

Exploring Treatment Approaches for Cervical Spondylosis Based on the Theory of “Bone Xuanfu-Collaterals-Marrow”

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Abstract: Cervical spondylosis is a degenerative disease primarily characterized by neck pain, limited mobility, upper limb numbness, and even functional impairment. It falls within the scope of traditional Chinese medicine classifications such as “neck impediment syndrome,” “bone impediment syndrome,” and “sinew impediment syndrome.” Traditional Chinese medicine predominantly addresses this condition through macro-level differentiation and treatment approaches such as liver and kidney deficiency, invasion by wind-cold-damp pathogens, and blood stasis obstructing collaterals. While these methods yield reliable therapeutic outcomes, they offer relatively limited systematic interpretation of the local microstructures and functional states of the cervical spine. Based on the theory of Bone Xuanfu-Collaterals-Marrow, this paper explores the pathogenesis and treatment approaches of cervical spondylosis from an integrated perspective of macroscopic holism and microscopic structure. The theoretical connotations of “Bone Xuanfu,” “Collaterals” and “Marrow” are elaborated, as well as their internal relationships in the physiology and pathology of the cervical spine. After that, the pathogenesis and progression of cervical spondylosis are analyzed from three aspects: “obstruction of Bone Xuanfu,” “stasis of collaterals,” and “deficiency and malnourishment of marrow.” Finally, a staged treatment approach of “opening Xuanfu, nourishing collaterals, and replenishing bone marrow,” is proposed, which is discussed with corresponding therapeutic methods and herbal formulas. This aims to provide a novel theoretical perspective for the syndrome differentiation and treatment of cervical spondylosis within traditional Chinese medicine.

Keywords: Cervical spondylosis; Bone Xuanfu; Collaterals; Marrow; Traditional Chinese medicine treatment

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1. Introduction

Cervical spondylosis is a common and frequently occurring disease among middle-aged and elderly population. With changes in modern lifestyles, its incidence shows a noticeable trend toward the younger population^[1]. The disease is based on the degenerative changes of the cervical intervertebral discs, followed by a series of

pathological changes such as hyperostosis, ligament hypertrophy, and compression of nerve roots or the spinal cord. Clinical manifestations include neck, shoulder and arm pain, dizziness, limb numbness, etc., which significantly affects the quality of life of patients^[2]. In traditional Chinese medicine (TCM), it is mostly classified into the category of “impediment syndrome”. Its occurrence is considered to be closely related to factors such as liver and kidney insufficiency, deficiency of Qi and blood, invasion of external pathogens, and blood stasis obstructing the collaterals^[3]. The main therapeutic approaches are tonifying liver and kidney, activating blood to dredge collaterals, expelling wind and dissipating cold^[4].

However, traditional syndrome differentiation and treatment approaches often focus more on holistic and macroscopic considerations, while paying insufficient attention to the distribution of Qi, blood, and body fluids within the cervical bones, micro-circulation status, and the specific conditions of marrow nourishment in the cervical region. In recent years, with the continuous evolution of the theory of microscopic syndrome differentiation in traditional Chinese medicine, the “Xuanfu-Collaterals” theory has gradually emerged and become a key entry point for the study of degenerative osteoarthropathy. Among these, “Bone Xuanfu” is regarded as the microscopic pathway for the circulation of Qi, blood, and body fluids within the bones^[5]. “Collaterals” serve as the intricate network system for the movement of Qi and blood^[6]. “Marrow” is the fundamental substance for the growth, development, and functional maintenance of bones^[7]. These three are complementary and mutually reinforcing, collectively supporting the structural stability and functional coordination of the cervical spine. This paper aims to integrate the theoretical framework of “Bone Xuanfu-Collaterals-Marrow” to systematically and thoroughly analyze the occurrence and development of cervical spondylosis, and propose corresponding therapeutic strategies accordingly, to expand the understanding of its TCM pathogenesis and enrich the approaches for clinical syndrome differentiation and treatment.

