Craniosacral osteopathy revisited
Part II
THM waves

Abstract

Traditional craniosacral osteopathy is founded upon two central beliefs, which largely determine the way it is taught and practiced. The first is the belief that the CRI is an objective phenomenon powered by variations in CSF pressure. This is contradictory to the other belief that this rhythm can be felt all over the body, synchronously and at the same amplitude. Logic precludes the existence of such an objective rhythm and it has never been measured. This logical impossibility has been confirmed by studies on the inter-rater reliability of osteopaths, which have shown that several operators could not feel the CRI synchronously. In parallel to osteopathy's description of the CRI, much medical research has been dedicated to a physiological phenomenon, called 'Traube Herring Mayer' or 'vasomotor' waves. These rhythms cover a whole series of frequencies, slower than the pulse or respiration, which can be felt over all tissues. Within the skull, vasomotor waves produce two main rhythms, which beat at 2/mn and 10/mn (physiological 'B' and 'C' waves). These rhythms are sometimes synchronous, sometimes asynchronous for two different parts of the craniospinal system or between different areas of the body. Since vasomotion produces the only other known rhythms - other than the arterial pulse or breathing - described in tissues, they can safely be identified – or partly so - with the CRI. The physiology and physiopathology of B, C or THM waves, a 'hot' subject in medicine, is, therefore, directly relevant to cranial osteopathic care. This physiology vindicates the fundamental importance of the CRI/vasomotion in body economy. With this vital - and accepted - phenomenon, cranial osteopathy can find its physiological niche, and a ready-made substratum for further clinical and fundamental research.

In my preceding article, I have suggested that traditional craniosacral osteopathy is founded on an impossible physiology. This impossibility, however, must not be understood, in any way or form, as a negation of the entire model. Craniosacral osteopaths should be considered, like all other osteopaths, as *bona fide* practitioners. The explanations they use may be right or wrong, but the efficacy of their technique should not be in doubt, or, if we have any doubts, they should be no more and no less serious than those raised by 'structural' osteopathy.

We therefore have to separate entirely what *was said* about CSO, by Sutherland or his students, from what *was practiced* by them. CSO is, I believe, a remarkable therapy, based on a model formulated one hundred years ago, when physiology and anatomy were not able to cope with *all* of its assumptions[1].

We propose to deal with the questions evoked in part I. Such as: what do CS osteopaths actually feel? Why can't they agree on what they feel? How do they improve their patient's health? What happens during a V-spread? What are the so called 'still points'? Why do tiny motions of tiny bones produce 'clinical results' throughout the body? Why is there no variation of amplitude between the CRI at the feet, at the sacrum and at the head?

To answer these questions, we must first distinguish between the two main types of motions felt by the hand of the osteopath. The operator may feel

- 'rhythmical' motions everywhere. These have led to the development of the notion of CRI. They seem to be due to some fluid 'filling' and 'emptying' tissues.

- 'spontaneous twists', also felt over all tissues, that cannot be explained by fluid motion. The operator is supposed to 'follow' these spontaneous twists in order to have a therapeutic effect

The present article will deal with the first type, i.e., the simple 'shrinking' and 'swelling', felt by osteopaths at slow frequencies (10/mn or 2/mn). Do they exist, in spite of the absence of any evidence in the current medical literature?

They indeed exist and they were missed, literally, as a result of an 'artefact'. The model used by cranial, i.e., its insistence on the fact that 'a central pump drives CSF throughout the body' explains why the massive evidence in favour of the existence of slow rhythms was missed.

Since the 19th century, numerous authors have described, discussed and quantified a whole series of "rhythmic" phenomena in the human body, distinct from the respiratory and cardiac pulses[2]. In the medical literature, they are referred to as "vasomotor waves" or Traube, Herring and Mayer waves after the physiologists who observed them (THM). All blood vessels,

[1] The initial intuition of Sutherland dates from the time he was a student of Still, at the ASO.

[2] The CRI was perceived and described several centuries before Sutherland. See my review on the history of osteopathy called the 'One hundred year war'. See also my lectures on the history of craniosacral at my site www.connective.org

as well as lymphatic vessels, demonstrate these spontaneous motions. Vessels of all sizes are seen to pulsate at slow frequencies, i.e., slower than the heart beat. Hundreds of articles detail their complex physiology.

