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PREVENTION & REHABILITATION: EDITORIAL

Visceral factors in rehabilitation & health

In this section 2 papers have been selected to illustrate a little considered aspect of rehabilitation and prevention; and that is, visceral health.

Developmentally, of course, the viscera are both an older more fundamental structure than the musculoskeletal system, yet movement therapists and bodyworkers often place great focus on the musculoskeletal function with "just enough to get by" focus on the visceral function.

The first of the two papers, by Bove, *A model for radiating leg pain of endometriosis* investigates a new possible mechanism for pain generation in Endometriosis, while the second paper, by Bramati-Castellarin et al., *Repeat-measures longitudinal study evaluating behavioural and gastrointestinal symptoms in children with autism before, during and after visceral osteopathic technique (VOT)* reviews the effects of direct manual work to the viscera in children on the autistic spectrum, assessing their function before, during and after a 6-week course of treatment [Note: Bramati-Castellarin et al's paper can be read in full in the previous edition of JBMT:20:3]. Bove highlights how female patients with a prevalent musculoskeletal presentation, such as sciatica, may actually be experiencing their symptoms as a result of the visceral condition Endometriosis, while Bramati-Castellarin et al. demonstrate how application of manual techniques to the viscera may result in changes to even some of the brain-based behavioural symptomology of autism.

Visceral conditions are many and varied, and range in scope from those causing slight metabolic inefficiencies to those that are severe or even catastrophic in effect. Endometriosis, one such condition, affects an estimated 176 million women worldwide regardless of their ethnic and social background. Many remain undiagnosed and are therefore not treated. Endometriosis is a condition where tissue similar to the lining of the uterus (the endometrial stroma and glands, which should only be located inside the uterus) is found elsewhere in the body (Kennedy et al., 2005).

It is generally acknowledged that an estimated 10% of all women during their reproductive years (from the onset of menstruation to menopause) are affected by endometriosis (Rogers et al., 2009). This equates to 176 million women throughout the world, who have to deal with the symptoms of endometriosis during the prime years of their lives (Drake et al., 2005).

The viscera receive motor drives from the cranial and sacral parasympathetic fibres and from the sympathetic chain running segmentally down the spine. When viewed through a psychosomatic lens, which may include more traditional medical systems, such as shamanism or Ayurvedic medicine, uterine issues are seen as potentially associated with life issues around sexuality, emotional balance and flow (Simpson, 1999; Straus et al., 1992). Even before puberty begins around 11–14 years of age, most people are deeply programmed with their culture's prevailing views of sexuality; yet most of these views remain incongruent with biological design (Saxon, 2012; Ryan and Jetha, 2012; Buss, 2003); it is the rare exception for men and women to pass into, and through, adult life without significant sexual challenges.

Since descending pathways from the limbic-emotional centres of the brain are, by their nature, utilised to modulate visceral function, including neural drive, blood flow and smooth muscle tone, it is feasible that specific emotional stressors may exert differing effects on differing components of the visceral system; though the received wisdom is that the effects may be more generalized than targeted.

According to Barral (1989, 1993), lesions, adhesions and tugor (the cells ability to optimise its own space) can be found anywhere in the pelvic, abdominal and thoracic cavities:

- The ovaries
- Fallopian tubes
- Peritoneum
- The uterosacral ligaments,
- The cul-de-sac,
- The Pouch of Douglas
- The rectal-vaginal septum

This suggests that, in addition to Bove's findings of endometrial cells creating an inflammatory response in the sciatic nerve tissue, they may also successfully bind with

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any of the neural tissues in these regions and create localized or referred symptoms along these distributions.

Digestive organs lungs and pleura

Endometriosis has effects physically, emotionally and mentally. Health Psychology texts suggests that human beings should be viewed as complex systems, and that health and illness should not be viewed as having a single causal factor (Ogden, 2000). Within Health Psychology, individuals are not viewed as passive victims of illness, but as participants in illness. Therefore, the whole person should be treated, not just the physical.

Within Health Psychology, health and illnesses can be seen to play out on a see-saw. At any given time the patient can be placed somewhere on that see-saw. People progress from homeostasis towards illness and back again. This is relevant to endometriosis because its cyclical nature means that patients can move from being very ill, to potentially being quite well, on a monthly basis. In other diseases, the cycles of health and illness are often spread over longer periods. Understanding the role that psychological factors play in illness could help to alleviate psychological symptoms which, themselves, may drive or exacerbate physical symptoms.