2. Connotation of the theory of “Bone Xuanfu-Collaterals-Marrow” and their interrelationship

2.1. Theory of Bone Xuanfu

The term “Xuanfu” was first recorded in *Huang Di Nei Jing (The Yellow Emperor’s Inner Classic)*, originally used to describe sweat pores. Liu Wansu, a renowned physician during the Jin and Yuan periods, profoundly expanded the concept of “Xuanfu”, defining it as the subtle pore-like structures distributed throughout the human body and regarding it as a crucial pathway for the ascent and descent of Qi and the circulation of body fluids^[8]. In contemporary research, “Xuanfu” is often associated with microscopic physiological structures such as tissue microcirculation and intercellular spaces^[9]. “Bone Xuanfu” specifically refers to the microscopic pores within the skeletal system, including regions such as periosteal blood vessels, trabecular bone spaces, and marrow cavities. It serves as an important pathway for the distribution of Qi, blood, and body fluids as well as the excretion of metabolic wastes within bone^[10]. Its patency is directly related to the nutrient supply of bones and the maintenance of metabolic homeostasis.

2.2. Theory of collaterals

Collaterals are the fine networks that branch from the main meridians and spread throughout the body. They function to connect the interior and exterior, infuse and nourish Qi and blood, and nourish tissues^[11]. As stated in the *Ling Shu (Spiritual Pivot)*, “Collaterals are the interior; those that branch horizontally are the collaterals.” Wu Yiling proposed that collaterals constitute a “three-dimensional network system,” emphasizing their

high correlation with microcirculation ^[12]. In the cervical region, collaterals are widely distributed around the muscles, ligaments, periosteum, and intervertebral discs, serving as important micro-pathways for maintaining the circulation of Qi and blood in the neck and nourishing the tendons and bones ^[13]. The patency of collaterals directly affects the blood supply and neural function of local cervical tissues.

2.3. Theory of marrow

“Marrow” is the essential refined substance in traditional Chinese medicine. It is transformed from kidney essence, stored in the bones, nourish the bones, as well as nourishes the brain and spinal cord ^[14]. As stated in the *Su Wen (Plain Questions): Treatise on Correspondence between Yin and Yang*, “The kidney generates the bone marrow.” The abundance of marrow determines the solidity of the bones and the stability of central nervous system function ^[15]. The cervical spine, as an important part of the spine, relies on marrow to fill and nourish its bony structures and the intraspinal contents (e.g., the spinal cord). Marrow deficiency leads to weak bones and an empty spine, accelerating degeneration ^[16].

2.4. Internal relationships among the three

The “Bone Xuanfu-Collaterals-Marrow” are interdependent physiologically and function synergistically. Bone Xuanfu serves as the gateway for Qi, blood, body fluids, and marrow fluid to enter and exit the bones. The collaterals are the pathways that transport Qi and blood to nourish the marrow and maintain the patency of Xuanfu, and the marrow constitutes the material basis for maintaining the structure and function of bones.

The collaterals transport Qi and blood to Bone Xuanfu, and Bone Xuanfu regulates the local distribution of Qi, blood, and body fluids through opening and closing. If the collaterals are stagnated, Bone Xuanfu will lose nourishment, leading to dysfunction in opening and closing. The marrow relies on the continuous nourishment of Qi and blood transported through the collaterals. If the collaterals are obstructed, the marrow will lose nourishment, and gradually become deficient. The transformation and distribution of marrow depend on its passage through Bone Xuanfu. If Xuanfu is stagnated and blocked, the metabolism of marrow will be hindered, and the bones will lose nourishment. These three components together constitute the micro-level support system for the “structure-nutrition-function” of the cervical spine. Dysfunction in any part of this system can contribute to the occurrence and development of cervical spondylosis.

