Title: The Nerve of that Stoma!

Abstract. The statement that stomas have no pain receptors (nociceptors) is often touted by some ostomy care professionals and then carried on by ostomy patients. This myth has been promulgated by so many for so long that patients today are still repeating this fallacy. Somehow the distinction between a stoma and the rest of the intestinal tract seems to have created a separate existence for a stoma apart from the rest of the intestinal tract when one describes the lack of nerves for the stoma while implicitly regarding the nervous system of the remainder. It is odd how this separation came about since everyone who discusses the stoma immediately characterizes it as the end portion of the intestinal tract brought above skin level onto the abdomen. Yet, when talking about nerve endings of the stoma, it is almost as if the surgeon created by magical sleight of hand a stoma apart from the intestine. The reality is that there are abundant varieties of nerve endings throughout the gastrointestinal tract.

Discussion: One of the fascinating and positive changes regarding social acceptance of ostomies is the use of the Internet by so many younger ostomates who willingly and creatively share their stoma management experiences with their worldwide followers. This more open exchange also has allowed the fallacy of stomas lacking nerves to literally travel across the globe at a speed hitherto unknown. These links from here in the USA and overseas are typical of this example, but if you listen very closely you will still hear the repeated myth of stomas lacking nerves.

https://www.youtube.com/watch?v=4NAJuycN4Co. Accessed March, 21, 2021

https://www.youtube.com/watch?v=cUM05Xvq8vQ. Accessed March, 21, 2021.

The presumed lack of pain receptors, which derive from the nervous system, is supported by macroscopic observations that cutting into the stoma elicits no pain and that cautery into the bowel wall elicits no pain. However, these observations are made without a fuller understanding and application of the distinct functions of the enteric nervous system as it interacts with the central nervous system and brain. As a consequence the myth of the stoma lacking nerves or pain receptors persists. The false deductive reasoning put forth for this myth is: painless, therefore, no pain receptors. The reality is that there are structural differences of

nerve fibers within the gut and those leading to the peripheral zones that limit the signal intensity, and that the brain does not always perceive the noxious stimuli.

For decades ostomy communities comprising physicians, nurses and ostomates have been told and have repeated the phrase that stomas have no nerves and therefore feel no pain. Conversely, statements have been proffered that because the stoma lacks nerves it cannot feel pain when injured by cutting or cautery. Another variant that skirts very closely to the original claim of stomas lacking nerves is to state or write that the stoma does not have pain receptors. A recent "ask the nurse" article in the Fall 2020 edition of the UOAA Phoenix publication caught my attention and was the basis for my rejoinder about this persistent myth of stomas lacking nerves or pain receptors.

If it is correct that Albert Einstein coined the phrase that: "The only source of knowledge is experience" then it is helpful to also acknowledge the wisdom of Hippocrates (c.460 – c. 377 B.C.) when he wrote in his Laws, book IV: "There are in fact two things, science and opinion; the former begets knowledge, the latter ignorance." Since we are addressing a topic that falls within the arena of Hippocrates, namely, matters of health and well-being, I wish to prudently characterize the notion of ignorance or opinion as naïve knowledge when speaking of persistent myths that seem to have a foundation built upon scant knowledge. Many well intended searchers of truth and knowledge have come up short at times when they observe some phenomena and settle for the first impression gained instead of applying more rigorous and scientific endeavors to separate partial truths from more complete proofs. This state of naïve knowledge often gives rise to believable myths that seem to endure in spite of evolving scientific knowledge. Or, maybe it is the case that once satisfied with an early explanation derived from naïve knowledge, one remains content with information that sounds persuasive and complete. In the case of the question concerning nerves and pain receptors within the gastrointestinal (GI) tract it is easy to follow the logic presented to the casual observer as follows. The stoma feels no pain. The stoma is part of the intestinal tract. Therefore the intestinal tract has no nerves or pain receptors. When pressed to justify this syllogistic statement the argument is delineated to separate pain receptors from nerves by insisting that the stoma lacks pain receptors but the intestinal tract still has nerves. These types of false syllogisms are seductive in their simplicity and hard to retract. The

problem with the attempt to separate pain receptors from nerves is that pain receptors or nociceptors are specialized nerve endings. They are not "not" nerves, but a specialized form of neurons or nerve endings that serve a distinct function apart from other types of nerves found throughout the GI tract, such as stretch receptors or the nerves responsible for motility. Additionally, not all nociceptors or pain receptors transmit their signals equally or evoke the same levels of response. Nor do all nociceptive responses reach a level of conscious awareness.

