

Part 13 - discussion, summary and conclusion

Abstract: This series sought to present published material relative to somatosensory pathophysiology associated with the hypotheses underpinning the clinical findings of vertebral subluxations. It also provides evidential rationale relative to manual or instrument adjusting of biomechanical segmental pathomechanics. While the greater part of the evidence for the fundamental principles of vertebrogenic conditions is from medical sources, most of the clinical evidence of positive manipulative outcomes based on those principles are chiropractic and osteopathic sources, with some from Western European medical doctors. A range of finely tuned and highly specific segmental adjustive techniques are available in order to restore segmental joint physiology and normalise noxious sensory input which may be associated with particular clinical presentations. It is acknowledged that the concept behind this subluxation model is dynamic, and that continuing research may well further explicate its physiological rationale, its degree of clinical contribution, and the potential for appropriate deployment of physical correction.

Peter Rome and John Waterhouse

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Introduction

The neuropathophysiological observations and the *Vertebral Subluxation Complex* (VSC) or *Somato-Autonomic Visceral Complex* (SAVC) hypotheses offered in extensive neurophysiology literature has been contributed to by Sato A and Sato Y, (1, 2, 6, 8) Jänig, (3, 4, 16) Schmidt, (1, 2) McLachlan, (4) Brooks, (5) Koizumi, (5) Kimura. (6) Korr, (7) as well as by chiropractors Cramer, (9) Budgell (8, 9) Haavik, (11, 12) Henderson, (9, 13) Pickar, (9, 14) and osteopaths Coote, (15) King, (16) and Patterson, (16) to list but a few.

Apart from vertebral subluxation, various terms have arisen in reference to the biomechanical aspect of this clinical finding, these include - fixation, somatic dysfunction, and vertebral dysfunction. However vertebral subluxation is offered as a complex in order to cover more of the elements

neuroscience research supports a neurophysiologic rationale for the concept that aberrant stimulation of spinal or paraspinal structures lead mav to segmentally organized reflex responses of the autonomic nervous system, which in turn may alter visceral function.' Budgell BS, 2000. (26)

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involved in a lesion which considers:

- Pathophysiology of articular function particularly vertebral facets, but not limited to spinal articulations
- Pathophysiology of somatosensory activation
- Pathophysiology of somato-autonomic reflexes
- > Pathophysiology of somatovisceral, somato-somatic and somatovascular reflexes
- Pathophysiology of innervated structure(s)
- Restoration of the articular function is directed at removing noxious somatosensory input and reinstating the physiology of the involved structures and their functions.

This comprehensive subluxation model is based on biomechanical segmental disturbance and the resultant noxious sensory activation of somatosensory and somato-autonomic reflexes. This may influence a segmentally associated structure's physiology leading to its pathophysiology and ultimately signs and symptoms. The innervated target associated with that segmental level may be another somatic structure such as a skeletal muscle, organ, smooth muscle, neural aberrations as in nerve pain, or paraesthesia. In this series, the term vertebral subluxation includes the osteopathic lesions, somatic dysfunction and vertebral dysfunction. This renders the VSC as being much more than just a simple joint displacement. (17, 18, 19, 20, 21, 22)

Although other joints may trigger a somato-autonomic response, the focus here is predominantly on the sensory-rich vertebral facets.

It is reasonable to conclude that if physiological somato-autonomic reflexes can influence so much of the body's general physiology, then physically disturbed, noxious sensory input through to activated reflexes may have the potential to cause aberrant function of structures innervated by those reflexes, a form of pathophysiology. (23)

Review

This series seeks to provide a synopsis of some of the evidence relating to the vertebral adjustment of vertebral subluxations as a logical, scientific, effective, convenient, safe, and non-invasive therapeutic model to address those lesions of biomechanical-neural of vertebral origin. It focusses on the noxious neural effects of somatosensory activation within a VSC or SAVC. This SAVC model is based on published physiological and medical evidence as a key element in explaining factors in vertebrogenic conditions involving vertebral dysfunction. Vaňásková at al recognised such vertebrovisceral syndromes in their study of vertebrogenic dysfunction in relation to dysphagia. (24)