3. Pathogenesis analysis of cervical spondylosis based on the theory of “Bone Xuanfu-Collaterals-Marrow”

3.1. Obstruction of Bone Xuanfu: Qi stagnation and blood stasis as the onset of the disease

Chronic strain of the cervical spine or invasion by external wind-cold-damp pathogens allows these pathogenic factors to attack Bone Xuanfu, causing its obstruction and blockage. This disrupts the movement of Qi, blood, and body fluids, resulting in local Qi stagnation, blood stasis, and internal generation of phlegm-dampness ^[17]. Modern medical research has shown that the early stage of cervical degeneration is often accompanied by microcirculatory disturbances of the vertebral endplates, and bone marrow edema, which highly aligns with the pathogenesis of “obstruction of Xuanfu” ^[18]. At this stage, patients typically present with stiffness and pain in the neck, restricted movement, fixed pain locations, a dark tongue or with ecchymosis, and a wiry and unsmooth pulse. If untreated or improperly treated, the static blood and phlegm-dampness will intermingle and further obstruct Xuanfu, leading to

disease progression.

3.2. Stasis of collaterals: Disharmony of Qi and blood as the turning point of pathogenesis

With the progression of the disease, the obstruction of Xuanfu further affects the functioning of the collaterals, leading to stasis in the collaterals and disharmony of Qi and blood. As stated in the *Lin Zheng Zhi Nan Yi An (Case Records as a Guide to Clinical Practice)*, “Chronic illness enters the collaterals.” Clinical manifestations include stabbing pain in the neck and shoulders, upper limb numbness, dizziness, and tinnitus, indicating that Qi and blood fail to ascend to nourish the head and eyes or extend peripherally to reach the limbs. Insufficient vertebral artery blood supply and microcirculatory disturbances around nerve roots can also be interpreted from the perspective of stasis in the collaterals, as shown in modern research^[19].

3.3. Deficiency and malnourishment of marrow: Bone atrophy and collateral emptiness as the consequence of advanced disease

Chronic duration consumes Qi and blood, involves the liver and kidney. Kidney essence becomes deficient, leading to insufficient generation of marrow. Consequently, the bones lose their nourishment, and the collaterals become empty. At this stage, patients often present with neck soreness and weakness, frequent dizziness, flaccid limbs, unsteady gait, and even incontinence. The tongue is pale with scant coating. The pulse is deep, thready and weak. Imaging often reveals obvious degenerative signs such as cervical osteophytes, narrowing of intervertebral spaces, and spinal cord compression, which are highly consistent with the TCM understanding of “marrow deficiency and bone atrophy.” Marrow deficiency not only results in fragile bone structure but also deprives the collaterals of their filling and irrigation, forming a vicious cycle of “bone atrophy-collateral emptiness”^[20].

4. Therapeutic approaches based on the theory of “Bone Xuanfu-Collaterals-Marrow”

4.1. Opening Xuanfu: Promoting patency for functional restoration, reopening the microscopic gateways

“Opening Xuanfu” is the core therapeutic method for the early stage of the disease, where pathogenic pathogens obstruct the microscopic channels inside the bones^[21]. Its purpose is to restore the “opening, closing, and free passage” function of Bone Xuanfu as the gateway for the inflow and outflow of Qi, blood, and body fluids, and to expel pathogenic factors such as wind, cold, dampness, and stasis that have accumulated internally^[22]. The essence of this method lies in “dredging” and “dispersing.” It not only refers to dredging Qi and blood, but also emphasizes “opening the subtle Xuanfu orifices.” Therefore, the selection of medicinals prioritizes those that are “light, dispersing, and penetrating,” as well as “pungent and moving to scatter.” Therefore, for the early-stage syndrome of obstruction of Bone Xuanfu with Qi stagnation and blood stasis”, the treatment should prioritize “opening Xuanfu”, aiming to restore the normal distribution of Qi, blood and body fluids.

