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NEWSLETTER #113 MARCH 2023

Et Tu, Cochrane?

A Cochrane review on spinal cord stimulation (SCS) for low back pain was published on March 7, 2023 (Traeger et al.). Based on an analysis of 13 studies described as "randomised controlled trials (RCTs) and cross-over trials comparing SCS with placebo or no treatment for low back pain" and limited further to subsets of each of these categories, the authors drew the broad conclusion that “SCS probably does not have sustained clinical benefits that would outweigh the costs and risks.”

There are 3,082 reports of SCS primary data and relevant study protocols in WIKISTIM, and one might reasonably ask whether a subset of only 13 could be representative and whether analysis of this subset could justify such a conclusion in an influential publication. In fact, a subset of only 6 is relevant to the clinical decision to perform an SCS trial or implant because 7 of the 13 studies analyzed “required participants to already be implanted with an SCS [sic] and have achieved stable pain control.” (see page 15).

Notably excluded from the Cochrane review were RCTs comparing SCS with alternative active treatments for low back pain in widespread use, with their attendant expense and risks. Among these alternatives is surgery; thus, our 2005 RCT of SCS vs. reoperation, which has been widely cited, was excluded because of its “ineligible comparator.” Our finding, namely that, at 2.9-year mean followup, SCS had significantly better outcomes and, in the great majority of patients, obviated the need for reoperation, was dismissed. Also dismissed was our companion cost-effectiveness study that showed SCS to be dominant (more effective and at the same time less expensive).

WIKISTIM lists many SCS studies reporting favorable results with follow-up of several years and a few with two decades or more. One might think this would inform the definition of “long term,” but on page 1 in the Traeger review, the authors note, “Our primary time point was long-term follow-up (≥ 12 months),” and then, on page 2, go on to say, “None of our included studies evaluated the impact of SCS on mean LBP

intensity in the long term.” In the context of prior literature with much longer followup, albeit of lower quality (typically case series), how can a conclusion about “sustained clinical benefits” be drawn from the current review?

Curiously, the Traeger review included the study by Hara et al. in JAMA, a negative SCS trial published on October 18 more than four months after the review search end date of June 10 (see page 9). The Hara paper was the subject of our November newsletterand led us to ask “Cui bono?” Inclusion of this study allowed Traeger et al. to claim (on page 20), “Only the Hara 2022 study assessed the benefits of SCS versus placebo using a treatment period of longer than three weeks," and it appears that this inclusion altered the conclusion of the Cochrane review. Should we question this as confirmation bias, perhaps with a Latin phrase?

Traeger et al. (see page 8) say, “We excluded studies that only compared different forms of SCS.” SCS trials have been reported for 66 years, but paresthesia-free waveforms enabling blinded RCTs have been in use for no more than 10 years. To date such studies have generally compared one waveform with another, and while this might be useful in showing noninferiority and securing regulatory approval for market, it is not particularly relevant to the clinical decision to perform an SCS trial or implant or to judging the overall benefits of SCS. Waveform comparisons should not have been dismissed outright, however, as this eliminated widely cited studies (Senza, Sunburst, DTM, Evoke) in which the superiority of the study waveform presumably represented real net benefit. We may hope that future Cochrane reviews will include such studies, that future SCS studies will use a relevant clinical comparator, and that SCS can be represented by multiple waveforms available from the same device.

”Low back pain” (LBP), of course, is not a diagnosis but rather a symptom attributable to a variety of conditions (degenerative, traumatic, post-surgical, etc.) and mechanisms (nociceptive, neuropathic, etc.) with different clinical presentations (viz., mechanical or not). Historically, paresthesia-based SCS had limited technical success in achieving overlap by paresthesia of axial LBP (as opposed to radiating leg pain) and correspondingly limited clinical results. Only in recent years, with the development of novel waveforms, have claims been made supporting broader use of SCS for axial LBP. The new Cochrane review makes none of the above distinctions, and by excluding so many recent studies, it fails to represent its subject faithfully.