What is fundamental regarding knowledge of the world around us is that as we continue to explore its makeup and actions we come away with increasing understanding of its identity, how it operates and, potentially, its purpose. Inquiring minds persist in revealing fuller understanding of phenomena with enhanced tools and methodologies that lend greater understanding and finer distinctions. This empirical approach to learning about the world underpins the philosophy and practice of evidenced-based knowledge and action. Empiricism and scientific methodology are tightly intertwined in our method of learning about the anatomy and physiology of living organisms and it is what drives our pursuit of evolving evidence-based knowledge which enhances medical and nursing practice. The ever expanding pursuit of more complete knowledge is what we strive for to keep us up to date and more fully informed.

Since it is impractical for any one person to directly experience all events in life it behooves one to borrow or learn from the valid experiences of other truly learned individuals. We build our knowledge base upon both direct experience and shared experience. To this end it is helpful to share the accumulating knowledge of the behavior of the human intestinal tract and its neurological anatomy and physiology as ably revealed by truly learned researchers and experimenters, and by direct experience of those who have a GI tract.

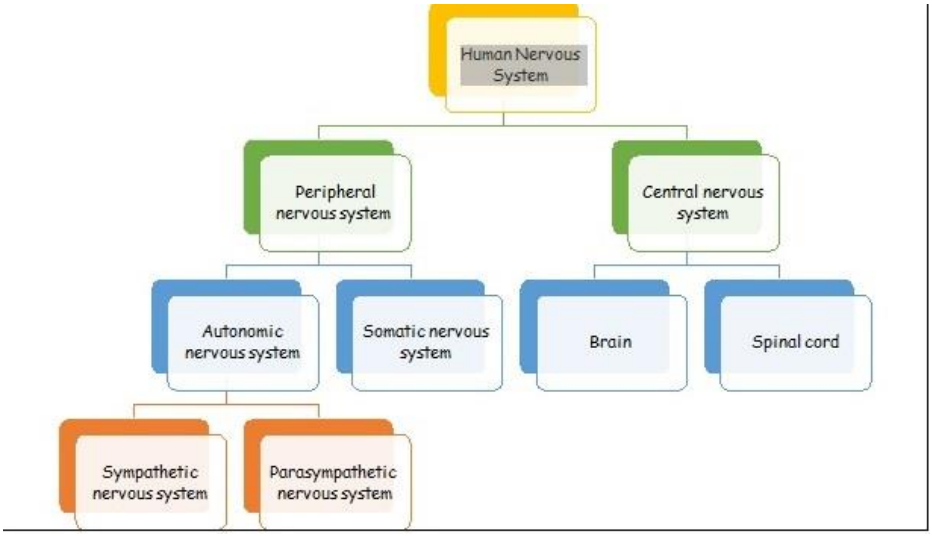
As noted earlier, the bases for these repeated claims of stomas having no nerves or no pain receptors is based upon observational encounters of patients not expressing or demonstrating any signs of pain or distress when encountering some mechanical traumas like cutting or cautery to the bowel. Not observing a painful reaction from a person whose stoma is sliced or burned truly does at first glance cement in the mind a notion of a lack of nerves or pain receptors.

Cauterizing the loop colostomy is a scary event for any patient and made even more distressful when the aroma of burnt flesh insults the olfactory senses as well.

Not having experienced pain from a cut or burned piece of bowel tissue while immediately recognizing pain from a cut or burn to the skin almost confirms that something is missing, and this something must be nerves or pain receptors. How else to explain this bizarre outcome? Even in the face of such dramatic experiences it is hard to not conclude otherwise. This false reasoning persists on several planes of false comparisons. We recognize skin pain and eye pain and the pain of broken bones rather readily. Almost all of our sensory experiences of pain have derived from injuries to those organs.

Before beginning to explore the neurological behaviors of the GI tract it is useful to distinguish between the unique divisions of the nervous system of humans.

The nervous system branches off into two main divisions (CNS) and (PNS).



https://psychologyhubcouk.files.wordpress.com/2017/03/human-nervous-system1.jpg accessed April 18, 2021

- Central Nervous System (CNS)
  - The brain
  - The spinal chord
- Peripheral Nervous System (PNS)
  - Somatic Nervous System (voluntary) which relays information to and from the skin and skeletal muscles, which in turn are loaded with many nociceptors.
  - Autonomic Nervous System (involuntary) which relays information to internal organs and branches into two subdivisions
    - Sympathetic Nervous System which controls organs in times of stress
    - Parasympathetic Nervous System which controls organs when body is at rest