Adhesions and infertility

Infertility is a morbidity suffered by many women with adhesive diseases such as endometriosis, pelvis inflammatory disease (PID), peritoneal infections such as tuberculosis, appendicitis or surgeries. The impairment of reproductive organs has many affects to performance, mechanics, mobility, motility and a variety of other mechanisms. A common endpoint for adhesions is distortion of the normal tuba-ovarian relationships preventing ovum capture and transport. Adhesions causing this end range form a filmy avascular band that pulls the fimbriae outward to the pelvic sidewall; to dense, matted structures causing a thick-walled blocked fallopian tube and complete obstruction.

The suspensory ligaments of the urogenital system are important in the mobility and function of the pelvic organs. Examples include the uterovesical ligaments attaching the bladder to the uterus. The uterosacral ligaments help to suspend the uterus posteriorly. The urogenital system is also supported by ovarian ligaments, suspensory ligaments, and tubo-ovarian ligaments. Just as the ligaments are important in the structure and function of a joint, they are equally important in the mobility and function of the pelvic organs (Barral, 1989).

Similarly, good organ function is likely prerequisite to good musculoskeletal function, both physiologically and biomechanically. It appears that recurrent drives to the spinal cord from noxious stimulation of the A-afferents and B-afferents can cause changes in the neural excitation at the spinal cord segment creating a viscerosomatic reflex. Clinically, this appears to manifest as inhibition or the low threshold motoneurons found in preponderance in the deeper musculature (see Wallden, 2013 for more discussion). In addition, any pain in the viscera is likely to be aggravated by compression, such as a palpating hand or contraction of the abdominal musculature. In function, the viscera are utilized to provide a counter-pressure to the contracting abdominal musculature to allow effective force transfer. Indeed, the very name "viscera" is derived from "viscous" which means a non-compressible entity. Any discomfort associated with visceral compression is likely to therefore result in altered muscular recruitment to minimize compressive forces on the viscera themselves.

The symptoms of dysfunction in the reproductive system can present clinically as dysfunction of the reproductive organs, pelvic asymmetry, endometriosis, sacral dysfunction, bloating, or pain (Barral, 1989; Barral, 1993). Symptoms related to lymphatic congestion in the pelvic region with hormonal bias are dysmenorrhea, premenstrual syndrome, ovarian cysts, emotional instability, and depression (Chila, 2010). Release of fascial and ligamentous restrictions is believed to decrease pressure on blood vessels, thereby optimising the vascular function and improving the efficacy of the lymphatic system (Chila, 2010).

This improved efficacy, in turn, aids not just in correcting symptoms, but also in restoring optimal blood flow to the organs, optimizing function and normalising the ability for hormone production (Barral, 1993). Decongestion of the lymphatic system can help remove waste from the organs and thus help normalise their function (Chikly, 2005). Mobilising fluid and cellular waste from the pelvic cavity should also allow hormones to more efficiently arrive at the target tissues (Chikly, 2005). Within the reproductive system, this decongestion could theoretically lead to normalised hormone levels, normalised menstrual cycles, and improved fertility. In a different paper by Bove & Chapelle, published in this Journal in 2011, it was shown that visceral manipulation may effectively break down and prevent adhesions in a rat model; also making the correlation between adhesions and infertility among other common visceral complaints.

Ovaries and endometriosis

The posterior part of the broad ligament allows movement from bottom to top. The suspensory ligament of the ovary attaches the ovary to the lateral wall of the lesser pelvis and subperitoneal lumbar fascia. All other ligaments attach to mobile structures, including the uterus. Due to infection and/or surgeries, adhesions can often cause pelvic and lumbar pain, as well as tubal problems. These types of adhesions provoke pain in synchrony with the menstrual cycle, with pain being maximal during the pre-menstrual phase.

Pelvic pain

Pain of the lower pelvis found with endometriosis or malfunction of the organs may be due to congestion, fluid, nervous, spasmodic, mechanical or psychological factors. Referring pain from the genital centre can be from spasmodic uterine contractions (due to uterocervical malpositioning) or uterine adhesions, which can include endometrial tissue. Local tissue problems can bring about

local vasoconstriction as well as visceral spasms, with an associated slowing down of venolymphatic flow.

Leg pain

Some kinds of visceral pain go as far down as the lower leg. Pain of tuba-ovarian origin should never extend past the ankle. The cutaneous tibial ramus circulates particularly in the internal calf and irritation of this nerve can be confused with sciatica. The saphenous nerve (branch of the femoral nerve) has a posterior terminal branch in the leg which is related to the saphenous vein. Irritations of this branch also produces similar symptoms (Barral, 1993).

