p. 248
34. T. Sreekumar, Astangahridaya Vaghbhata (English transulation and Commentary) 2015th ed. Vol. 1, Publication Department Harisree Hospital; Kerala, Sutrastana 12/ 49-50, 277.
35. Sendur OF, Turan Y, Tastaban E, Serter M. Antioxidant status in patients with osteoporosis: a controlled study. Joint Bone Spine, Oct, 2009; 76(5): 514–8.