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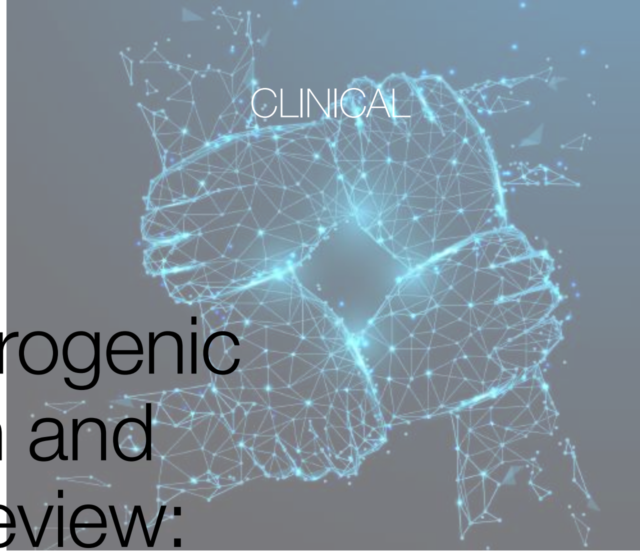

Neurodynamics of vertebrogenic somatosensory activation and Autonomic Reflexes - a review:

Part 7 The cervicogenic factor

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Abstract: Articular activation of sensory nerves should not be seen as being limited to nociceptive receptors as other neural sensory pathways are also vulnerable to noxious stimulation.

Indexing terms: Vertebral subluxation; cervicogenic; Somatosensory; Autonomic nervous system.

Introduction

'Cervical dysfunction is the most common cause of neck pain.' (1)

Due to its anatomical proximity to the brainstem, a disturbed cervical vertebra appears to have the potential to adversely influence a number of neural structures and physiological functions. As such, this neurophysiological impact may contribute a profound neurospinal component upon the autonomic nervous system - especially the brainstem nuclei of the parasympathetic cranial nerves. (See also Cranial Nerves Part VIII) (2, 3, 4, 5, 6)

... cervical spine subluxations can affect 'central corticomotor facilitory and inhibitory neural processing and cortical motor control' involving the upper extremities.'

As nociception is a neurological phenomenon, it qualifies as a somatosensory response. Cervicogenic headaches are another example. Both examples of neural reflex disturbance indicate that cervical subluxations or dysfunction are more than just osseous disturbance. (7, 8)

The cervical spine has featured strongly in studies on spinal influence upon the ANS. Three examples of these are cervicogenic headaches, cervical vertigo, and the cervical vertebral impact on particular cranial nerves. In whiplash injuries, a number of authors report classic examples of the cervicogenic pathophysiological neural symptoms of sensory, motor, and autonomic dysfunction associated with mechanical disruption of the cervical spine. Uchida and Budgell suggest that monitoring of the ciliospinal reflex as a possible diagnostic aid in assessing the neural status of the cervical sympathetic trunk. (9)

Although they acknowledge medical controversy regarding cervicogenic headaches, Antonaci and colleagues recognise involvement of the nucleau cordalis and that '*Neuroimaging and* *kinematic analysis of neck motion may aid in diagnosing difficult CEH*' (Cervicogenic Headache). Four years later Vincent stated that the '*Cervicogenic headache (CEH) is a well-recognized syndrome,' and 'a relatively common syndrome*.' (10, 11, 12)

It is noted that while there is increasing literature and evidence of the condition, there seems an implied reluctance to cite refereed papers from chiropractic or osteopathic sources – the principal proponents in the field. A medical alternative which also recognises the cervicogenic nature of headaches would be interventionist measures such as nerve blocks. Although Edmeads suggested that nerve blocks are of temporary benefit and should not be administered frequently. (13, 14, 15)

Headaches, migraines, cardiac and respiratory changes feature as being regularly associated in cervicogenic-related conditions. Using Wistar rat subjects, a potentially pertinent paper by Edwards et al in 2015 outlined potential adverse effects of a disrupted cervical spine. This suggests a physiologically functional (mechanical) normalised cervical spine would tend not to experience those symptoms. The authors found that noxious sensory stimulation from whiplash involving the C2 spinal nerve, can precede cervical dystonia. Further, that this could influence the autonomic pathways resulting in such conditions as cardiovascular and respiratory abnormalities, dysphagia, and '*eye position*' disturbances. (16, 17)