The Swedish physiologist Lundberg made a systematic investigation and review of the significance of these waves in relation to intracranial pressure (ICP). Expanding on the work of Guillaume and Janny, he continuously recorded, for days, the variations of intracranial pressure. These studies were made on neurological patients. Apart from the usual effects of breathing and heart pulses, three main other "rhythms" can be measured in the CSF. The word "rhythm" is rather inappropriate since none of these periodic phenomena are constant or regular. Lundberg distinguishes three types of variations, in decreasing order of amplitude:

- A or Plateau wave, these are, most often, brutal, sustained and marked increases in ICP, often accompanied by severe clinical disturbances

- B waves, these come in periods, and beat at a rhythm of 0.5 to 2 per minute

- C waves, the weakest, occur at a frequency of 4, 6, 8 or 10 per minute. They appear for long periods of time but can be too weak to be measurable. They are the most constant.

All three are of a larger amplitude than the waves caused by breathing or the heart cycle.

Pathological and physiological ABC waves

Initially, and owing to the population studied by Lundberg, A and B waves were considered as pathological, i.e., as signs of an acute failure of the control systems of the ICP. C waves, were immediately recognized as the effect of Traube Herring Mayer waves in the closed skull cavity. In other words, CSF pressure rises with each systole, falls with each inspiration [3], but *rises with the ascending part of each vasomotor wave*. The periodic swelling and shrinking of the cerebral vessels (mainly the meningeal arterial tree) directly increases and decreases CSF pressure. In other words, the increase in cerebral blood volume caused by vasodilation (during THM waves) acts as temporary and rhythmical "space-occupying" lesions.

The work of Lundberg was expanded by others, using less invasive methods of measurement as well as healthy subjects. 'A' and 'B' waves were

[3] It falls during respiratory inspiration, something that is easily overlooked in the teaching of cranial where thoracic inspiration is considered as secondary to or driven by CRI inspiration.

observed in normal people. Mild plateau (or 'A') waves can be seen during specific phases of sleep, whereas B-waves can be observed fifty percent of the time in normal persons[4]. They are more marked and more frequent in neurological patients.

. Osteopaths are therapists with a highly trained sense of touch, who lay their hands for many minutes, sometime an hour or more, on their patient's heads. We would not be surprised if their perception of a slower-than-the-heart swelling and shrinking of the skull is none other than the effect of THM waves within the cranial cavity. There is simply nothing else that pulsates at the rhythm osteopaths report, or, said the other way, THM waves beat exactly at the two frequencies (2/mn, and 10/mn) given for the CRI. .

THM pulsations are of a greater amplitude than the heart or respiratory waves. We cannot preclude that human hands can perceive them. The simplicity of their measurement (with ultrasonography, for instance) would considerably simplify research protocols in CSO[5].

Why haven't these waves been reported in the numerous studies of CSF physiology mentioned above? These research protocols showed only two rhythms in the CSF, the heart and respiratory waves. There are major differences, however. First, the heart and respiratory waves are constant[6]. They are not only *regular* but also *synchronic* for the entire CNS, with a slight delay between the brain and the spinal cord. They would therefore appear in any measurement of any part of the brain made during any given interval of time. THM waves are inconstant and not synchronic for different parts of the brain or the spinal cord. More precisely, they can sometimes be constant and synchronic and sometimes not. They can be synchronous with breathing or not. B waves, for instance, which correspond to the 2/mn rhythm reported by some osteopaths, can appear for half an hour, six hours or more and then disappear. C waves are more constant but are not spread equally over the entire cerebral circulation. Typically, one area of the cerebral vasculature will undergo vasomotion, whilst others are at rest[7].

Vasomotion

THM waves are also called 'vasomotor' waves. They are present in all vessels, large and small, veins and arteries, lymph and bile ducts. They are considered to have a 'protective effect' on the circulation and tissues, i.e.,

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[4] I propose to identify part of the phenomenon called the 'still point' as a physiological A wave.