The principles of evidence-based medicine confer priority but not exclusivity on high-quality studies, recognizing the importance of prior art and clinical experience (Sackett et al.). In fact, Concato et al. reported in 2000 that “meta-analyses of observational studies produce results that are similar to meta-analyses of randomized trials.” Evidence that is judged as weak by new standards should not be treated as if it were nonexistent (see Guyatt et al.). Furthermore, as Petticrew noted in 2003, meta-analyses of studies of high technical quality but limited relevance can yield misleading results, as appears to be the case in the Traeger study.

Cochrane reviews have been an important part of evidence-based medicine. Like systematic reviews in general they can be at the mercy of their selection processes vis-à-vis the available evidence at the time(s) chosen. On occasion, Cochrane has acknowledged the validity of criticisms: “selection of studies for inclusion was faulty . . . choice of outcomes was faulty” and has published corrections. SCS researchers, for their part, are addressing methodological deficiencies that once were common, as guidelines specifically for neuromodulation are published and adopted by journals (see, for example, Katz et al., 2021; Duarte et al., 2022). We look forward to reviews that are more representative of the benefits, risks, and costs of SCS and thus useful for guiding practice and policy.

Long COVID and WIKISTIM

Most of the longtime industry supporters who have issued grants to support WIKISTIM in years past have disappointed us this year. Many tell us that the economic downturn coinciding with COVID and continuing afterwards is to blame. As we approach our 10th anniversary, we are dangerously close to becoming a casualty.

We have 150 subscribers who use the corporate email addresses of the four largest neurostimulation companies and presumably are their employees; an unknown additional number of employees, consultants, etc. use personal addresses. WIKISTIM’s benefit to these companies can be measured in employee time savings and efficiency, and thus in full-time equivalents or dollars. We believe that by serving all of you at scale, we contribute to the field of neuromodulation very cost-effectively.

We urge all our subscribers whose employers and businesses benefit from their use of WIKISTIM to request that they support us with a grant or donation.

Likewise, we urge those who appreciate the benefits of neurostimulation to donate to WIKISTIM so that we can continue to provide this free service.

Thank You

We thank the Terry Daglow and Todd Sitzman for their donations, which were greatly appreciated.

Discuss Freely

Letters to the Editor are a slow process; not until this week (after 5 months) did JAMA publish the letters responding to its October paper by Hara. Our comments appeared in this newsletter after only 5 weeks. This month’s comments on the Cochrane report, which by the way does not support or allow letters to the editor, are appearing after only 10 days.

Please consider adding your thoughts on this and other subjects to our Discussion section. Unlike letters to the editor, it has no deadlines or limitations on number of authors, word count, or citations

Increase in the Number of Subscribers

WIKISTIM now has 1713 subscribers. Thank you for spreading the word!

Citations Added From Search on March 8, 2023

Whenever possible, we provide free full-text links. For journals where a full-text PDF downloads immediately when a page is opened or has a “watermark,” we link to the link rather than to the PDF. (If necessary to see all of the lists, please click “View Entire Message.”) Please note, The National Library of Medicine is now including what it refers to as "preprints" in PubMed. By "preprint," the NLM means an article that has not yet been peer reviewed. Such articles report research funded by the U.S. National Institutes of Health. PubMed also includes links to peer-reviewed full text articles before they appear in print (referred to here as "epubs") and full-text links to accepted articles before they have been formatted for print. One might well call these "preprints." In the full-text links in WIKISTIM, we don't distinguish between versions of accepted articles. We do, however, note when an article appears in PubMed in advance of peer review (see Gao in the DBS section below).

Deep Brain Stimulation (now 7459 citations)

