

Manipulative Therapy of Cervical Spine and Cerebral Blood Flow

STUDY PROPOSAL

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The neck conveys vital structures from and to the head and trunk. It enables the head to be placed in a position to receive from the environment all information other than that provided by touch. The function of the cervical vertebrae is very important in supporting the head and its weight (approximately 7 kg.). The cervical spine is completely encircled by intricate layers of muscles that perform the complex function of controlled movement and stabilization of the cervical spine. The neck carries elements of the autonomous nervous system which take part in the activity of internal organs.¹¹

The cervical spine, as a highly loaded part of a human's vertebrae, is subject to different disorders, and most of them are connected with the patient's age. At the same time, morphological, structural, and dystrophic alterations of the cervical spine may promote different disturbances of the vertebral arterial circulation and sympathetic innervation.¹

Spano (1982) suggests that any morphological and structural alteration of the cervical spine may lead to stenosis or substenosis of the vertebral arterial circulation and hence to brain stem anoxia.¹ These problems arise from a common malady of mankind -- cervical spondylosis (which is a general term indicating restrictive changes in the vertebral bodies about the interspace, usually associated with chronic discopathy).

The physiologic degenerative aging process, as elsewhere, occurs in the cartilaginous and ligamentous structures of the cervical spine. The process is especially accentuated by the repeated stress and strains imposed by this very mobile structure.¹¹ Cervical disc degeneration (cervical spondylosis) may occur and may remain asymptomatic. It may give rise to local pain or it may give rise to both local and referred pain from posterior joint strains, resulting from spinal instability. It may lead to the production of a neurocentral osteophyte, causing root irritation or impairment of root conduction. Certain symptoms may arise from irritation of the sympathetic plexus around the vertebral artery, and on occasion, symptoms may be related to obstruction of a vertebrae itself by neurocentral osteophyte.⁹ As it is known from anatomy and physiological features of the cervical sympathetic trunk, the larynx, heart, lungs, and bronchi are likely to be affected in the event of stimulation or irritation of the preganglionic fibers of the sympathetic nervous system following static or dynamic alterations of the cervical spine.¹ Consequently, we have to consider two main complications of cervical spondylosis: the influence on cervical blood flow and the influence on the sympathetic nervous system.

The brain receives blood supply from a carotis and a vertebralis systems. Each vertebral artery arises in the supraclavicular space from the subclavian artery and ascends in a bony canal in the cervical vertebrae to enter the skull through the foramen magnum. There, each gives off into the posterior cerebellar artery and the anterior and posterior spinal arteries. At the ponomedullary

junction, the two vertebral arteries join to form the basilar artery. The vertebrobasilar system normally nourishes the cervical cord, brain stem, cerebellum, thalamus, auditory, and vestibular functions of the inner ear, and usually the medial temporal and occipital lobes of the cerebral hemisphere.²

Since the vertebral arteries have a long extracranial course and pass through the transverse process of C6 to C2 vertebrae before entering the cranial cavity, one might expect them to be subject to trauma, spondylotic compression, and a variety of vascular diseases.⁴ Although, the two vertebral arteries contribute between 10 and 15 percent of the cerebral blood flow, they supply blood to over 90 percent of the cervical spinal cord, nerve roots, and their supporting tissues. Generally, the brain has very rich collateral blood supply through a.carotis, and a.basilaris, so attempting to think of improvement of cervical blood flow in a.vertebrae is improbable, but it is not excluded.