[5] At the time of the writing of this article, Ibelieve that a recent research project, sponsored by the AOA, soon to be published, has shown a significant correlation between the 'CRI' – as reported by trained osteopaths – and THM waves.

[6] except for the respiratory waves which stops, obviously, when the subjects stop to breathe.

[7] See Auer's article on vasomotion in the cat.

they both reduce peripheral resistance and improve tissue perfusion. Within blood vessels, for instance, during the 'dilatory' phase of the vasomotor wave, blood volume increases. During the 'shrinking' phase, the volume decreases. This poses no particular problem in the peripheral tissues which can easily accommodate increases in blood volume. They have a relatively 'unlimited' space around them to swell and shrink. The brain is imprisoned in an almost closed box. Brutal increases of blood volume cannot be easily accomodated. The parenchyma of the brain, an extremely delicate tissue, will be compressed and literally, 'hammered' by such increases. If vasomotion occurs at different times, at different levels of the CNS, increases and decreases in blood volume cancel each other out, with the net gain of vasomotion maintained, without its disadvantages. During pathological A and B waves, there seems to be a *synchronic beating* of vasomotion, across large parts of the brain vasculature. When the normal buffering mechanisms do not operate – as in neurological patients - these waves become extremely deleterious to the brain substance. The intracranial pressure increases with each heart beat/THM wave, hammering, each time, the parenchyma of the CNS. In other words, during pathological A and B waves, liquids come into the brain with no way out. This occurs in neurological patients, who often suffer from space-occupying lesions, and have, therefore, already used up all their "compensation space".

Physiological A and B wave – our osteopathic 'CRI' - correspond probably to synchronic vasomotor waves *accommodated* by the buffering mechanisms that keep intracranial pressure within normal range. For most of us, however, vasomotion is mainly a "patchwork" phenomenon, affecting, in succession specific beds. An osteopath trained in "listening with his hands" would feel therefore perceive them *all the time*, just like physiologists measure them all the time in the cerebral vascular system, sometimes synchronously for the entire CNS, sometimes not. The two main frequencies reported for THM waves, correspond, as I said above, to the two frequencies reported by cranial osteopaths, the 8 to 12/mn and 1 to 2/mn rhythms.

Reaching the periphery

Let us suppose that THM waves are the physiological phenomenon that corresponds to the CRI, within the craniospinal system. We are still left with the question as to how the CRI reaches all parts of the periphery simultaneously and without losing its amplitude. The answer is obvious. Vasomotion is a universal property of blood vessels and it can be measured in all circulatory beds, whether arterial, veinous or lymphatic. In other words, an osteopath who would lay his hands on the feet or on the cranium would be able to feel the same frequencies mentioned above. The amplitude would be the same since the power of vasomotion is similar for all blood vessels of comparable size in the body. This corresponds to the fact that osteopaths, whether they feel the CRI synchronously or not over the entire body, do feel it with the same amplitude. THM waves have the same amplitude, everywhere, but can be synchronous or asynchronous, depending on many factors, not evoked here[8].

It does not come as a surprise, then, that craniosacral osteopaths do not feel the CRI in unison on the same patient. THM waves often 'beat' in every tissue, *independently of the waves at the cranium.* The frequencies perceived in the four studies on osteopathic perception of the CRI are exactly within the range of THM waves. The craniospinal cavity is only specific insofar as its THM waves occur in a tightly 'closed' box. .

The medical CRI

The physiology and pathology of vasomotion have been researched and documented for more than a hundred years. Confirming that THM waves do correspond to the CRI will give our profession a beautiful dowry : the considerable research made so far on vasomotion. In other words, from a totally unknown and unseen phenomenon, the CRI becomes a highly researched physiological process. Moreover, historical justice will be made. Early osteopaths like Littlejohn, the main teacher of Sutherland, discussed many times in their writings the 'peristalsis' of the brain as a result of vasomotion.