1. Alosaimi F, Dominguez-Paredes D, Knoben R, Almasabi F, Hescham S, Kozielski K, Temel Y, Jahanshahi A. **Wireless stimulation of the subthalamic nucleus with nanoparticles modulates key monoaminergic systems similar to contemporary deep brain stimulation.** Behav Brain Res 2023 444:114363 PubMed Free Full Text
2. Bahadori-Jahromi F, Salehi S, Madadi Asl M, Valizadeh A. **Efficient suppression of parkinsonian beta oscillations in a closed-loop model of deep brain stimulation with amplitude modulation.** Front Hum Neurosci 2023 16:1013155 PubMed Free Full Text
3. Bangel KA, Bais M, Eijsker N, Schuurman PR, van den Munckhof P, Figee M, Smit DJA, Denys D. **Acute effects of deep brain stimulation on brain function in obsessive-compulsive disorder.** Clin Neurophysiol 2023 epub PubMed
4. Cajigas I, Morrison MA, Luciano MS, Starr PA. **Cerebellar deep brain stimulation for the treatment of movement disorders in cerebral palsy.** J Neurosurg 2023 epub 10:1-10 PubMed
5. Chang B, Mei J, Ni C, Xiong C, Chen P, Jiang M, Niu C. **Development and validation of a prediction model for anxiety improvement after deep brain**

stimulation for Parkinson disease. Brain Sci 2023 13(2):219 PubMed Free Full Text

6. Chang B, Xiong C, Ni C, Chen P, Jiang M, Mei J, Niu C. **Prediction of STN-DBS for Parkinson's disease by uric acid-related brain function connectivity: a machine learning study based on resting state function MRI.** Front Aging Neurosci 2023 15:1105107 PubMed Free Full Text
7. Chaudhuri SE, Ben Chaouch Z, Hauber B, Mange B, Zhou M, Christopher S, Bardot D, Sheehan M, Donnelly A, McLaughlin L, Caldwell B, Benz HL, Ho M, Saha A, Gwinn K, Sheldon M, Lo AW. **Use of Bayesian decision analysis to maximize value in patient-centered randomized clinical trials in Parkinson's disease.** J Biopharm Stat 2023 epub 1-20 PubMed Free Full Text
8. Chen H, Zhao D, Luo Z, Shen L, Shu Y, Li L. **A screening method based on analytic hierarchy process for closed-loop DBS strategies of Parkinson's disease.** Technol Health Care 2023 epub PubMed
9. Chen M, Chen Z, Xiao X, Zhou L, Fu R, Jiang X, Pang M, Xia J. **Corticospinal circuit neuroplasticity may involve silent synapses: Implications for functional recovery facilitated by neuromodulation after spinal cord injury.** IBRO Neurosci Rep 2022 14:185-194 PubMed Free Full Text
10. de Oliveira F, Vaz R, Chamadoira C, Rosas MJ, Ferreira-Pinto MJ. **Bilateral deep brain stimulation of the subthalamic nucleus: targeting differences between the first and second side.** Neurocirugia (Astur : Engl Ed) 2023 epub PubMedFree Full Text
11. Derksen M, Zuidinga B, van der Veer M, Rhemrev V, Jolink L, Reneman L, Nederveen A, Forstmann B, Feenstra M, Willuhn I, Denys D. **A comparison of how deep brain stimulation in two targets with anti-compulsive efficacy modulates brain activity using fMRI in awake rats.** Psychiatry Res Neuroimaging 2023 330:111611 PubMed Free Full Text
12. di Biase L, Piano C, Bove F, Ricci L, Caminiti ML, Stefani A, Viselli F, Modugno N, Cerroni R, Calabresi P, Bentivoglio AR, Tufo T, Di Lazzaro V; Lazio DBS Study Group. **Intraoperative local field potential beta power and three-dimensional neuroimaging mapping predict long-term clinical response to deep brain stimulation in Parkinson disease: a retrospective study.** Neuromodulation 2023 epub PubMed Free Full Text
13. Duchet B, Sermon JJ, Weerasinghe G, Denison T, Bogacz R. **How to entrain a selected neuronal rhythm but not others: open-loop dithered brain stimulation for selective entrainment.** J Neural Eng 2023 20(2) PubMed Free Full Text
14. Eskandari K, Fattahi M, Riahi E, Khosrowabadi R, Haghparast A. **A wide range of deep brain stimulation of the nucleus accumbens shell time independently reduces the extinction period and prevents the reinstatement of methamphetamine-seeking behavior in rats.** Life Sci 2023 319:121503 PubMed