Also in relation to cervical dysfunction headaches, Braaf and Rosner suggested that 90% of headaches are cervicogenic in nature. They published seven studies on cervical disturbances over the period 1953 to 1975. (18, 19, 20, 21, 22, 23, 25, 25, 26)

In further animal experiments, Edwards et al established that the *intermedius nucleus* of the medulla (InM) receives input from the cervical region leading to autonomic responses. It is also associated with the coordination of tongue movements. (16)

Additional research by Edwards and colleagues investigated neurological sensory afferent links between the upper cervical spine (namely the C2 nerve), postural control, mouth and eye movement, as well as respiratory and cardiovascular symptoms. They also identified a proprioceptive association through a group of brainstem nuclei. In particular the research noted that stimulation of the intermedius nucleus (InM) '*mimicked the response of second cervical nerve stimulation*'. Their findings tend to corroborate the link between the upper cervical sensory afferents and the autonomic nervous system control through the InM. They also recognise the potential for dysphagia and a form of cardiorespiratory dysfunction which may be associated with a disturbed cervical spine, and cervical dystonia resulting from whiplash injuries. (27)

Vaňásková et al also noted that in cervicogenic dysphasia the swallowing reflex may involve five of the cranial nerves: *Trigeminal* (V), *Facial* (VII), *Glossopharyngeal* (IX), *Vagus* (X), and the *Hypoglossal* (XII). (28)

In extensive research involving cervicogenic disorders, Haavik-Taylor and colleagues have demonstrated that cervical spine subluxations can affect '*central corticomotor facilitory and inhibitory neural processing and cortical motor control*' involving the upper extremities. This central processing could also be indicative of the wider implications of neural effects from mechanical vertebral disturbances, VSCs. (29)

The ENT surgeons Franz and colleagues suggested that cases of cervicogenic oto-ocular syndrome could be due to vertebral disturbance (functional disorders) associated with such signs and symptoms as, mydriasis, sensorineural hearing loss, vertigo, tinnitus, and *Eustachian tube* dysfunction. In the study, patients' ANS function was monitored by observing pupil size. The cervical spine was assessed by a physical therapy examination of facet mobility. (31)

The neck-tongue syndrome may also be seen as being cervicogenic in nature. It is characterised by associated neck or sub-occipital pain. As headaches usually accompany this condition, the syndrome is now classified in the *International Classification of Headache Disorders* (ICHD-3) as item code 13.5, *Neck-tongue syndrome*. In an indication of a spine-related biomechanical factor of its onset, the ICHD notes that pain associated with the syndrome is precipitated by a '*sudden turning of the head*'. Effective chiropractic management of the condition has been reported. (32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45)

In further research, Bolton and colleagues noted a vestibulo-sympathetic correlation with posture involving dorsal neck muscles, cervical afferents (C2, C3) with cardiovascular and respiratory responses in cat subjects. (46, 47)

Others studies indicate that birth injuries to an infant's neck may be a precursor to a range of cervicogenic conditions, including infantile colic. The physicality and the infant's vulnerability during the birth process are considered to render them particularly susceptible to cervical injury. Naturally, conventional chiropractors adapt light adjusting techniques on such patients. (49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 61, 63, 64, 65, 66, 67, 68, 69)

Rostocki stated that '*Many infants suffer neck injury during birth which can lead to lifelong health problems……….These injuries can be caused organically or through medical error and may affect any structure or system in the newborn infant's body. The cervical spinal column is very delicate in an infant and is often the site of trauma from a birth injury.*' (70) He also stated that '*Chiropractic for neck pain is perhaps the most common and popular complementary healing art used by patients the world over.*' (71)

Interpreting newborns' spine-related symptoms is a regular paediatric procedure for most chiropractors. (72, 73, 74, 75) Pizzolorusso and colleagues also found a rather extensive range of subluxation (osteopathic somatic dysfunctions) in 155 infant paediatric patients. (76)

Durand and Daniels investigated the compression of the C4 nerve root. They noted such symptoms as phrenic nerve palsy, shortness of breath, chest pain, and an elevated hemidiaphragm. While this is an example of a marked physical state, it is suggested that lesser segmental disturbances, irritation, or neural sensory activation of the C4 may also have the potential to lead to symptoms related to the structures involved, particularly when of a chronic nature. (77)

Conclusion

The listed variety of cervicogenic disorders would suggest that comparative studies of prevalence and therapeutic efficacy are warranted

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