Cranial osteopaths have claimed, for instance, that the amplitude of the CRI is a marker of health and disease. It 'beats strongly' in health and is markedly diminished in serious pathologies. We need just replace the letters CRI with THM. Several studies document the amplitude of THM waves in pathologic states ranging from cardiovascular, renal, metabolic to psychological imbalances. These studies generally confirm the profound disturbance of vasomotion[9][10][11][12][13][14] in all these pathological states. THM waves have even become a major marker in cardiovascular disease. Cardiac patients with no or little Heart Rate Variability - a phenomenon directly linked to THM waves - [15] have an 18-fold increased risk of dying the same

[8] It is interesting to note, however, that a central – medullary - command or pacemaker has been postulated, bringing us back to a 'cranially-centred model for CSO.
[9] Girard A *et al*, Clin Exp Hypertens 1995 Jan-Feb **17:1-2** 15-27
[10] Jarish WR *et al*, Experientia 1987 Dec 1 **43:11-12** 1207-9
[11] Inoue K *et al*, Am J Physiol 1991 Mar **260:3 pt 2** H842-7
[12] Cloarec-Blanchard L et al, Kidney Int Suppl 1992 **37** S14-8
[13] Fuller BF, Int J Psychophysiol 1992 Jan **12:1** 81-6
[14] Linden D et al, Clin Aut Res 1997 Dec **7:6** 311-4
[15] HRV constitutes the easiest way to measure the physiology of THM vasomotion.

year. Cranial osteopaths were right in insisting that this rhythm is of great physiological importance[16].

Several authors have tried to elucidate the importance of vasomotion in the body economy. It is generally considered as a good marker of autonomic nervous system balance since some of the frequencies of THM waves seem to be parasympathetic-controlled whilst others are mediated by the sympathetic nervous system[17][18][19][20]. Vasomotion also exists as an independent phenomenon, i.e., not dependent on a central nervous control, that enables tissues to finely control their perfusion. As mentioned above concerning the brain, it seems that these spontaneous variations in vessel caliber have a protective effect on tissues, buffering the rises and falls of blood pressure caused by the higher centers and the cardiac output. Moreover, a circulatory bed undergoing vasomotion exerts significantly less resistance than a bed with a similar cross-section but not undergoing vasomotion.

Metabolic and other waves

Vasomotor waves, although they correspond closely to what osteopaths call the CRI, do not constitute the sole explanation for the rhythms felt by the cranial osteopath. Several authors have identified rhythms with a six second frequency (average, 10 per minute, corresponding also to the CRI) in the very substance of the brain and distinct from variations in blood pressure. These are considered as "metabolic" waves, i.e., periodic phenomena linked to cellular rates of activity. Can the osteopath feel them idenpendently? Or are they felt as part of the 'concert' of natural rhythms that agitate the brain or any other tissues.

Other organs are known to have their "spontaneous mobility", such as the stomach, the gut or the spleen, and it is often commanded by a local pacemaker. The relationship of these rhythms to THM waves is, as yet, not clear. Within the skull, they do not cause any significant rise in CSF pressure and it is difficult to hold them responsible for the periodic swelling and shrinking reported by cranial osteopaths. I believe, however, that the mechanisms that underly 'cellular motricity' are very much implied in the perceptions of the osteopath and they will be discussed in the next article.

[16] JM Littlejohn DO is, as far as I know, the only osteopathic author who constantly refers to the importance of vasomotion in health. With his keen eye for the osteopathic application of physiological data, he did not miss the importance of a phenomenon already described in his time.

[17] Abbiw-Jackson RM et al, J Math Biol 1998 Sept **37:3** 203-34

[18] Haberth C et al, Clin Physiol 1999 Mar **19:2** 143-52

[19] Taylor JA et al, Am J Physiol 1998 Apr **274:4 pt 2** H1194-201

[20] Bertrand D et al, J Physiol (Lond) 1998 Nov 15 **513(pt 1)** 251-61

Further questions

Supposing we have identified the physiological nature of the CRI, several crucial questions remain. Why should micromanipulations of minor lesions in the skull, the sacroiliac or any other area, produce widespread effects? What mechanisms underlie techniques like V-spread or CV4? Can vasomotion explain the sensations and effects of "unwinding" or "myofascial release"?. Considering that vasomotion is an essential homeostatic mechanism, how do osteopaths affect it?

And the final question: should we still use the term "cranio-sacral" osteopathy, when we consider that its characteristic rhythm is possibly not centered in the skull/spinal canal?