Cerebral vessels are different from those in the periphery. The sympathetic fibers appear to have little functional significance except perhaps to regulate blood pressure effects in the larger vessels around the circle of Willis. The control of cerebral blood flow depends mainly on autoregulation, an intrinsic mechanism regulating vessel diameter in order to keep cerebral blood flow constant in spite of a variety of anatomical and metabolic variations.³ Ischemia inhibits the process of cerebral autoregulation, and the presence of collaterals cannot compensate. When autoregulation fails, cerebral blood flow has a linear relationship to blood pressure. Elderly patients tend to lose some of this autoregulatory compensation (especially with cervical spondylosis development) and so are normally prone to the effects of hypotension and hypertension.³

The blood vessels of the head receive their preganglionic sympathetic innervation from T1 to T2, but C8, T3, and even T4 may also contribute. The axons pass out into the sympathetic chain and ascend to synapse in the stellate and the superior cervical sympathetic ganglia. The postganglionic fibers distribute from the superior cervical sympathetic ganglion with the external and internal carotid arteries to the head. The intracranial postganglionics follow along the internal carotid artery to the circle of Willis and along branches of the external carotid, and distribute to the adventitia and the smooth muscle of intracranial vessels including arterioles of the pia mater, but not to the blood vessels in the brain substance. Postganglionic fibers also distribute to the middle meningeal artery. Postganglionic fibers from the stellate ganglion ascend along the vertebral arteries and basilar artery. These sympathetic fibers to the intracranial blood vessels are vasoconstrictors.⁵ Thus, anatomical data shows close connection between cervical structures and cervical blood vessels, and certain influence of cervical sympathetic network on cerebral blood flow is doubtless.

Next, we will consider sympathetic structures of the neck. The superior, middle, and inferior cervical ganglia send gray rami to all eight cervical spinal nerves. The superior cervical ganglion sends to the first four cervical nerves, the smaller middle cervical ganglion supplies the next two, and the large inferior cervical ganglion projects a gray ramus to the seventh and eighth cervical nerves.⁶

In the cervical spine, the gray rami from sympathetic cervical ganglion join the ventral primary divisions well outside the intervertebral foramina. The three sympathetic ganglia are usually in the connective tissue between the longus colli and longus capitis and the carotid sheath. The multiple branches of the cervical sympathetic chain include those ascending along the internal and external carotid arteries and those to the pharynx, cardiac plexus, and other areas, as well as those to the

spinal nerves. The sympathetic chain, therefore, is not technically part of the spinal column but a related structure.⁹

Before dividing into anterior and posterior primary divisions each spinal nerve gives off a small recurrent or meningeal branch, which is joined by a filament from the communicating cord between the anterior division of the nerve and the sympathetic, and then runs upwards through the intervertebral foramen to the spinal canal, where it is distributed to the vertebrae and ligaments, the blood vessels of the canal, and to the dura mater. To the intraspinal nerves formed in this manner by the union of the recurrent or meningeal branches of the spinal nerves with the sympathetic filaments from the rami communicantes, Toldt gives the name of n.sinuvertebrales.^{7,10} It winds around the pedicle on each side and splits into ascending and descending branches to supply the structures noted with various sensory modalities of position, pain, temperature, and so forth.⁹ Cervical manipulations (CM) influence not only subluxations of cervical vertebrae but affect all structures of the neck: ligaments, muscles, vessels, and especially nerves. The response of the sympathetic system for cervical manipulations (sympathetic stimulation) was clearly shown in a number of studies.¹²⁻¹⁶ It is possible to conclude through these data that CMs have complex influence on cerebral blood flow which should be attentively investigated.

Experimental Proposal: Design and Method

Total time involved is one year.

Phase I. Analytical investigation. Detailed literature research is performed and possible mechanisms of influence of spinal manipulative therapy (SMT) on cervical blood flow are proposed.

Phase II. Practical study. Patients between the ages of 30 to 65 with symptoms of cervical spondylosis will be examined by superficial rheoencephalography or Doppler equipment. All signs and characteristics of cerebral blood flow will be noted. After routine chiropractic examination patients take a prescribed course of chiropractic treatment with emphasis on cervical spine, 5-15 procedures. After treatment, repeated examination should be done under the same conditions.

Phase III. Analysis of results. Statistical processing of data. Preparation of final report and article to a refereed journal.

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JULY 1994