The ovaries and uterus refers to the pelvis and lower limbs as a visceromotor reflex. The uterus, if inflamed for any reason, can cause symptoms such as lumbo-sacral restrictions, lower back pain, or reflex knee pain from the genito-femoral and obturator nerves. Referral may be present in any nerve pathway from T9-L4 and S1-3. According to Barral (1993) upper cervical restrictions are also commonly found in conjunction with uterine problems; speculated to be due to oestrogen dysregulation. It is also possible that mechanical dysfunction at the sacral region secondary to local changes in muscle function occurring due to the afferent bombardment.

As described by Bove in his paper in this section, theories of the pathophysiology of endometriosis suggest that menstrual blood containing endometrial cells flows back through the fallopian tubes and into the pelvic cavity instead of out of the body. These cells are thought to adhere to organs and keep growing and bleeding over time. Cells could also move to the pelvic cavity through direct trauma, such as during a C-section delivery. A dysfunction in the immune system may also be a factor in failing to get rid of the misplaced cells.

In a study done by the American Fertility Society, patients with endometriosis were assessed during surgery (and later confirmed histologically) to be at either stage III or IV (The American Fertility Society, 1985) it was concluded that the establishment of a new blood supply is essential for the survival of an endometrial implant and the development of endometriosis. This suggests that the peritoneal environment of these women is favourable to the enhancement of the development of new blood vessels (angiogenesis), as Bove (2016) showed in his rats.

Barral (1989, 1993) found working with these organs directly, more specifically, the fascia surrounding the organs, appeared to free up these adhesions, congruent with Bove & Chapelle's earlier study (2011). This is presumed to optimize fluid dynamics in the area and decreased risk of neural compression. If this is correct, it would open up communication pathways between affected viscera and the brain stimulating the bodies internal healing mechanism. Of course, the effect of such treatment is not likely to be only confined to the abdominal region.

Viscera-brain connections

Barral et al. (2006) investigated the effect of visceral manipulation on brain activity using SPECT scans. Methods were carried out with eight subjects being treated. On day one, pre-treatment SPECT brain scans were performed prior to evaluation. On day two, the patients were treated by Jean-Pierre Barral. Post-Treatment SPECT brain scans were performed within 30 min after treatment. Visceral manipulation treatments were performed and patient specific. These treatments were guided by Jean-Pierre Barral's approach to evaluation.

One of the case studies, a 41-year old woman diagnosed with endometriosis with accompanying anxiety, depression and stomach pain, the pre-treatment SPECT scans showed excessive profusion in the thalamus and discontinuity in blood flow with the anterior cingulate gyrus. Barral's listening evaluation (in which Barral follows the line of tension within the tissues) suggested a primary tension in the thalamus with an extended listening from the thalamus to the stomach. Treatment lasted 30 min, mobilising the stomach followed by treatment of the brain with focus on the thalamus. This was followed by another stomach treatment and then balancing the tensions between these two locations. Post-treatment SPECT scans showed a difference in blood flow in the thalamus and the anterior cingulate gyrus. Also an increase of activity in the cerebellum, which occurred with all eight case studies. This seems to suggests that working viscerally can stimulate a physiological response within the brain; which may be one contributing mechanism to how Bramati-Castellarin et al. were able to elicit brain-based behavioural changes in from visceral work applied to the stomachs of children on the autistic spectrum.

Beyond manual work to the viscera

Neurologically the body conforms to a hierarchical system; action potentials descend from the brain, through the spinal cord and then onto the cells and tissues below. However, it is interesting to note that evolution of much of the human brain occurred long after the evolution of the viscera, hence this may explain why the afferent:efferent ratio is in the region of 9:1 according to some sources (Willard, 2002).

As touched on above, when internal organs are under stress we experience viscero-somatic reactions. Due to the organisation of the spinal cord, pain sensations from the skin, muscles and other somatic tissues (external to our organs) are delivered to the spinal cord via spinal nerve roots. Pain impulses from spinal nerves come together and converge with pain impulses from the internal organs and are sent via the spinothalamic tract to the pain centres in the brain. It is because of this convergence of neural input at the cord that pain perception in the brain is often not localised to the specific tissue responsible for generating the pain impulses. This helps explain why low back pain can actually be caused by constipation and why pain is felt in the left arm and chest during a heart attack.