Here is a rather complete introductory link to the makeup of the human nervous system that should inform and reinforce the reader's understanding. https://www.kenhub.com/en/library/anatomy/the-peripheral-nervous-system accessed April 18, 2021. From this broad description we can discern the magic of the somatic versus the autonomic nervous systems. One is highly sensate and the other operates in relative secrecy. One is loaded with receptors reacting to all kinds and levels of stimuli from the outside world and the other quietly permits activities of the internal organ system to carry on without calling attention to the machinery working and only reporting internal stimuli when they become significant in size, intensity or threat level to the well-being of the internal organ affected. One way to characterize the wisdom of these systems is to appreciate that we can eat without feeling all the sensations of internal stimulation of the whole of the gastrointestinal tract as the bolus of food transits. Whereas with the skin we can feel every touch whether or not we desire it. Is there any circumstance where it would be beneficial to feel every stimuli within the GI tract as the food migrates from mouth to anus? Just as with the skin, where pleasurable or non-threatening sensations are tolerated and accepted, so, too, do we appreciate the discriminate levels of sensation within the GI tract. However, for both systems, we do benefit greatly from stimulation threat levels that alert us to serious harm.

Our initial understanding of the function of the gastrointestinal tract literally begins with our first meal, either at the nipple or from the spoon. When we ingest something we are not aware of its passage to the endpoint, merely that at some future time some signal or sensation will alert us to the need to evacuate. We apply directed effort at chewing and swallowing what enters the mouth, which for very good reasons is loaded with sensory neurons and taste buds, and for a relatively brief moment or two we can feel the swallowed contents migrate downward. On occasions we can feel and even hear rumblings within the upper zone of our abdomen where we have learned that the stomach resides. Along this initial journey we have not experienced pain or discomfort as part of the natural order of eating or digestion. In fact, it is probably a good thing that we remain unaware of the passage of food and drink throughout the length of the internal pathway. And, just as the beginning of the GI tract is generously sensate so to do we find the terminus endowed with an abundance of sensate neurons to alert us to the presence of stool needing exit. How elegant indeed is the

arrangement wherein the beginning and endpoints of the tract are abundantly sensate but the intervening zone is relatively insensible during the normal course of digestion. Conversely, there may be times when we do feel pain or distress at the beginning of our food intake journey; however, we are getting ahead of ourselves by addressing extraordinary events related to food passage throughout the gastrointestinal tract. When eating or transport of foods do become problematic the signals giving rise to these issues become apparent.

The failure to dig deeper into the anatomy and physiology of the enteric nervous system traps the many casual observers to continue to falsely conclude that the stoma does not feel pain because it has either no nerves or lacks pain receptors. If the stoma is part of the intestinal tract and occasions arise when a noxious event such as a toxin, an inflammatory condition, ischemia or an obstructive episode arises to cause pain; how is it that the intestinal tract, of which a stoma is a part, and "lacking pain receptors" can feel pain under these circumstances? Either the stoma is not a part of the intestinal tract or the statement that a stoma lacks pain receptors is false. It is important to clarify the distinction between cutting and burning of the intestine or visceral organs and the transmission and perception of pain that does not arise from such actions. Aage Moller has explored this phenomenon and reported that: "Visceral nociceptors do not respond to cutting or burning injuries like their counterparts in the peripheral cutaneous tissue. Instead, they are activated in response to pathological change. Pain producing stimuli in the viscera include traction on the mesentery, inflammation, distension of hollow muscular-walled organs such as gastrointestinal, urinary tract, gall bladder. Also, strong contractions of muscle layers surrounding such hollow organs, chemicals irritants or ischaemia in organs such as the heart contribute to visceral nociception." Moller, Aage. Pain, Its Anatomy, Physiology and Treatment. ISBN-10: 1466395109, ISBN-13: 978-1466395107, Soft cover 364 pages, Publisher: Aage R. Møller Publishing, Publication date: February 2014

Knowing that stomas have nerve endings is revealed when a fuller understanding of the gastrointestinal tract demonstrates that there are different types of nerve fibers and behaviors. Among these fibers are found fast, medium, slow, myelinated fully or partially or not at all that characterize how much perception of certain stimuli are perceived at higher levels of awareness. From a thorough review of the professional literature there is abundant evidence to prove the

existence of intestinal nerve fibers throughout the whole of the enteric tract. A good starting point is Michael Gershon's paperback book: The Second Brain. In this book one will find a very comprehensive history of the early research leading to an enhanced and unfolding understanding of the existence of an enteric nervous system as well as the major scientists and investigators who laid the foundation for a robust explanation of the workings of the GI tract.

https://www.harpercollins.com/products/the-second-brain-michael-gershon?variant=32208028991522 . accessed March 21, 2021.