15. Fan JM, Khambhati AN, Sellers KK, Stapper N, Maya DA, Kunwar E, Henderson C, Sugrue LP, Scangos KW, Chang EF, Rao VR, Krystal AD. **Epileptiform discharges triggered with direct electrical stimulation for treatment-resistant depression: factors that modulate risk and treatment considerations.** Brain Stimul 2023 16(2):462-465 PubMed Free Full Text

16. Fridgeirsson EA, Bais MN, Eijsker N, Thomas RM, Smit DJA, Bergfeld IO, Richard Schuurman P, van den Munckhof P, de Koning P, Vulink N, Figee M, Mazaheri A, van Wingen GA, Denys D. **Patient specific intracranial neural signatures of obsessions and compulsions in the ventral striatum.** J Neural Eng 2023 epub PubMed Free Full Text

17. Gao Q, Schimdt SL, Chowdhury A, Feng G, Peters JJ, Genty K, Grill WM, Turner DA, Pajic M. **Offline learning of closed-loop deep brain stimulation controllers for Parkinson disease treatment.** ArXiv 2023 (preprint before peer review) epub arXiv:2302.02477v2 PubMed Free Full Text

18. González-Herrero B, Di Vico IA, Pereira E, Edwards M, Morgante F. **Treatment of dystonic tremor of the upper limbs: a single-center retrospective study.** J Clin Med 2023 12(4):1427 PubMed Free Full Text

19. Ikezawa J, Yokochi F, Okiyama R, Isoo A, Agari T, Sunami Y, Terao T, Takahashi K. **Deep brain stimulation for patients with dystonia in Machado-Joseph disease: three case reports.** J Neurol 2023 epub PubMed

20. Johari K, Kelley RM, Tjaden K, Patterson CG, Rohl AH, Berger JI, Corcos DM, Greenlee JDW. **Human subthalamic nucleus neurons differentially encode speech and limb movement.** Front Hum Neurosci 2023 17:962909 PubMedFree Full Text

21. Jost ST, Konitsioti A, Loehrer PA, Ashkan K, Rizos A, Sauerbier A, Dos Santos Ghilardi MG, Rosenkranz F, Strobel L, Gronostay A, Barbe MT, Evans J, Visser-Vandewalle V, Nimsky C, Fink GR, Silverdale M, Cury RG, Fonoff ET, Antonini A, Chaudhuri KR, Timmermann L, Martinez-Martin P, Dafsari HS; EUROPAR and the International Parkinson and Movement Disorders Society Non-Motor Parkinson's Disease Study Group. **Non-motor effects of deep brain stimulation in Parkinson's disease motor subtypes.** Parkinsonism Relat Disord 2023 epub PubMed

22. Kolesárová M, Franko O, Kolesár D, Gažová A, Kyselovič J. **New trends in advanced Parkinson disease stage therapy.** Ceska Slov Farm 2023 72(1):37-44 PubMed

23. Lange F, Eldebakey H, Hilgenberg A, Weigl B, Eckert M, DeSunda A, Neugebauer H, Peach R, Roothans J, Volkmann J, Reich MM. **Distinct phenotypes of stimulation-induced dysarthria represent different cortical networks in STN-DBS.** Parkinsonism Relat Disord 2023 109:105347 PubMed Free Full Text

24. Lewis S, Radcliffe E, Ojemann S, Kramer DR, Hirt L, Case M, Holt-Becker AB, Raike R, Kern DS, Thompson JA. **Pilot study to investigate the use of in-clinic sensing to identify optimal stimulation parameters for deep brain stimulation therapy in Parkinson's disease.** Neuromodulation 2023 epub PubMed

25. Liang YW, Lai ML, Chiu FM, Tseng HY, Lo YC, Li SJ, Chang CW, Chen PC, Chen YY. **Experimental verification for numerical simulation of thalamic stimulation-evoked calcium-sensitive fluorescence and electrophysiology with self-assembled multifunctional optrode.** Biosensors (Basel) 2023 13(2):265 PubMed Free Full Text

26. Lofredi R, Scheller U, Mindermann A, Feldmann LK, Krauss JK, Saryyeva A, Schneider GH, Kühn AA. **Pallidal beta activity is linked to stimulation-induced slowness in dystonia.** Mov Disord 2023 epub PubMed Free Full Text

