

Overview of Visceral Pain

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INTRODUCTION

Visceral pain is pain from internal organs and it is the one of the most common presentation of problems from internal organs. It is the most frequent form of clinically relevant pain and it is one of the most frequent reasons why patients seek medical attention. [1]



The “**Sick Durer**” which is a self-portrait of Albrecht Durer (1471-1528) – German printmaker, painter, and designer. [2]. On it Durer wrote “Do we der gelb fleck is und mit dem finger drawff dewt do is mire we” (**There, where the yellow spot is located, and where I point my finger, there it hurts**). This picture was sent to an out of town physician whom Durer had consulted. Though the illness remains unclear, and though the picture cannot be exactly dated. Durer was undoubtedly in pain. This illustrates that more than half a millennium before, pain may also be one of the common reason for seeking medical advices [2].

Not all people suffered from neuropathic pain or other chronic pain problems, but all of us must suffer from some form of visceral pain in the life, e.g. chronic pelvic pain due to dysmenorrhea, angina due to ischaemic heart disease, abdominal pain due to irritable bowel syndrome etc. However, visceral pain is often being neglected, inadequately managed and poorly treated because patients are often seen by doctors with no primary interest in pain --- they view pain as part of the causal disorder --- if they treat the disease, the pain will also go away [1]. As a result, they concern the diagnosis and treatment of the underlying disease. Moreover, there are inadequate animal models of visceral pain. Most of the management and treatment of visceral pain is extrapolated from somatic pain model.

Recently, people advocate “pain is a disease” and “pain” is the centre of the problem which lead to lots of psychosocial issues. It has been considered that the social burden of visceral pain may surpass that of pain from somatic (superficial) sources. [3]

CAUSE OF VISCERAL PAIN

1. Noiceptive: direct injury of an internal organs e.g. cardiac ischaemic, peptic ulcer
2. Inflammatory: acute or chronic inflammatory of an internal organs e.g. inflammatory bowel disease, ulcerative colitis, endometriosis
3. Neuropathic: may be neuropathic, not associated with primary damage of visceral nerves. But secondary to compression or damage by tumors

Sensory Characteristics of Visceral pain and their mechanism [1]

Psychophysics	Neurobiology
Not evoked from all viscera	Not all viscera are innervated by “sensory” receptors and many viscera are innervated by receptors whose activation does not evoke conscious perception.
Not linked to injury	Functional properties of visceral “sensory” afferents
Referred to body wall	Viscero-somatic convergence in central pain pathways
Diffuse and poorly localized	Few “sensory” visceral afferents. Extensive divergence in the central nervous system.
Accompany with motor and autonomic symptoms	Mainly a warning system, with a substantial capacity for amplification. e.g. patients with myocardial infarction, in addition to having retrosternal pain. They also had nausea, vomiting, anxiety, feeling of impending death which further gives more warning signals to slow down.

For the sensory characteristics of visceral pain -- “**Not evoked from all viscera**”, it is known that not all internal organs are sensitive to pain especially for solid organs e.g. liver parenchyma. Therefore, any lesions or injury of liver parenchyma will not be translated to signal that is interpreted as pain in the brain. In view of this sensory characteristic, lesions or injury in those organs are first discovered when there is abnormal function of the organs e.g. painless obstructive jaundice in patients having carcinoma of pancreas. However, for some hollow organs e.g. stomach, gut or urinary bladder where they are continuously or exposed to external environment, are relatively sensitive to pain e.g. urinary colic in patients having urinary stones.

CLINICAL PICTURES OF VISCERAL PAIN

It can be difficult to identify and may present in different ways in clinical setting. Most importantly, it may associate with life-threatening conditions e.g. acute myocardial infarction, intestinal obstruction. Therefore, prompt evaluation is mandatory.

Visceral Pain	True visceral pain	Nociception arising from neural sources in deep organs of the body With tissue injury
	Visceral hyperalgesia	Slow, poorly localized i.e. it may not even feel like pain e.g. colic Generally, no tissue injury
	Viscero-viscerohyperalgesia	Due to the sensory interaction between two internal organs that share common aspects of their afferent pathways
Referred Pain	Without hyperalgesia	Sharp, localized Less autonomic and emotional features
	With hyperalgesia	Convergence-facilitation

TRUE VISCERAL PAIN

It may be hard to diagnose and it has the following characteristics: **poorly localized, diffuse and poorly defined** and it is regardless of organ of origin [3]. It is usually in mid-line, lower sternum and upper abdominal area. It feels like a pressure and compression. It is usually associated with **autonomic features** (e.g. sweating, nausea and vomiting) and **highly emotional** (e.g. anxious, feeling of impending death). An example is myocardial infarction.

VISCERAL HYPERALGESIA

The **IAPS definition of hyperalgesia** is an increase in pain sensitivity to a nociceptive stimulus. Visceral hyperalgesia is the increased sensitivity to visceral stimulation following an injury or inflammation of internal organ.

Causes [4]:

1. Sensitization of primary sensory afferents innervating the viscera
2. Hyperexcitability of spinal ascending neurons (central sensitization) receiving synaptic input from the viscera

3. Dysregulation of descending pathways that modulate spinal nociceptive transmission.
4. Alternation in sensory neurons so that they are more responsive to naturally occurring stimuli. (peripheral) An enhanced sensitivity of the sensory pathways in the brain (central).

For visceral hyperalgesia, it **may not** be associated with tissue injury and inflammation e.g. irritable bowel syndrome where there is spontaneous and persistent pain in the absence of an apparent cause. It occurs in different type of functional chronic pain e.g. irritable bowel syndrome, interstitial cystitis, chronic pelvic pain, fibromyalgia etc.