After incorporating Gershon's research and lucid descriptions, continue to explore the rest of the professional literature that specifically addresses the neurological makeup of the intestinal tract. There is enough out there to finally enlighten all the WOCNs, other medical professionals and ostomates.

Adrian Miranda reinforces Moller's findings above when he writes about pain receptors and states that: "Visceral pain receptors are located on the serosa surface, in the mesentery, within intestinal muscle, and mucosa of hollow organs. Pain is initiated when receptors are stimulated by excessive contraction, stretching, tension or ischemia of the walls of hollow viscera, the capsule of a solid organ (liver, spleen, kidney), or of the mesentery." https://doi.org/10.1016/B978-0-323-39956-2.00010-8 and https://childrenswi.org/physician-directory/m/miranda-adrian accessed March 21, 2021

The succinct take away to help all the myth purveyors out there is to finally accept that the intestinal tract is loaded with nerves of all types and that awareness of some painful stimuli is to be carefully and fully understood and explained to any person who inquires or wishes to prophylactically caution about risk injuries to the surfaces of stomas. Another simple and a priori fact that should help to convince everyone that the stoma, a part of the intestinal tract, has nerves is that it moves: wiggles, spurts and propels contents unidirectionally. From this very clear fact it should be relatively easy to then inform oneself and others that nerves are there but not all nerves behave in the same manner or produce the same effect or outcome

It bears repeating to yourself and your patients with stomas that some levels or thresholds of stimuli have to be great enough to stimulate some of the particular nerves responsible and capable of transmitting painful or noxious stimuli to a

conscious level of perception. Unlike the skin which is loaded with nociceptors, It is not correct to state that the stoma, and by extension the intestinal tract, does not have nerves or that the stoma does not have pain receptors. There are pain receptors within the intestinal tract but not all levels of stimuli reach the level of conscious awareness all the time. In the normal condition of the intestine, of which a stoma is a part, typical pain (touch) receptors are not triggered to a perceived threshold. However when the bowel is sufficiently stressed by a noxious event such as when stretched, obstructed and subsequently swollen, the patient will "feel" painful. There are stretch receptors within the bowel wall that inform us of an obstructive event, again a noxious enough threshold to warrant attention. While experiencing an obstructive event, other physiological phenomena occur to further inform and distress us. On rare occasions, patients with stomas have strongly complained of stomal pain. Physical exams have often not been able to reveal any clear evidence of harm or obstruction to the stoma site. In these unusual situations, the phenomenon of psychic pain has been put forth to explain the pain; however, it just may be the case of a unique genetic makeup, patient anatomy and physiology phenomenon. Early experience with fibromyalgia patients comes to mind when these patients complained of the slightest brush of the skin eliciting significant pain and the health community, lacking an understanding, relegated their complaints to a psychogenic origin.

It took me a while to properly note the distinction between experiences and acquired scientific knowledge when, as a newly minted ileostomate in 1965, I was told that my stoma does not feel pain. On various occasions I had lacerated my stoma with the edge of my faceplate and felt no pain at the time of the cut injury. I had been warned of this risk by my surgeons and the newly known ostomy members from the lay ostomy organizations. Whenever I did see blood oozing from my stoma I looked carefully to rule out any evidence of lacerations. Sure enough, I had seen the lacerations and saw the gradual healing noted by the whitish line of the healing lesion. As a budding enterostomal therapist (ET) I carried forth with this belief and espoused to many audiences that the stoma has no nerves. I had done loop colostomy cauterizations in the hospitals where I worked and assured each patient that although what I was about to do to them seemed frightening and would smell a bit, it would not hurt. I really had to bargain for their trust in the face of what I was about to do. Yes! You read it correctly that I actually did cauterize open loop colostomies as part of my post-operative oversight for those types of ostomy patients. Being affiliated with a

medical school teaching hospital at my first inpatient gig was a wonderful training ground.

Then I started to wonder why the intestinal tract would hurt when it was obstructed or inflamed, conditions that I regularly encountered by my own bowel. I began to question my own beliefs and started to question how and why the myth of the bowel/stoma having no nerves persisted. To borrow a contemporary phrase, I started to explore the evidence for such statements. How is it that I have been able to learn about the unfolding evidence of the enteric nervous system and apply relevant knowledge going forward? Was it solely because I am living the experiences of periodic painful intestinal interludes? Surely, I am not alone experiencing painful intestinal episodes. I suspect that some within the medical and nursing professions also experience painful intestinal episodes, with or without a stoma. I suspect that all medical and nursing students are correctly taught about the different aspects of the human nervous systems. I would hope this is the case.