27. MacLean JA, Sanger TD. **Intermittent theta-burst deep brain stimulation in childhood dystonia.** Brain Stimul 2023 16(2):558-560 PubMed Free Full Text

28. Marcelis W, Vandamme S, Goethals M, De Weweire M, Vanhauwaert D, Cortier J, Maenhoudt W, Van Damme O. **Adapting STN-DBS stimulation pattern for the treatment of 'choreo dystonic lower limb dyskinesia' in Parkinson's disease.** Mov Disord Clin Pract 2022 10(2):323-325 PubMed

29. Mota CMD, Siler DA, Burchiel KJ, Madden CJ. **Acute deep brain stimulation of the paraventricular nucleus of the hypothalamus increases brown adipose tissue thermogenesis in rats.** Neurosci Lett 2023 799:137130 PubMed

30. Najera RA, Provenza N, Dang H, Katlowitz KA, Hertz A, Reddy S, Shofty B, Bellows ST, Storch EA, Goodman WK, Sheth SA. **Dual-target deep brain stimulation for obsessive-compulsive disorder and Tourette syndrome.** Biol Psychiatry 2023 epub PubMed

31. Nakamura M, Maruo T, Hashimoto H, Goto S, Ushio Y. **Brain abscess in a patient with generalized dystonia after deep brain stimulation: illustrative case.** J Neurosurg Case Lessons 2023 5(8):CASE22239 PubMed Free Full Text

32. Nambi Narayanan S, Subbian S. **HH model based smart deep brain stimulator to detect, predict and control epilepsy using machine learning algorithm.** J Neurosci Methods 2023 epub PubMed

33. Nawaz A, Hasan O, Jabeen S. **Formal verification of deep brain stimulation controllers for Parkinson's disease treatment.** Neural Comput 2023 epub 1-28 PubMed

34. Nip ISB, Burke MM 3rd, Kim Y. **The effects of deep brain stimulation on speech motor control in people with Parkinson's disease.** J Speech Lang Hear Res 2023 66(3):804-819 PubMed

35. Owodunni OP, Roster K, Varela S, Kazim SF, Okakpu U, Tarawneh OH, Thommen R, Kogan M, Sheehan J, Mckee R, Deligtisch A, Schmidt MH, Bowers CA. **Preoperative frailty risk in deep brain stimulation patients: risk analysis index predicts Clavien-Dindo IV complications.** Clin Neurol Neurosurg 2023 226:107616 PubMed

36. Pauly MG, Brüggemann N, Efthymiou S, Grözinger A, Diaw SH, Chelban V, Turchetti V, Vona B, Tadic V, Houlden H, Münchau A, Lohmann K. **Intronic variants, treatment, and review of the phenotypic spectrum in *VPS13D*-related disorder.** Int J Mol Sci 2023 24(3):1874 PubMed Free Full Text

37. Poon CH, Liu Y, Pak S, Zhao RC, Aquili L, Tipoe GL, Leung GK, Chan YS, Yang S, Fung ML, Wu EX, Lim LW. **Prelimbic cortical stimulation with L-methionine enhances cognition through hippocampal DNA methylation and neuroplasticity mechanisms.** Aging Dis 2023 14(1):112-135 PubMed Free Full Text

38. Rao AT, Chou KL, Patil PG. **Localization of deep brain stimulation trajectories via automatic mapping of microelectrode recordings to MRI.** J Neural Eng 2023 20(1) PubMed Free Full Text

39. Rosing J, Doyle A, Brinda A, Blumenfeld M, Lecy E, Spencer C, Dao J, Krieg J, Wilmerding K, Sullivan D, Best S, Mohanty B, Wang J, Johnson LA, Vitek JL, Johnson MD. **Classification of electrically-evoked potentials in the parkinsonian subthalamic nucleus region.** Sci Rep 2023 13(1):2685 PubMed Free Full Text

40. Roster K, Moya A, Owodunni OP, Courville EN, Schmidt M, Bowers CA. **A cautionary tale: frailty predicts mortality after deep brain stimulation and the risk analysis index has an unparalleled classification threshold.** J Neurosurg Sci 2023 epub PubMed