Resolution of biomechanical dysfunctional elements of an SAVC is sought through manual or instrument vertebral adjustment, which is directed at moderating vertebrogenic neural signs, symptoms and associated clinical condition(s). This biomechanical correction is conducted by the application of a mild, accurate, precisely directed, manual or instrument adjustment upon a segment-specific pathophysiological disturbance, the *subluxation complex*. Modification is sought by suppressing and stabilising the generated noxious sensory activation through restoring normal autonomic reflex arcs, neural tone, (25) articular function (joint physiology), facet positioning and release of associated muscular hypertonicity. In essence, the ultimate aim is to normalise sensory neural afference and associated neural efferents in order to restore all aspects of an innervated structure's physiology, thereby alleviating the symptomatic consequences of the addressed VSC.

Sato and colleagues researched the apparent influence of localised noxious somatosensory activation due to biomechanical vertebral disturbances with its impact upon the autonomic nervous system. They then noted resultant neurological effects upon innervated visceral and



somatic structures by somato-autonomic reflex influence upon physiology, the resultant dysfunction or pathophysiology. Other studies have explored noxious somatosensory insult from various peripheral articulations. In essence, such disturbances also stimulate a barrage from mechanoreceptors and nociceptors in the form of somato-autonomic, somatosomatic, and somatovisceral reflexes. Subsequently this noxious input would tend to explain the influence upon the physiology of structures innervated by the localised somatic disturbance potentially leading to clinical presentations. (26, 27)

Sensory neural vertebrovisceral integration is exhibited by somatovisceral reflex activation (1, 2, 3, 4, 6, 8, 16) This association is evidenced by the convergence of somatic and visceral afferent sensory fibres in the posterior horn of the spinal cord. Jinkins indicated that it is from this site that referred pain originates. It is therefore suggested that this is also a common origin of somatovisceral reflexes as well as the viscerosomatic reflexes. (28, 29, 30, 31, 32, 33, 34, 35, 36)

This somatovisceral phenomenon of the *Convergence Theory* suggests that somatic and visceral autonomic afferents may have the same or some of the same central connections at this level of the spinal cord to the thalamus, and sensory cortex. Due to this convergence of afferent fibres, the effect of somatic sensory activation would not necessarily be confined to somatic efferent reflexes only. They may also influence physiological function in vascular and other smooth muscle structures thereby affecting sphincter and visceral function. (28, 37, 38, 39, 40, 41)

The classical concept of the Dorsal Root Ganglion (DRG) as merely an assembly of afferent pathways of sensory neurons has been challenged. Evidence by Lu and colleagues using animal subjects demonstrated somatovisceral convergence in that the DRG is more a '*laterally displayed portion of the spinal cord*'. (42)



Photo 1: Dorsal Root Ganglion of a rat. Taken from *'Flipboard' December 2021*, an agglomerator. Photographer unknown, but acknowledged.

The available evidence also indicated that noxious somatosensory stimulation associated with for example a subluxation, would have the potential to activate both the sympathetic and the parasympathetic elements of the autonomic nervous system. They may induce symptoms of dysfunction of target physiology due to its influence through a somatovisceral reflex innervation. A typical clinical presentation would be cervicogenic headaches and associated symptoms which may include blurred vision, nausea, sensitivity to light or noise, restricted neck motion, pain around the eyes, lacrimation, tinnitus, and dizziness. (9, 43, 44)

Noxious sensory activation may also be reflected at other disturbed vertebral levels producing distinctive signs, symptoms and conditions for that segmental level. (45) Common examples for these other neurosensory involvements would not be limited to somatic structures such as radicular paresthesias, vertebrogenic sciatica, thoracogenic intercostal neuralgia, and vertebrogenic pain of biomechanical origin, but also functional disorders such as, dyspepsia, dysphagia, or intestinal motility (24, 28, 46, 47, 48) Interestingly, a relatively recent (2016) paper by Berezutsky from Russia incorporates the term *vertebrogenic visceropathy*. (49)

This biological pathophysiology as acknowledged by Sato et al stated that 'An understanding of all of these properties of the somato-autonomic reflexes appears to be essential for explaining the neural mechanisms by which the majority of physical treatments affect diseases.' (50)

Correcting the 'SAVC'

The objective of the corrective adjustment is to neutralise that pathophysiological sensory input of an SAVC by modifying, suppressing, or eliminating its noxious activation in order to normalise associated pathophysiological dysfunction identified by associated signs and symptoms. This contribution as a remedial vector for conditions involving a somato-autonomic reflex appears to be in demand by patients as a viable option in their care programme.