How to account for this persistent myth? It appears that naïve knowledge is still seriously hindering progress in the understanding of the GI tract. Dare I suggest that incorporating sources of knowledge from all manner of specialists should be as broad as possible? I know it is much harder to un-teach and un-learn than otherwise; however, the persistence of this myth promulgation clearly demonstrates that some within the WOCN and ostomy patient arena have to get re-educated. Let me offer this step to help you.

Pain receptors themselves are very complex and need fuller understanding of the exquisite relationships to genetics and chemical and physical environments surrounding them. I would expect everyone affiliated with treatments of inflammatory diseases (IBD) and functional bowel disorders is fully aware of the hallmark characteristic of pain that derives from varying states of the diseases. Clearly, pain receptors within the bowel, of which stomas are very much a part, are being affected and to varying degrees.

There remains more we do not know than our current state of knowledge reveals about the complexity of living organisms I encourage all to kill the ignorant myth and make everybody's stoma happy again knowing that it does have nerves. If we can say the nerve of that person, then we should also be ready and willing to say the nerve of that stoma!!

Conclusion: The overarching impact regarding the operative rule of the intestine is: no nerves, no transit. Another takeaway from Gershon's reporting about the second brain that resides within the gut is that the enteric nervous system, technically a part of the peripheral nervous system, does not necessarily follow commands originating in the brain or spinal cord nor does it always send information back to the spinal cord and brain. If the gastrointestinal tract were to report to the brain every time food is passing throughout its length we would all be in a bit of distress feeling the effects of normal digestion. There are other investigators exploring the brain and supraspinal regions to map out a better understanding of pain associated with IBD. Again, it bears repeating that a bowel not under "serious or prolonged" duress may not perceive pain but it still has pain receptors. A fuller understanding of the intestinal tract's mode of operation includes the more complete neuroendocrine processes that take place throughout the gut.

If you need further enlightenment and assurance about from whom to learn a fuller understanding of gut anatomy and physiology, let me encourage your appetite with the following notations and references.

1. Gershon's bona fides can be viewed at this link:

   https://www.pathology.columbia.edu/profile/michael-d-gershon-md accessed March 21, 2021
2. The existence of the enteric nervous system had been discovered in the mid-1800s by a German scientist for whom the understanding of Hirschsprung's Disease evolved. I suspect many WOCN/ET practitioners have encountered infants needing some form of temporary bowel diversion from this disorder. When the Auerbach plexus is lacking or poorly functioning then aperistalsis takes place and the patient is placed in grave danger from obstruction.
   https://www.sciencedirect.com/topics/veterinary-science-and-veterinary-medicine/auerbachs-plexus accessed March 21, 2021
3. Bayliss and Starling discovered the unidirectional reflex phenomenon of the intestine and promulgated the Law of the Intestine in the late 1800s and early 1900s. Ulrich Trendelenberg added his discoveries during the First World War, around 1917, and coined the term peristaltic reflex, which eventually replaced the Law of the Intestine terminology.

   https://jamanetwork.com/journals/jama/article-abstract/253420 accessed March 21, 2021

https://core.ac.uk/download/pdf/11012241.pdf accessed March 21, 2021

https://brainworldmagazine.com/it-takes-guts-an-interview-with-dr-michael-d-gershon/ accessed March 21, 2021

https://www.jneurosci.org/content/31/29/10516 accessed March 21, 2021

https://journals.sagepub.com/doi/10.1177/1756283X12446158 accessed March 21, 2021

https://link.springer.com/article/10.1007/s10571-020-00967-3 accessed March 21, 2021

4. For those who wish to get into the academic weeds and learn more about the evolving understanding of pain mechanisms, I heartily recommend the following from Zhuo-Ying Tao, Richard J. Traub, Dong-Yuan Cao, Chapter 8 - Epigenetic Modulation of Visceral Pain, Editor(s): Guang Bai, Ke Ren, In Translational Epigenetics, Epigenetics of Chronic Pain, Academic Press, Volume 7, 2019, Pages 141-156, ISSN 25425358, ISBN 9780128140703, https://doi.org/10.1016/B978-0-12-814070-3.00008-9. accessed March 21, 2021
5. Another good reference to the unique features of visceral sensations can be found here: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2732716/ accessed March 21, 2021

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A beneficiary of lived experiences and knowledge from those experiences and additional explorations.

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