41. Versalovic E, Klein E, Goering S, Ngo Q, Gliske K, Boulicault M, Sullivan LS, Thomas MJ, Widge AS. **Deep brain stimulation for substance use disorders? An exploratory qualitative study of perspectives of people currently in treatment.** J Addict Med 2023 epub PubMed Free Full Text (scroll down on this page for full-text link)

42. Voruz P, Haegelen C, Assal F, Drapier S, Drapier D, Sauleau P, Vérin M, Péron JA. **Motor symptom asymmetry predicts cognitive and neuropsychiatric profile following deep brain stimulation of the subthalamic nucleus in Parkinson's disease: a 5-year longitudinal study.** Arch Clin Neuropsychol 2023 acad013 PubMed Free Full Text

43. Wang P, Zhao L, Wang T, Mei W, Li J, An Y, Li L, Li Z. **Comparison of half-effective concentration of propofol in patients with Parkinson's disease and non-Parkinson's disease.** Clin Interv Aging 2023 18:307-315 PubMed Free Full Text

44. Wiest C, Torrecillos F, Pogosyan A, Bange M, Muthuraman M, Groppa S, Hulse N, Hasegawa H, Ashkan K, Baig F, Morgante F, Pereira EA, Mallet N,

Magill PJ, Brown P, Sharott A, Tan H. **The aperiodic exponent of subthalamic field potentials reflects excitation/inhibition balance in parkinsonism.** Elife 2023 12:e82467 PubMed Free Full Text

45. Witzig V, Alosaimi F, Temel Y, Schulz JB, Jahanshahi A, Tan SKH. **Gait improvement by high-frequency stimulation of the subthalamic nucleus in parkinsonian mice is not associated with changes of the cholinergic system in the pedunculopontine nucleus.** Neurosci Lett 2023 epub 137134 PubMed Free Full Text

46. Wong JK, Lopes JMLJ, Hu W, Wang A, Au KLK, Stiep T, Frey J, Toledo JB, Raike RS, Okun MS, Almeida L. **Double blind, nonrandomized crossover study of active recharge biphasic deep brain stimulation for primary dystonia.**Parkinsonism Relat Disord 2023 109:105328 PubMed Free Full Text

47. Wu D, Zhao B, Xie H, Xu Y, Yin Z, Bai Y, Fan H, Zhang Q, Liu D, Hu T, Jiang Y, An Q, Zhang X, Yang A, Zhang J. **Profiling the low-beta characteristics of the subthalamic nucleus in early- and late-onset Parkinson's disease.**Front Aging Neurosci 2023 15:1114466 PubMed Free Full Text

48. Wu N, Liu H, Wang J, Zhang C, Wu C, Huo X, Zhang G. **Study on deep brain magnetic stimulation method based on magnetic replicator. Chinese.** Sheng Wu Yi Xue Gong Cheng Xue Za Zhi 2023 40(1):1-7 PubMed

49. Xu J, Huang T, Dana A. **Deep brain stimulation of the subthalamic nucleus to improve symptoms and cognitive functions in patients with refractory obsessive-compulsive disorder: a longitudinal study.** Neurol Sci 2023 epub PubMed

50. Yang Y, He Q, Dang Y, Xia X, Xu X, Chen X, Zhao J, He J. **Long-term functional outcomes improved with deep brain stimulation in patients with disorders of consciousness.** Stroke Vasc Neurol 2023 svn-2022-001998 PubMed Free Full Text

51. Yang Y, Zhang F, Gao X, Feng L, Xu K. **Progressive alterations in electrophysiological and epileptic network properties during the development of temporal lobe epilepsy in rats.** Epilepsy Behav 2023 141:109120 PubMed

52. Yuen J, Goyal A, Rusheen AE, Kouzani AZ, Berk M, Kim JH, Tye SJ, Blaha CD, Bennet KE, Lee KH, Shin H, Oh Y. **High frequency deep brain stimulation can mitigate the acute effects of cocaine administration on tonic dopamine levels in the rat nucleus accumbens.** Front Neurosci 2023 17:1061578 PubMed Free Full Text