Commonly used medicinals are those with pungent-dispersing, diffusing-unblocking, blood-activating and stasis-resolving properties. For example, wind-dispersing medicinals such as *Herba Ephedrae* (Mahuang), *Ramulus Cinnamomi* (Guizhi), *Rhizoma et Radix Notopterygii* (Qianghuo), and *Radix Saposhnikoviae* (Fangfeng), with pungent flavour and dispersing nature, can open Xuanfu, and expel exogenous pathogens. Blood-activating and resuscitative medicinals such as *Moschus* (Shexiang), *Bomeolum Syntheticum* (Bingpian), *Rhizoma Ligustici Chuanxiong* (Chuanxiong), and *Radix Curcumae* (Yujin), with aromatic flavour and penetrating nature, can

activate blood and dissipate mass, and directly act on the microscopic structures. Phlegm-resolving and mass-dissipating medicinals such as *Semen Sinapis Albae* (Baijiezi), *Rhizoma Pinelliae* (Banxia), *Bulbus Fritillariae Thunbergii* (Zhebeimu) can clear up phlegm and dredge collaterals, and eliminate obstruction within Xuanfu.

A representative formula that can be selected is Tongxuan Huoxue Decoction (Self-formulated), which include Mahuang, Guizhi, Chuanxiong, Yujin, Baijiezi, *Radix Salviae Miltiorrhizae* (Danshen), and *Radix Glycyrrhizae* (Gancao). In this formula, Mahuang and Huizhi open Xuanfu and dispel cold; Chuanxiong and Yujin activate blood and open orifices; Baijiezi resolve phlegm and dissipate mass; Danshen dredge collaterals and resolve stasis; Gancao harmonizes all the medicinals.

4.2. Nourishing collaterals: Focusing on nourishment to reconstruct the distribution network

“Nourishing collaterals” is key in treating the advanced stage of the disease with disharmony of Qi and blood. The “nourishing” carries the dual meaning of “circulation” and “nourishment”^[23]. On one hand, it involves activating blood and unblock meridians to break blood stasis, ensuring the smooth movement of Qi and blood. On the other hand, it aims to nourish blood and soften sinews, replenishing the consumption, this is the so-called treatment with both dredging and tonifying. At this stage, the obstruction of Xuanfu has affected the macroscopic collateral system. The therapeutic focus shifts from “opening” to equally emphasizing “nourishing” and “dredging,” aiming to restore the functions of collaterals in distributing Qi and blood and nourishing the tendons and bones. Therefore, for the syndrome of collateral stasis with disharmony of Qi and blood, the appropriate treatment is to “nourishing the collaterals”, which primarily involves activating blood circulation and unblocking the collaterals, while also considering nourishing the blood and softening the sinews^[24].

Vine-based, insect-based, and blood-nourishing/blood-activating medicinals are commonly used. Vine-based medicinals such as *Caulis Spatholobi* (Jixueteng), *Caulis Trachelospermi* (Luoshiteng), and *Caulis Sargentodoxae* (Daxueteng) can dredge collaterals, activate blood and relax sinew. Insect-based medicinals such as *Lumbricus* (Dilong), *Scorpio* (Quanxie), and *Bombyx Batryticatus* (Jiangcan) can penetrate deep into the collaterals, dispel wind and dredge collaterals, break up stasis. Blood-nourishing and blood-activating medicinals such as *Radix Angelicae Sinensis* (Danggui), *Radix Salviae Miltiorrhizae* (Danshen), *Semen Persicae* (Taoren), and *Flos Carthami* (Honghua) can activate and nourish blood to repair collateral damage. A representative formula that can be selected is Huoluo Xiaoling Pill combined with modified Danggui Sini Decoction, which include Danggui, Danshen, *Olibanum* (Ruxiang), *Myrrha* (Moyao), Guizhi, *Herba Asari* (Xixin), Jixueteng, and Dilong. The whole formula works together to warm and unblock collaterals, activate blood circulation, and relieve pain.