Key facts to be considered in each case would include the chronicity, severity, and duration of onset of the noxious sensory input and nature of original aetiology, e.g. trauma. These would be considered by a clinician in conjunction with a number of the patient's lifestyle factors. (See also Part 10 of this series 'The vertebral adjustment of the vertebral subluxation – more than manipulation.')

The physiological recognition that noxious somatic afferents can influence visceral function through the ANS, offers a natural intervention portal in health care for a range of conditions. While medications may suppress somatosensory symptoms, they would not alone be expected to rectify physical-mechanical articular lesions. (24) (See also Part 10 of this series)

Discussion

This series of thirteen papers on a somato-autonomic-visceral triad which focussed on the vertebral subluxation has been largely supported by medical citations. It is apparent that a medical reference base and case narratives have been available to all health professions for many decades. However, this model has not been incorporated into patient medical care (with noted exception) despite patient demand. Nor has it been justly recognised as a reasonable and rational clinical option for a range of conditions despite the available evidence. (24)

Patient narratives, patients' reports, and case reports have also been available and deserve greater recognition in the evidential hierarchy at the pragmatic clinical level as an applied science. (51, 52, 53, 54, 55, 56, 57, 58) Such clinical research protocols are not particularly suitable for laboratory research methods. As stated by Agnes, 'one of the best features of the case report is it has the facility to report novel findings and better-quality therapeutic strategies.' (59) Ebrall states clearly that 'Appropriately utilised case reports have the potential to improve the methodological design of clinical trials, thereby improving patient care.' (60) It is suggested that

without case reports there would be little or no grounds to conduct more formal levels of research and are therefore worthy of greater recognition. (61, 62)

There is a natural responsibility to record emerging clinical findings including positive as well as the neutral or negative outcomes of clinical practice. Case reports offer anecdotal narratives by all health professions. The electronic Index to Chiropractic Literature (ICL) (https://www.chiroindex.org/#results) provides the profession's data listing from over 50 chiropractic journals. The medical PubMed index also carries some of these chiropractic journals. A number of both the ICL and PubMed listed journals specialise in case reports. These include:-

- > Journal of Upper Cervical Chiropractic Research
- > Annals of Vertebral Subluxation Research
- > Paediatric, Maternal & Family Health
- > Journal of Manipulative and Physiological Therapeutics
- BMJ Case Reports
- Journal of Medical Case Reports
- Clinical Care Reports
- Journal of Surgical Care Reports
- > Australia Pacific Chiropractic Journal
- Part 6 of this series carries case reports from the '*International medical literature clinical application of the somatovisceral model*'.

In consideration of those with reservations

Contrary to claims that there is no evidence supporting chiropractic theories, considerable medical data has demonstrated that the evidence has been in the medical literature and PubMed medical index for a considerable time. Due to this rather extensive medical reference base, claims that there is no evidence to support chiropractic concepts are unsubstantiated and therefore such claims are considered false. A retraction of such tenuous dissenting claims is warranted unless formal research evidence to the contrary can be demonstrated.

As identified by Vaňásková and colleagues the traditional English language medicine (ELM) appears to not have valued, or has dismissed neurophysiological somato-autonomic principles. (24) However after what may be intransigence, ELM papers now seems somewhat more receptive to the concept of mechanical back pain, but with limited recognition of just the one element of a subluxation complex, vertebral dysfunction. (Compare Part 6 of this series)

It would be up to dissenters of the somato-autonomic/somatovisceral model to demonstrate an absence of that pathophysiology in order to reject or even modify the neurological principles involved. That is, to demonstrate the absence of somato-autonomic-visceral complexes in association with the vertebral subluxation. Such a position would tend to contradict readily available formal research. (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 63) No formal studies challenging this vertebrogenic neurophysiology model were located.