53. Zimmermann J, Sahm F, Arbeiter N, Bathel H, Song Z, Bader R, Jonitz-Heincke A, van Rienen U. **Experimental and numerical methods to ensure comprehensible and replicable alternating current electrical stimulation experiments.** Bioelectrochemistry 2023 151:108395 PubMed Free Full Text

Dorsal Root Ganglion Stimulation (now 242 citations)

1. Kuwabara Y, Howard-Quijano K, Salavatian S, Yamaguchi T, Saba S, Mahajan A. **Thoracic dorsal root ganglion stimulation reduces acute myocardial ischemia induced ventricular arrhythmias.** Front Neurosci 2023 17:1091230 PubMed Free Full Text

Gastric Electrical Stimulation (still 519 citations)

Peripheral Nerve Stimulation (now 686 citations)

1. Abd-Elsayed A, Moghim R. **Efficacy of peripheral nerve stimulation with a high frequency electromagnetic coupled (HF-EMC) powered implanted receiver in treating different pain targets/neuralgias.** J Pain Res 2023 16:589-596 PubMed Free Full Text
2. Alexoudi A, Vlachakis E, Banos S, Oikonomou K, Patrikelis P, Verentzioti A, Stefanatou M, Gatzonis S, Korfias S, Sakas D. **Combined invasive peripheral nerve stimulation in the management of chronic post-intracranial disorder headache: a case report.** Clin Pract 2023 13(1):297-304 PubMed Free Full Text
3. Dominguez Garcia MM, Abejon Gonzalez D, de Diego Gamarra JM, Cánovas Martinez ML, Balboa Díaz M, Hadjigeorgiou I. **Symptoms and pathophysiology of cluster headache. Approach to combined occipital and supraorbital neurostimulation.** Rev Esp Anestesiol Reanim (Engl Ed) 2023 epub PubMed
4. Gilligan C, Burnside D, Grant L, Yong RJ, Mullins PM, Schwab F, Mekhail N. **ReActiv8 stimulation therapy vs. optimal medical management: a randomized controlled trial for the treatment of intractable mechanical chronic low back pain (RESTORE trial protocol).** Pain Ther 2023 epub PubMed Free Full Text
5. Li J, Li Y, Shu W. **Peripheral nerve stimulation relieves post-traumatic trigeminal neuropathic pain and secondary hemifacial dystonia.** Front Neurol 2023 14:1107571 PubMed Free Full Text
6. Mach S, Javed S, Chen GH, Huh BK. **Peripheral nerve stimulation for back pain in patients with multiple myeloma as bridge therapy to radiation treatment: a case series.** Neuromodulation 2023 epub PubMed
7. Sevim M, Alkiş O, Kartal İG, Kazan HO, İvelik Hİ, Aras B, Kabay Ş. **Comparison of transcutaneous tibial nerve stimulation versus percutaneous tibial nerve stimulation in category IIIB chronic prostatitis/chronic pelvic pain syndrome: a randomized prospective trial.** Prostate 2023 epub PubMed

Sacral Nerve Stimulation (now 1164 citations)

1. Rueb J, Goldman HB, Vasavada S, Moore C, Rackley R, Gill BC. **Effect of pulse width variations on sacral neuromodulation for overactive bladder symptoms: a prospective randomized crossover feasibility study.**Neurourol Urodyn 2023 epub PubMed
2. Swallow CH, Harvey CN, Harmanli O, Shepherd JP. **Universal urogynecologic consultation and screening for fecal incontinence in pregnant women with a history of obstetric anal sphincter injury: a cost-effectiveness analysis.**Urogynecology (Hagerstown) 2023 29(3):351-359 PubMed
3. Wang XH, Wang JW, Zhang W, Liu XD, Yan ZH, Meng LF, Zhang YG. **Application ofthe first rechargeable sacral neuromodulation system for treatment of neurogenic lower urinary tract dysfunction in China: a case report.** Am J Transl Res 2023 15(1):324-329 PubMed Free Full Text

Spinal Cord Stimulation (now 3082 citations)