4.3. Nourishing marrow: Prioritizing tonification to consolidate the root

“Nourishing the marrow” is the fundamental treatment for the late stage of the disease, marked by root deficiency and branch excess, with the core pathogenesis being deficiency of the liver and kidney, and insufficiency of the marrow sea^[25]. This method embodies the principle of “treating the root cause of disease.” The long-term degeneration of the cervical spine is ultimately rooted in the depletion of the fundamental substance known as the “marrow”. At this stage, the focus of treatment shifts from “eliminating pathogens and dredging collaterals” to “reinforcing healthy Qi and consolidating the root”. By replenishing genuine Yin and genuine Yang, it nourishes the bone marrow, strengthens the bones, and fortifies the collaterals. Therefore, for the syndrome of marrow deficiency with malnourishment, bone atrophy and collateral emptiness, the treatment should focus on “nourishing

the bone marrow”, emphasizing tonifying the liver and kidney, replenishing essence, and promoting marrow generation.

Animal-derived tonics and kidney-tonifying bone-strengthening medicinals are commonly used. Kidney-tonifying and essence-supplementing medicinals such as *Radix Rehmanniae Preparata* (Shudihuang), *Fructus Corni* (Shanyurou), *Fructus Lyci* (GouQi), and *Semen Cuscuta* (Tusizi) can nourish the kidney, supplement essence, and promote the generation of marrow. Bone- and sinew-strengthening medicinals such as *Colla Corni Cervi* (Lujiaojiao), *Colla Testudinis Plastris* (Guibanjiao), *Cortex Eucommiae* (Duzhong), and *Radix Dipsaci* (Xuduan) can tonify liver and kidney, strengthen sinew and bones. Qi-replenishing and blood-nourishing medicinals such as *Radix Astragali* (HuangQi), *Radix Codonopsis* (Dangshen), *Radix Angelicae Sinensis* (Danggui), and *Radix Paeoniae Alba* (Baishao) can replenish Qi, generate blood, and promote transformation of marrow. A representative formula that can be selected is Zuogui Pill combined with modified Guilu Erxian Decoction, which include Shudihuang, *Rhizoma Dioscoreae* (Shanyao), Shanyurou, GouQi, Lujiaojiao, Guibanjiao, Duzhong, and *Radix Achyranthis Bidentatae* (Niuxi). The whole formula works together to tonify the kidney, replenish marrow, and strengthen sinews and bones ^[26].

In summary, the three methods are not completely separated. In clinical practice, it is often necessary to apply one method as the principal, two methods in combination, or all three methods concurrently, according to the patient’s specific syndrome. Generally, during the acute or early stage, the focus is “opening Xuanfu”. In the chronic or middle stage, the emphasis shifts to “nourishing the collaterals”. During the remission or late stage, the priority is “nourishing the marrow”, and this principle is maintained throughout to prevent recurrence.

5. Conclusion

Based on the theory of “Bone Xuanfu-Collaterals-Marrow”, this paper systematically discusses the pathogenesis and treatment of cervical spondylosis from the perspective of integrating macroscopic and microscopic aspects. It holds that the occurrence and development of cervical spondylosis begin with stagnation and blockage of Bone Xuanfu, undergo a key turning point with stasis and obstruction of collaterals, and ultimately result in deficiency and malnourishment of marrow. Treatment should be implemented by stages and at multiple levels: Open Xuanfu to unblock collaterals and dissipate mass in the early stage, nourish the collaterals to activate blood and nourish sinews in the middle stage and nourish the marrow in the late stage to strengthen bones and consolidate the root in the late stage. This theoretical framework not only enriches the connotation of TCM syndrome differentiation and treatment for cervical spondylosis, but also provides a new clinical approach of “regulating structure at the micro-level and restoring function at the macro-level”. It should be noted that the theory of “Bone Xuanfu-Collaterals-Marrow” is still in the exploratory stage. The correspondence between its micro-level substance and modern medical structures, as well as the efficacy mechanisms of specific herbal formulas, still requires further verification through basic and clinical research. In the future, methodologies such as imaging, microcirculation detection, and molecular biology can be employed to deepen the application of this theory in the prevention and treatment of cervical spondylosis, thereby promoting the modernization of osteology and traumatology of traditional Chinese medicine.

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