International Pelvic Pain Society, San Diego 2002

Chronic Pelvic Pain as a Form of Complex Regional Pain Syndrome

Role of Autonomic Nervous System in Chronic Pelvic Pain

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Thus the task is, not so much to see what no one has seen yet,

But to think what nobody has thought yet,

About what everybody sees.

Schopenhauer

Professionals treating women suffering from chronic pelvic pain are acutely aware that despite their best efforts some of the patients do not respond to standard therapeutic modalities. Common threads in their history include multiple surgeries, some of them with temporary improvement of pain symptoms, pathology out of proportion to experienced pain (opinion of the surgeon), or no visible pathology [1],[2], pain is aggravated by stress, pain is a daily occurrence. Other frequent findings include history of sexual or physical abuse [3, 4] as a child or adult, traumatic memories, and co-morbidities[5],[6] including: vulvar vestibulitis, fibromyalgia, interstitial cystitis, irritable bowel syndrome [7], chronic allergies, etc.
Laparoscopy under general anesthesia may be deceptive, rather than helpful. When there is lack of significant pathology, we will label minimal inactive endometriosis, minor pelvic adhesions and dilated pelvic veins as causes of chronic pelvic pain, even that during laparoscopic pain mapping under conscious sedation similar lesions in other patients would not be associated with pain. On the other hand during pain mapping we will find that entire pelvis reproduces pain [8] including pain perception on the opposite side to the side examined [9]. One of the most common findings in this group of patients is that many times despite failing to discover a definite source of pain the appearance of the pelvis suggests that this patient has chronic pain – entire pelvis is congested.

Looking for similar conditions in the other fields of medicine, one is struck by similarities between Chronic Pelvic Pain and Complex Regional Pain Syndromes (CRPS) I and II. Causalgia (from Greek burning pain) presently reclassified as CRPS II, was first defined by S. Weir Mitchell, Civil War physician. He described development of burning pain in the distal extremity following partial, even minor nerve injury under the high stress conditions of the battlefield zone. In addition to spontaneous pain, patients reported sensitivity to light touch and triggering of the pain by strong emotions, loud noise, and movement of the extremity. The physical signs included swelling and mottling of the skin, smoothness and loss of skin appendages and on occasion arthritis [10]. In 1916 Leriche reported dramatic relief of symptoms following sympathectomy. The reports of causalgia were usually limited to the time of war: Civil War, WWI, WWII and Vietnam War. Between the wars concept of sympathetically affected pain was applied to patients without detectable nerve injury and it was named by Evans Reflex Sympathetic Dystrophy (RSD). The RSD was first described in 1902 by Sudeck, it was characterized by asymmetrical pain and swelling of the distal extremity following a fracture, minor soft tissue trauma, low-grade infection, frostbite, burns, stroke or myocardial infarction. In addition to pain and swelling, autonomic symptoms included: altered skin color and temperature, and altered sweat production. The pain is exacerbated by keeping extremity in a dependent position, movement and pressure on the joints; again significant pain relief can be accomplished by sympathetic block.

At first glance it would be hard to compare visceral chronic pelvic pain and extremity pain in CRPS, but upon closer examination there are several similarities. Some of the autonomic symptoms used to diagnose CRPS may not be applicable to Chronic Pelvic Pain (CPP): CRPS – asymmetry of blood flow and temperature between left and right extremity, CPP – Pelvis is in the middle; difference in sweat production between left and right extremity in CRPS can not be used in CPP. On the other hand similarities include: Increased response to pain in patients with CPP (ovulation may bring the patient to the ER and initiate new cycle of exacerbated pain). Relatively minor stimuli will maintain the pain: minimal endometriosis, adhesions, occult hernias are most likely triggers rather than the sole cause of the pain. Patients with CPP complain that the pain is worse while standing, walking and prolonged sitting, or in other words, when the pelvis is in a dependent position. Laparoscopic findings include: hyperalgesia in the pelvis during pain mapping under conscious sedation[8], congestion of the vessels in the pelvis, and more than 50% improvement of pain after transection of superior hypogastric plexus (part of autonomic nervous system)[11].
Overview of Autonomic Nervous System

It is not about anatomy, it is about function.

The autonomic nervous system is the operating system of our body. A good analogy would be a computer, where autonomic system is motherboard (hardware) and Windows operating system (software) combined. It runs in the background without making us aware of its function, it keeps us alive. It runs programs (routines), it has predetermined program for every function of our body [12]. It has programs to maintain our blood pressure, breathing, bowel movement, hormone production, inflammatory response, erection, temperature control, etc. These programs allow us to function and survive in our changing environment (within certain limits). There are limitations however; our autonomic nervous system does not have a program to supply us with oxygen under water. If we are drowning consciously we will be able to override the urge (program) to take the breath, but at some point we will be forced to take a breath to fill the lungs, unfortunately we lack the program to extract oxygen from water (for our autonomic nervous system underwater environment does not exist). Our autonomic system is not very smart, but it is adaptive. Given sufficient amount of time and data our autonomic nervous system can develop new routines (occasionally quite useless), like in the case of Pavlov’s dog. The possibility exists that in the case of RSD, the autonomic nervous system has developed a maladaptive routine, which has pain as its integral part, Sympathetically Maintained Pain (SMP).

