Sacral neuromodulation

The neural control of storage and voiding of urine is complex and dysfunction can be difficult to treat. One treatment for people with refractory symptoms is continuous electrical nerve stimulation of the sacral nerve roots using implanted electrodes and an implanted pulse generator.

Herbison et al searched the Cochrane Incontinence Group Specialised Register (searched 10 February 2009), CENTRAL (The Cochrane Library 2008, Issue 1), MEDLINE (January 1980 to March 2008), EMBASE (January 1980 to March 2008), CINAHL (January 1982 to March 2008) and the reference lists of relevant articles.

Selection criteria: Trials that tested implanted electronic stimulators connected to electrodes attached to the nerves and providing continuous Electrostimulation for neuromodulation.

Data collection and analysis: Both authors selected studies, assessed quality, and extracted data.

Main results: Eight reports of randomized studies that evaluated implants that provided continuous stimulation were included. It was unclear whether some reports included patients who also appeared in other reports, so no data were pooled. In spite of this, it seems clear that continuous stimulation offers benefits for carefully selected people with overactive bladder syndrome and for those with urinary retention but no structural obstruction.Many of the implants did not work and many required revision operations. Many questions remain about patient selection and the best way to use these devices.

Authors' conclusions: In spite of methodological problems, it would appear that some people benefit from implants that provide continuous nerve stimulation. More research is needed on the best way to improve patient selection, carry out the implant, and find why so many fail. The effectiveness of implants should be tested against other interventions, particularly in people with an overactive bladder [1)].

In the early 1980s Tanagho and Schmidt began developing an implantable sacral electrode that would provide the basis for the concept of sacral neuromodulation (SNM) and the InterStim device (Medtronic) [2)]

Neuromodulation utilizes Electrostimulation to alter the function of an organ. Advances in technology and improved knowledge of micturition physiology have coincided with the growth of neuromodulation for the treatment of urinary urgency/frequency, urge incontinence, and non-obstructive urinary retention. Currently, the most common modality for bladder neuromodulation involves stimulation through the S3 foramen or sacral neuromodulation [3)].

The Spinal Cord Neuromodulator (SCONETM) reactivates and retrains spinal neural networks. A case study introduces initial evidence that home-based, self-administered SCONE therapy may be a safe and effective method of delivering this neuromodulation modality and may have the ability to minimize clinic visits, which is especially salient in today's public health environment [4)].

Indications

Permanently implantable neuromodulation (e.g. InterStimTM by Medtronic) is indicated for refractory urinary urgency, frequency, urge incontinence, non-obstructive urinary retention, and fecal incontinence. If a trial with a temporary lead placed adjacent to the sacral nerve via the S3 foramen produces>50% reduction in symptoms, it is connected to an implantable pulse generator. The mechanism of action is poorly understood but may modulate the afferent signals of the micturition reflex [5] Improvement in symptoms is seen in up to 70% of patients with complete resolution in incontinence around 39% [6]. Contraindications to implantation include failure to improve with trial and the likely need for repeated MRIs in the future (the device is MRI conditional for head only with ≤ 1.5 Tesla MRI).

Preliminary results of chronic sacral neuromodulation confirmed its advisability in children with neurogenic lower urinary tract dysfunction. Patients with detrusor-sphincter dyssynergia had better results compared to those with detrusor overactivity [7]

[1], [6]
Herbison GP, Arnold EP. Sacral neuromodulation with implanted devices for urinary storage and voiding dysfunction in adults. Cochrane Database Syst Rev. 2009 Apr 15;(2):CD004202. doi: 10.1002/14651858.CD004202.pub2. PMID: 19370596.

[2]
Tanagho EA, Schmidt RA, Orvis BR. Neural stimulation for control of voiding dysfunction: a preliminary report in 22 patients with serious neuropathic voiding disorders. J Urol. 1989 Aug;142(2 Pt 1):340-5. doi: 10.1016/s0022-5347(17)38751-7. PMID: 2787411.

[3]
Sherman ND, Amundsen CL. The current use of neuromodulation for bladder dysfunction. Minerva Ginecol. 2006 Aug;58(4):283-93. PMID: 16957672.

[4]
Gad P, Zhong H, Edgerton VR, Kreydin E. Home-Based SCONETM Therapy Improves Symptoms of Neurogenic Bladder. Neurotrauma Rep. 2021 Mar 18;2(1):165-168. doi: 10.1089/neur.2020.0061. PMID: 34223551; PMCID: PMC8240827.

[5]
Sukhu T, Kennelly MJ, Kurpad R. Sacral neuromodulation in overactive bladder: a review and current perspectives. Res Rep Urol. 2016; 8:193–199

[7]
Dekopov AV, Tomskiy AA, Isagulyan ED, Yurasov IS, Salyukova YR, Salyukov RV. Lechenie narusheniya funktsii tazovykh organov u detei s mielodisplaziei metodom khronicheskoi sakral'noi neirostimulyatsii [Chronic sacral neuromodulation for pelvic floor dysfunction in children with spina bifida]. Zh Vopr Neirokhir Im N N Burdenko. 2022;86(1):48-55. Russian. doi: 10.17116/neiro20228601148. PMID: 35170276.