Introduction

- Neuromodulation has been used clinically for the last 20 years, predominantly treating pain, tremor or spasticity
- Neuromodulation has increasingly gained traction for treating functional gastrointestinal symptoms resistant to conservative treatments
- The best studied of this application of sacral neuromodulation (sacral nerve stimulation) is for fecal incontinence (FI)

Sacral nerve stimulation is delivered via an implanted stimulator (Interstim, ex) and has been shown to reduce episodes of FI and improve quality of life. This method, however, is expensive and invasive and requires surgical procedures under general anesthetic. Therefore, other non-invasive and more economical neuromodulatory techniques have been explored: pudendal nerve stimulation, posterior tibial nerve stimulation, and transcutaneous IFC.

Interferential Current Therapy (IFC)

- IFC has been found to be effective in small studies to manage FI and constipation
- IFC is non-invasive, cost effective and convenient
- IFC can reach targeted deeper tissue if the target tissue lies on a diagonal path between the circuits outside electrode border.
- There are 2 types of IFC:
  - “true” IFC that is generated by the use of 4 electrodes
  - “premodulated” IFC that is generated within a device that delivers the currents and transmits via 2 electrodes
  - True IFC had the greater voltage recording at depth, showing superiority in efficiency of stimulation at deeper levels.
  - “True” IFC is believed to have maximal stimulation deep at the intersection of the 2 currents whereas premodulated IFC is though to act superficially near the electrodes.

Potential actions of IFC on various systems

- The mechanism of action if IFC in GI disorders is not understood.
  - IFC may influence the neuroplasticity of the enteric nerves, inducing structural, intrinsic or synaptic changes leading to altered neuronal function
  - Neuroplasticity has been associated with motility disturbances in inflammatory bowel disease and irritable bowel syndrome.
• IFC causes increased propagating sequences and increased colonic activity but evidence has yet to be found to determine the precise mechanism of action
  o One hypothesis is that the IFC exerts it effects via electric ally stimulating excitable cells which produce slow wave activity in the bowel responsible for peristalsis, or that it directly stimulates the nerves of the enteric nervous system.
  o Because the placement of electrodes is in close proximity to the spinal cord, it is suggested that IFC effects may be exerted directly to the spinal cord, influencing the ANS either through afferent or efferent pathways.

Gastrointestinal Application of IFC

Children: There have been many studies indicating IFC is beneficial in children with severe constipation, fecal incontinence and decreased motility in addition to improving bladder dysfunction.

Adults: There are only a few studies that have explored IFC in adults with constipation.

Discussion

o The authors of this paper feel that the intra-abdominal cross current of IFC is the best location of the electrodes however there is recent research that the application of IFC to the sacral nerves over the sacral region is beneficial.

o Benefits of IFC last from 6 months to 2 years after termination of treatment with home stimulation recommended upon relapse.

o Numerous studies have found IFC to have benefit with several studies using a placebo-controlled group.

o It is hard to recreate a sham stimulation, however, as patients will know if they are receiving treatment or not which complicates research.

Also, parameters have not been determined for optimal stimulation but several studies have used the same frequencies: 4-kHz carrier frequency is selected with a beat frequency sweep of 80-160 Hz with a carriable intensity of <33 mA in adults. The beat frequency sweep varied in pediatric studies from 8-120 Hz to 80-150 Hz.

To date, no serious adverse effects of IFC have been described.

IFC is contraindicated in pregnancy and should not be used in patients with a cardiac pacemaker per these authors. Also, IFC should not be used in the presence of metal implants in the abdomen or spine due to risk of thermal injury per these authors.

Conclusion

IFC is an attractive therapy for chronic GI disorders as it appears effective, is relatively low cost and is a non-invasive and non-pharmacological intervention. Of course, more research is always needed....
Other similar studies:

1) Yik et al. (Neuromodulation. 2016 July;19(5):515-21.) found transcutaneous electrical stimulation with currents crossed within the lower abdomen at the level of S2-S4 improved symptoms of constipation in >50% of children with treatment resistant constipation.

2) Van Wunnik et al (Best Pract Res Clin Gastroenterol 2011 Feb;25(1):181-91) found transcutaneous stimulation using electrodes over the lumbosacral region improved constipation symptoms.

3) Yik et al. (Neuromodulation 2017 Nov 22) showed treatment resistant slow transit constipation responded to transcutaneous electrical stimulation using IFC across the abdomen when given daily for many months. Stimulation daily for 6 months produced clinically significant improvement in defecation frequency, soiling, abdominal pain, urge to defecate and quality of life in half of these chronic patients.

4) Chew et al. (Colorectal Dis 2011 May;13(5):567-71) found S3 transcutaneous electrical nerve stimulation seems to be a promising noninvasive method to treatment fecal incontinence.


6) Thomas et al (Colorectal Dis 2013 Nov; 15(11):1406-9) showed transcutaneous sacral nerve stimulation at S3 was effective and a safe treatment for fecal incontinence.

Questions

1) Do you use IFC in your clinic for constipation or FI?
2) What set up do you use for IFC (crossing front/back through the abdomen or sacral placement)?
3) Do you have patients get a home TENS unit for self care?
4) What do you tell your patient about how electrical stimulation helps?