Furthermore, this convergence within the spinal cord is set up in such a way that the visceral sensory fibres synapse with the somatic motor fibres, while the somatic sensory fibres do not synapse with the visceral motor fibres (Willard, 2002). The functioning of the organs are arguably more essential for survival than muscles and joints, hence it seems even the wiring of the body is set up to compromise

muscular function (which will naturally therefore affect joint function) in order to preserve the vitality of our organs. In short, the focus of manual therapists and other bodyworkers on the musculoskeletal system may sometimes — perhaps often - be missing the point when looking to address causation. The circuitry of our central nervous system is wired for survival; and so musculoskeletal dysfunction, and may be even some neocortical pathologies (such as some features of autism) may be the symptom of underlying visceral pathology.

A different clinical example might be that when the liver is under stress, sensory drives, including those passed through the phrenic nerve, will cause an afferent bombardment of the cord, which is why the classic referral pattern of liver disease is to the right shoulder/neck region. A function of this may be to inhibit use of musculature that under normal circumstances would be recruited and would load that right upper quarter, such as carrying a bag, pushing down to get up from the floor, or even or throwing a ball (or punch, or spear) which may could further distress to the inflamed organ.

The connection between the innervation of the internal organs and the musculoskeletal system can be seen in their referral patterns. One theory for the reason the visceral afferents converge with the somatic efferents is the notion that muscles, being the most biologically active tissue in the body, are able to effectively and safely dissipate this excess neural drive through contraction or spasm. In essence the muscles, in this view, serve as a dampening system to protect both the organ and the nervous system itself. This would make good evolutionary and physiological sense, whilst correlating with the way we understand the nervous system to develop from a movement perspective.

In infant development, the effect of a child being left helplessly on its tummy or its back means that after a period of time the irritation to the somatic afferents causes an afferent bombardment (much like an inflamed organ) that causes an impulse to travel down the associated motor nerves to trigger a movement to decrease that irritation from the somatic afferents (Vojta, 2006; Wallden, 2008). Much like a viscero-somatic reflex, this somato-somatic reflex appears to be the means by which babies learn to move, while viscerosomatic reflexes appear to be a means by which visceral and neural function can be maintained.

How common is visceral dysfunction?

Surveys have shown prevalence rates among adults of 25% for intermittent abdominal pain and 20% for chest pain; 24% of women suffer from pelvic pain at any point in time. For over two-thirds of sufferers, pain is accepted as part of daily life and symptoms are self-managed; a small proportion defer to specialists for help. Visceral pain conditions are associated with diminished quality of life, and exert a huge cost burden through medical expenses and lost productivity in the workplace (Smita et al., 2013).

Visceral pain should be suspected when vague midline sensations of discomfort are reported by a patient. True visceral pain is characterised as a vague, diffuse, and poorly defined sensation (Procacci et al., 1986; Vecchietet al., 1989). Regardless of specific organ of origin, the pain is usually perceived in the midline spanning anywhere from the lower abdomen up to the chest. In the early phases the pain is perceived in the same general area and it has a temporal evolution, making the onset sensation insidious and difficult to identify (Giamberardino, 1999). Visceral pain changes in nature as it progresses.

Pain from a specific organ can be experienced, or "referred" to different sites of the body. There is no pathology or no cause for pain at these referred somatic sites however the pain will be experienced at this location, often with significant intensity. Referred pain is sharper, better localised, and possibly accompanied by autonomic or emotional signs (Vecchiet et al., 1989; Cervero, 2000).

Of course, as with any deep tissue within the body, undiagnosed visceral pathology is also commonplace. Often those with mild visceral pathology may feel bloated, put on weight, feel fatigued and so, using their own best wisdom, sign up to the local gym to "get fit" or "flatten their stomach".

The sensory neurons from the viscera pass through the sympathetic chain ganglia. Those ganglia behave as miniature control centres to mediate circulation to the organs and the muscles supplied at that level. Anytime there is an increased metabolic demand, such as exercise for a muscle, or inflammation in an organ, therefore, they automatically go into competition for nutrition, oxygen and waste removal with tissues on the same nerve channel. For example, if a patient had a gall bladder dysfunction, they automatically have competition with the thoracic erectors on the right side. If they then attend the gym and do an exercise placing metabolic demand on these tissues; such as using a rowing machine or lifting loads (eg deadlifts, back squats), the neuroendocrine system must determine which is the greater stress; the exercise, or the gall bladder dysfunction. If it is the exercise, then the gall bladder may be depleted of blood flow worsening the issue, while, if it's the gall bladder, the right-sided thoracic erectors performance capacity will be compromised and risk of ensuing injury due to fatigue or dyssynergic contraction may be increased. The likelihood would be that training would not go well; neither in the shorter term, nor the longer term.