1. Barbosa RG, Lages GV. **The placement of the spinal cord stimulator paddle electrode via monoportal interlaminar endoscopic approach: technical note.** Neuromodulation 2023 epub PubMed
2. Falowski SM, Benison AM, Nanivadekar AC. **Regional coverage differences with single- and multiarea burst spinal cord stimulation for treatment of chronic pain.** Neuromodulation 2023 epub PubMed
3. Goudman L, Putman K, Van Doorslaer L, Billot M, Roulaud M, Rigoard P, TRADITION consortium, Moens M. **Proportion of clinical holistic responders in patients with persistent spinal pain syndrome type II treated by subthreshold spinal cord stimulation compared to best medical treatment: a study protocol for a multicentric randomised controlled trial (TRADITION).** Trials 2023 24(1):120 PubMed Free Full Text
4. Hasoon J, Robinson C, Urits I, Viswanath O, Kaye AD. **Utilizing 10kHz stimulation to salvage a failed low frequency spinal cord stimulation trial.** Orthop Rev (Pavia) 2023 15:57624 PubMed Free Full Text
5. On J, Polania Gutierrez JJ, Plaza-Lloret M, Dua A, Sun Z. **Spinal cord stimulation for the treatment of refractory pain from Tarlov cysts: a case report.** Cureus 2023 15(1):e33928 PubMed Free Full Text
6. Powell MP, Verma N, Sorensen E, Carranza E, Boos A, Fields DP, Roy S, Ensel S, Barra B, Balzer J, Goldsmith J, Friedlander RM, Wittenberg GF, Fisher LE, Krakauer JW, Gerszten PC, Pirondini E, Weber DJ, Capogrosso M. **Epidural stimulation of the cervical spinal cord for post-stroke upper-limb paresis.** Nat Med 2023 epub PubMed

7. Prabhala T, Figueroa F, Harland T, Nabage MN, Pilitsis JG. **The use of salvage procedures for wound complications in neuromodulation.** World Neurosurg 2023 171:e596-e604 PubMed

8. Rajkumar S, Venkatraman V, Yang LZ, Parente B, Lee HJ, Lad SP. **Short-term health care costs of high-frequency spinal cord stimulation for the treatment of postsurgical persistent spinal pain syndrome.** Neuromodulation 2023 epub PubMed

9. Tanei T, Maesawa S, Nishimura Y, Nagashima Y, Ishizaki T, Mutoh M, Ito Y, Saito R. **Relief of central poststroke pain affecting both the arm and leg on one side by double-independent dual-lead spinal cord stimulation using fast-acting subperception therapy stimulation: a case report.** NMC Case Rep J 2023 10:15-20 PubMed Free Full Text

10. Verma N, Romanauski B, Lam D, Lujan L, Blanz S, Ludwig K, Lempka S, Shoffstall A, Knudson B, Nishiyama Y, Hao J, Park HJ, Ross E, Lavrov I, Zhang M. **Characterization and applications of evoked responses during epidural electrical stimulation.** Bioelectron Med 2023 9(1):5 PubMed Free Full Text

11. Wallace MS, North JM, Phillips GM, Calodney AK, Scowcroft JA, Popat-Lewis BU, Lee JM, Washabaugh EP 3rd, Paez J, Bolash RB, Noles J, Atallah J, Shah B, Ahadian FM, Trainor DM, Chen L, Jain R. **Combination therapy with simultaneous delivery of spinal cord stimulation modalities: COMBO randomized controlled trial.** Pain Manag 2023 epub PubMed Free Full Text

12. Witkam RL, Kragt EAM, Arnts IJJ, Bronkhorst EM, van Dongen R, Kurt E, Steegers MAH, van Haren FGAM, Maandag NJG, Gort C, Henssen DJHA, Wegener JT, Vissers KCP. **Spinal cord stimulation for failed back surgery syndrome: to trial or not to trial?** J Pain 2023 epub PubMed Free Full Text

13. Zinboonyahgoon N, Saengsomsuan N, Chaikittiporn N, Wangnamthip S, Kositamongkol C, Phisalprapa P. **Cost-utility and cost-effectiveness analysis of spinal cord stimulation for chronic refractory pain in the context of developing country.** Pain Physician 2023 26(1):69-79 PubMed Free Full Text>

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