Some may still contend that manipulation is not a sophisticated avenue towards influencing the ANS. The more recent advent of transdermal electronic applications to activate the vagus nerve in this field of biological inducement draws attention to the prospective potential for non-invasive somato-autonomic influence. Acupuncture has also been regarded physiologically as a somatovisceral model with substantial clinical evidence. (64, 65)

Regular clinical experience, as well as manipulative spinal management of infant patients (including studies of medical spinal manipulation of infants), would suggest that a psychosomatic

element would not be a factor in explaining the efficacy of spinal manipulation. (66, 67, 68, 69, 70)

Similarly, skeptical claims that positive outcomes from manipulation are only a placebo effect would indicate that any placebo benefit from the manipulation must be more effective than previous 'real' treatment which is usually medical.

As with other health professions, there has also been significant chiropractic research involving animal subjects. Such studies on anaesthetised animals would also tend to refute the placebo effect theory. Vernon reviewed 18 animal studies while Henderson summarised some 34 animal studies since 1975, these included 31 studies on the subluxation, and 3 on adjustment of the subluxation. Rosner notes 11 animal studies involving five different species, while Colloca has conducted research of spinal adjustments on sheep. (71, 72, 73, 74, 75)

Budgell and Sato state that 'A great deal of basic research on somato-autonomic reflex regulation of visceral function has been carried out in anaesthetised animals, particularly cats and rats. These animal models have been useful in revealing the underlying neural mechanisms in the absence of emotional influences.'(8)

Summary

The literature discussed here has been offered in a series as a means of appraising the various elements of somatosensory physiology and pathophysiology. These may be viewed as a rationale for many vertebrogenic clinical signs, symptoms, and a range of conditions. The evidence presented pathophysiological elements comprising the SAVC model within which noxious somatosensory activation may initiate somatic-autonomic, somatovisceral and somatosomatic pathophysiological reflexes.

The plethora of neurophysiological and clinical evidence support reports of positive physicalmanual-instrument clinical outcomes and provide a rational confirmation regarding the concepts of particular disturbed somatosensory autonomic physiology. This model of intervention may be considered a primary conservative avenue to access and positively influence offending vertebrogenic autonomic aberrations. That is, those associated with noxious somatosensory reflexes and the physiological function of vertebral segments and corresponding innervated structures.

In essence it was found that the literature demonstrated that

- Physically disturbed somatic structures particularly vertebral articulations, can activate somato-autonomic and somatovisceral reflexes due to noxious sensory input;
- Physically disturbed vertebral facets which are richly endowed with sensory receptors have the potential to initiate these noxious somato-autonomic reflexes. (76) Apart from vertebral facets, other disturbed vertebral structures may contribute to this noxious sensory input such as intervertebral discs, ligaments, capsules, cartilage, intrinsic and paraspinal muscles and tendons; (77)
- The activated noxious neural sensory receptors bombard associated somatovisceral reflex arcs to potentially influence the physiological function of innervated structures associated with that reflex. Considering their sensory neural symptoms, cervicogenic headaches and segmental mechanical articular back pain would be typical but elemental examples of this reflex pathway;
- Being under autonomic reflex influence, structures related to the sensory segmental disturbance may result in dysfunction of skeletal muscle, sphincters, blood and lymphatic vessels, glands, or smooth muscle in various organs; (78, 79)

- The term *Vertebral Subluxation Autonomic Complex* (VSAC) would seem appropriate considering the sensory barrage from elements of a vertebral subluxation;
- Homeostatic physiology may be affected;

It would then follow that:

- Spinal segmental adjustments of the primary spinal segmental source may be effective in eliminating or suppressing the over-stimulated sensory reflex input by restoring physiological articular function and positioning, thereby alleviating the noxious mechanoreceptor input;
- The positive clinical outcomes associated with somatic, osseous adjustments directed at neutralising a noxious barrage, may be attributed to the normalisation of this form of pathosensory source within a vertebral subluxation complex (VSC);
- Removal of that noxious somatic stimulus may help normalise the activated somatovisceral reflexes and assist the affected organ or structure back towards normal function and homeostasis; and
- Due to the segmental vertebrogenic origin of the articular sensory afference of the aberrant autonomic reflexes, modification of the effects of the involved segment by adjustment would appear to be more appropriate than general manipulation. (80, 81, 82, 83, 84)

The principles expressed in this series would validate patients' own reports of positive outcomes. (51) In regard to patient experiences, it is acknowledged by Lewin who stated in 2014 that '*If the patient feels better, he or she probably is better*.' (85)

It is not suggested here that spinal manipulative therapy is a panacea for all conditions. However, in view of the evidence, it is deserving of a far greater and authentic assessment of its potential as one of the logical therapeutic options for a range of clinical conditions – not only simply biomechanical-related pain syndromes alone. A major step to accomplish this would be more formal interprofessional collaborative research into the potential pathophysiological role of this SAVC hypothesis.