Abdominal neurological connections

Conventional medical treatment for neurological disorders such as epilepsy, migraine, and autism focuses on the brain-based approaches. Although standard medical treatment is often helpful, the underlying causes of these disorders are not well understood. Furthermore, some individuals respond poorly, or often have side effects to modern medicine. Evidence is accumulating in the medical literature that the enteric nervous system (ENS) - that part of the nervous system associated with the gastrointestinal tract - also plays a role in these disorders. Complementary therapies that address the nervous system of the abdomen hold potential as useful adjuncts to conventional treatment for certain neurological disorders.

It is evident both from the historical and modern literature that the peripheral nervous system, and particularly that portion associated with the gastrointestinal tract, is a

prominent element in certain neurological disorders associated with the cerebral brain. Some researchers regard the presence of abdominal features in these illnesses as important and of possible etiological significance (Peppercorn and Herzog, 1989; Horvath et al., 1998; Recent and forgotten aspects of visceral pain). Recently, autism has been added to the list of neurological conditions with abdominal features.

The ENS can influence the CNS both through nerve reflexes and the production of neuropeptides. It is estimated that between 80 and 90% of vagal fibres are visceral afferents (Davenport, 1978; Willard, 2002). Recent work has also shown a vast overlap of neuropeptide activity in the gut and the brain (Pert et al., 1985).

Recent medical research may add autism to the growing list of neurological illnesses with abdominal features; a growing body of literature which has now been added to by Bramati-Castellarin et al.,. People with classical autism show three types of symptoms: impaired social interaction, problems with verbal and nonverbal communication and imagination, and unusual or severely limited activities and interests. Symptoms of autism usually appear during the first three years of childhood and continue throughout life. Although there is no cure, appropriate management may help relatively normal development and reduce undesirable behaviours.

One study investigated a consecutive series of children with chronic enterocolitis and regressive developmental disorder. The twelve children (mean age 6 years) had a history of normal development followed by loss of acquired skills, including language, together with diarrhoea and abdominal pain (Murch et al., 1998). They reported that 47 out of 50 autistic children studied showed significant bowel pathology. When subjected to colon cleansing, these children showed notable improvement in their autism symptoms. The researchers conclude, "We re-emphasise the fact that there is a consistent pattern of gut inflammation in a high proportion of children within the broad autistic spectrum. Understanding the link between the bowel and the brain in autism may allow new insights into this devastating illness." (Murch et al., 1998).

Further evidence of intestinal involvement in autism has surfaced when a substance called secretin has been surprisingly effective in the treatment of autism for some children. Secretin is a natural substance that is produced in the intestinal tract by all mammals. It is a hormone that regulates water homeostasis throughout the body and influences the environment of the duodenum by regulating secretions in the stomach, pancreas, and liver. It is a peptide hormone produced in the cells of the duodenum, which are located in the intestinal glands (Häcki, 1980). Secretin also helps regulate the pH of the duodenum by inhibiting the secretion of gastric acid from the parietal cells of the stomach and stimulating the production of bicarbonate from the centroacinar cells and intercalated ducts of the pancreas (Häcki, 1980).

While it is not a drug, and not harmful, the FDA nevertheless requires that it be sold only by prescription. Secretin is usually given by slow injection (infusion), but other methods of administration are being considered. The only FDA-approved use for secretin is in the diagnosis of gastrointestinal problems, not as a treatment for any disorder.

After Victoria and Gary Beck successfully treated their autistic child with secretin, it triggered interest in this substance and a study by Horvath et al. (1998) looked at the therapeutic effects of secretin on three autistic children noting significant clinical improvement, both gastrointestinal and behavioural. Secretin is now being tested with more autistic children to determine its potential.

Stretching the walls and flexures of the duodenum and colon is hypothesised to allow the organs to maintain proper function and secrete these hormones naturally. Manual therapy with the viscera itself may therefore have a direct affect on disease modulation by releasing adhesions within these anatomical articulations, optimizing fluid dynamics and minimizing aberrant neural function; as the work of Bramati-Castellarin et al. suggests.

Conclusion

Neurological and infertility diseases with or without significant visceral symptoms may be approached from a complementary medicine model that proposes the role of the abdominal nervous system in the etiology and treatments. By linking the historical, clinical systems-oriented approaches to the modern research literature on the enteric nervous system, a complementary approach may be created which integrates the best of standard medical practice with traditional modalities and systems that are consistent with anatomy and physiology.

Further research into the etiology and treatment of these conditions should consider possible abdominal nervous system involvement. Clinically, the presence of significant abdominal features may indicate that the treatment plan include traditional features (i.e. diet, lifestyle, colon hydrotherapy, and manipulative therapies) which may favourably influence digestive and enteric nervous system functioning.

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