For this **functional visceral pain**, it may be due to **altered Brain Gut Axis** which is a theoretical model depicting bidirectional neural pathways linking cognitive, emotional and autonomic centres in the brain to neuroendocrine centres, the enteric nervous system and the immune system [5]. Bodily visceral functions (e.g. digestion, nutrient absorption, gaseous exchange, excretion) require complex regulation in which the CNS is highly integrated with peripheral and enteric nervous systems and hormonal controls. Accordingly, altered brain-gut interactions can contribute to autonomic dysregulation of the gut and associated pain and perceptual changes in visceral disorders like irritable bowel syndromes [5].

VISCERO-VISCERO HYPERALGESIA

It is pain due to **sensory interactions between two internal organs** that share common aspects of their afferent pathway [3]. Example may include:

- Patients with coronary heart disease and gallbladder calculosis, could experience greater frequency of attacks of angina and biliary colic than patients with a single one of these conditions. This could be based on partially overlapping (T5) afferent pathways [6].

REFERRED PAIN WITHOUT HYPERALGESIA

Referred pain i.e. **pain is felt remote from the location of the affected organs** e.g. referred cardiac pain to left upper arm and hand. There is no dedicated sensory pathway for internal organs. The signals for internal organs connect with the sensory pathway of adjacent somatic organs e.g. skin (i.e. visceral somatic convergence) so those signals are misinterpreted by the brain as feeling pain in a site distant to origin of the pain.

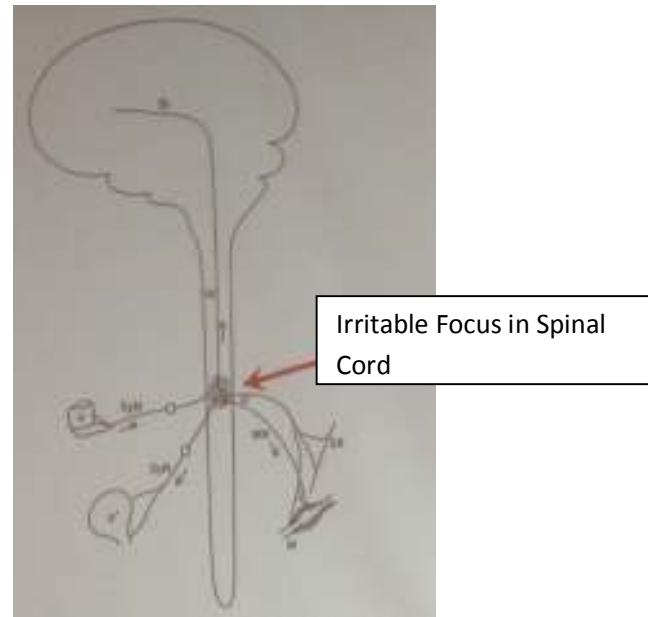
REFERRED PAIN WITH HYPERALGESIA (Viscero-somatic hyperalgesia)

Referred pain can occur with hyperalgesia i.e. clinically this is demonstrated by eliciting hyperalgesia in the somatic region to which the pain is referred [7]. This is usually confined to the superficial muscles, which can display sustained irritability and contractions [3].

Referred pain with hyperalgesia from internal organs is likely caused by a **process of central sensitization caused by viscerosomatic convergent neurons (“convergence-facilitation”)** [3].

It is common in visceral pain because it is emphasized by the repetitiveness of visceral episodes and can persist long after the initiating pain has ceased [3,8] and example of convergence-facilitation is dysmenorrhoea [8].

Convergence-facilitation was proposed by MacKenzie J. in 1909 in which visceral pain afferent signals creating an “irritable focus” within the spinal cord, so that other, segmentally appropriate, somatic inputs could now proceed abnormal and referred pain sensation [9]. The concept of an “irritable focus” has more recently been resurrected with another label – central sensitization.



GENERAL TREATMENT PRINCIPLE

1. Address underlying pathology for definitive treatment
2. Relief symptoms

Pharmacological - Classical analgesic (very few specific pain killers for visceral pain and treatment are from extension from those in somatic pain conditions)

- Organ specific / mechanism based: (1) Spasmolytics
(2) Proton pump inhibitors

Non-pharmacological - Interventions e.g. sacral nerve stimulation for interstitial cystitis

- Psychological Management

3. Pain specialist consultation and procedures (a clear cause may never be found)

REFERENCE

1. Cervero & Laird (1999); Vol.353, 2145-2148, The Lancet
2. G.D. Schott; The Sick Durer – A Renaissance prototype pain map; BMJ.2004 December 18;329(7480): 1492.
3. Giamberardino MA. Visceral Pain. IASP Pain Clinical Updates. Volume XIII, No.6. Dec 2005. IASP Press.
4. Visceral Pain: The Neurophysiological Mechanism. Handbook of experimental pharmacology, 2009; 194:31-74.
5. Current opinion and supportive palliative Care, 2012, March; 6(1): 17-26.
6. Foreman RD (2000). In: Mayer EA, Saper CR (Eds). The Biological Basis for Mind Body Interactions, Progress in Brain Research, Vol. 122. Amsterdam: Elsevier: 209-221.
7. Giamberardino MA. Recent and forgotten aspects of visceral pain. Eur J Pain. 1999;3:77-92
8. Giamberardino MA, Berkley KJ, Lezzi S, De Bigontina P, Vecchiet L. Pain threshold variations in somatic wall tissues as a function of menstrual cycle, segmental site and tissue depth in non-dysmenorrheic women, dysmenorrheic women and men. Pain. 1997;71:187-97.
9. MacKenzie J . Symptoms and their interpretation. London: Shaw, 1909.