Acute and Chronic Pain

The role of acute pain is quite straightforward; the pain is there to inform us about an injury to our body (treat to homeostatic integrity of the tissue). At this stage nociceptors (free nerve endings) within the tissue are activated by painful stimuli. Afferent nerve fibers transmit the message to the dorsal horn of the spinal cord. In the spinal cord the pain message undergoes initial processing, causing the signal to be increased or diminished before it is transmitted to the brain structures, where it is recognized as pain. In the case of the acute pain, autonomic nervous system is usually involved only marginally. It increases blood flow through the injured area, or runs routines to respond to an invading infection. It may also run other predetermined routines that we are unable to detect due to its seamless operation.

Chronic pain is quite a different condition. First, the definition of chronic pain is not very clear, “If pain persists beyond usual course of an acute injury or disease, or recurs every few months or years, it is regarded as chronic”. Chronic pain does not serve the same purpose as acute, because it may happen without any apparent tissue injury or even
after removal of the tissue (phantom leg after amputation). In chronic pain, spinal modulation is usually geared toward the hypersensitization of nerve cells through a phenomenon called “windup”[13],[14], when an environment is created in which even small impulses are registered and amplified, leading to the perception, that physiologic conditions like distention of the bowels or bladder, or ovulation are painful. The role of the autonomic nervous system in the chronic pain appears to be much greater.

Role of Autonomic Nervous System in Chronic Pain

Sympathetically Maintained Pain (SMP)[15] occurs in a number of chronic pain conditions within CRPS system. In testing involving patients with CRPS II spontaneous pain and hypersensitivity to cold and touch in the affected hand can be alleviated by thoracic sympathectomy, or by the block of the stellate ganglion and than rekindled by subcutaneous injection of epinephrine, indicating sympathetic contribution to the pain.

The role of the autonomic nervous system is to maintain and to adapt our body to the environment. If the new stimulus (including pain stimulus) is maintained for a sufficiently long time it becomes part of the environment within which the autonomic nervous system functions. For the autonomic nervous system this stimulus (pain) is neither negative or positive, it is just a part of the environment. The autonomic nervous system does not make judgments, it just runs routines, the judgments are made by central controls. If the central controls are constantly distracted by other issues, such as dealing with stress, significant past emotional or physical traumas like in post traumatic stress disorder, the central controls will not prevent pain from being incorporated into new maladaptive programs. After this point removal of the initial source of pain may not alleviate the pain permanently, as the system will look for new sources of pain to plug it into this program, creating Sympathetically Maintained Pain.

Testing the Function of The Autonomic Nervous System

This concept prompted us to research the function of the autonomic nervous system (ANS) in patients with chronic pelvic pain not responding to standard treatment methods including surgery, birth control pills, GnRH agonists, etc. The difficulty we face evaluating ANS is, that we know only bits and pieces of its function on the synaptic level, but we are unaware of most of its complex interactions in the whole body. Whenever a new signaling system is discovered we get another piece of the puzzle, but at this point our puzzle has mostly holes. Several researches tried to create a unified overview of ANS, but we are ending mostly with multiple arrows. A group from psychology department of Ohio State University proposed the concept of autonomic space, which partially addresses the complexity of the issue (fig.1)[16]. The linear analysis of interactive, redundant and plastic systems like ANS although possible is totally inadequate to describe its function. For this reason we were looking for a global marker to evaluate the function and the dysfunction of ANS.

Fig 1., Berntson, GG; Cacioppo, JT; Quigley, KS, 1991
We found a suitable tool in a form of Autonomic Symptom Profile®, 169 items self-completed questionnaire concerning different aspects of autonomic symptoms. The questionnaire was designed by Suarez et al. from the Autonomic Reflex Laboratory, Neurology Department at Mayo Clinic[17]. The questionnaire with item-weighting was used to establish The Composite Autonomic Symptom Scale (COMPASS) and its results were compared with Composite Autonomic Scoring Scale (CASS) derived from Autonomic Reflex Screen (ARS) – “gold standard” assessment using battery of noninvasive autonomic tests. The validation paper was published in Neurology by Suarez et al. in 1999. Generally speaking higher scores are associated with a greater degree of autonomic dysfunction. The mean overall COMPASS score were different for controls, patients with non autonomic peripheral neuropathies and the neurogenic autonomic failure group. In addition to general scores, COMPASS provides a breakdown of the symptoms to different categories of autonomic dysfunction. This includes orthostatic intolerance, vasomotor, secretomotor disorder, gastroparesis, autonomic diarrhea, constipation, bladder disorder, pupillomotor impairment, sleep disorder, syncope, also included are categories for underscorining and overscorining/psychosomatic.

Autonomic Nervous System Function in Patients with Chronic Pelvic Pain.

In our study, using Autonomic Symptom Profile® in patients with chronic pelvic pain and healthy controls without a history of pelvic pain, we found significant differences in function of autonomic nervous system between the study and the control group. Most of the subcategories showed also a statistically significant difference in their scores. There was no statistically significant difference between chronic pelvic pain and the control group in underscorining and overscorining/psychosomatic categories.

Our data suggests that at least some of the patients with chronic pelvic pain suffer from complex neurological condition, which involves a dysfunction of the autonomic nervous system. One would also include in this spectrum of chronic pelvic pain, interstitial cystitis, and irritable bowel syndrome (mostly constipation predominant).

It would be important to establish if by using COMPASS prior to laparoscopy we would be able to predict which patients will be likely to improve using surgery alone and which will require additional comprehensive treatment after the laparoscopy.

The fact that autonomic nervous system serves as the vast network of bridges between the central nervous system (including cognition and emotions), external environment and the rest of our body [18-23], makes comprehensive treatment including stress management and psychotherapy essential.
Bibliography