The data presented includes around currently available evidence. The hypotheses may be modified as ongoing research develops. They are offered as appropriate hypotheses in explaining a range of clinical presentation and outcome phenomena.

Consideration is suggested here for a number of vertebrogenic conditions that may have traditionally been considered idiopathic in nature and origin.

Conclusion

The current neurophysiological literature potentially validates the rationale of the morphological phenomenon of somato-autonomic reflex activation initiated by aberrant somatosensory receptors associated with mechanically disturbed vertebrae. Further, that these reflexes may then exert an influence on their innervated structure(s). These may be apparent as a number of somatic and visceral signs, symptoms of dysfunctions, hence a designation of vertebrogenic. Such a syndrome may be considered a somato-autonomic-visceral subluxation complex where the vertebral subluxation element could be considered the initiating factor.

The nature of the evidence is such that the chiropractic model should be recognised and warrant continued assessment to explore its contribution to reported positive outcomes, and to bring about a greater perception of the physiology involved. Currently the evidence is sufficient to justify continued adoption for those patients who are recorded as having benefited and for potential patients as a clinical option.

Formal research as well as empirical clinical evidence would seem a rational validation in support of the somatosensory autonomic-visceral dysfunction-based clinical presentations of positive outcomes. This aberrant SAVC phenomenon warrants exploitation as it relates to disturbed parasympathetic and sympathetic function. Adverse somatic sensory input may be recognised and potentially neutralised in order to positively influence specific structures and physiological functions.

Continuing research leading to a greater comprehension of the neurophysiological effects relating to the somato-autonomic visceral complexes and the advantages of addressing vertebral complexes, would seem justified.

This physical-somatic-neurological approach affirms the intrinsic nature of chiropractic and osteopathic hypotheses in the management of a range of somato-autonomic-visceral, somato-somato and somato-humoral conditions.

This series presents the available evidence, but they are not intended as analyses, however, it has been concluded that the literature cited provides substantial evidence to establish:

- That somato-autonomic reflexes are a part of standard somatosensory physiology;
- That disturbed somatic structures may activate autonomic reflexes due to noxious input;
- That noxious somato-autonomic reflexes may result in symptoms and signs of anatomic disturbance or dysfunction;
- That activated somatosensory barrage may primarily originate from biomechanically disturbed articulations, particularly vertebral facets;
- That activated somatosensory reflexes are primarily the mechanoreceptors and nociceptors associated with pain, pressure, inflammation, and proprioception;
- That removal or minimisation of that noxious input may relieve signs and symptoms;
- That signs and symptoms may suggest dysfunction altered function of the innervated structure, namely organ, or muscle;
- That common conditions under this model would include, headaches, sciatica, altered sphincter function, dysphagia, altered smooth muscle function, altered angiosomes, dermatomes, and myotomes;
- That most of the evidence presented is already available through the medical index PubMed, the Index to Chiropractic Literature, or the Osteopathic Medical Digital Library; and
- That it is therefore not possible to substantiate claims that there is no evidence to support the chiropractic model.

Over 20 years ago, Budgell stated that

'Recent neuroscience research supports a neurophysiologic rationale for the concept that aberrant stimulation of spinal or paraspinal structures may lead to segmentally organized reflex responses of the autonomic nervous system, which in turn may alter visceral function.' - Budgell BS, 2000. (26)



Peter Rome DC (ret), FICC cadaps@bigpond.net.au *Cite:* Rome P. Waterhouse JD. Neurodynamics of vertebrogenic somatosensory activation and Autonomic Reflexes - a review: Part 13 - discussion, summary and conclusion. Asia-Pacific Chiropr J. 2021;1.4. URL apcj.net/papers-issue-2-4/ #RomeWaterhouse13Conclusion

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