Peripheral Nerve Stimulation for Chronic Pain: A Systematic Review of Efficacy and Safety Across Five Anatomical Domains

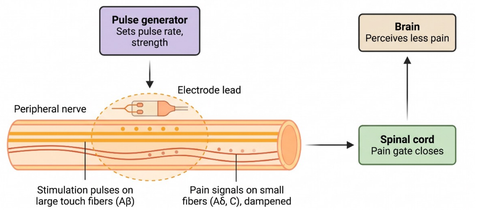
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01 Background

Peripheral nerve stimulation (PNS) delivers targeted electrical impulses to peripheral nerves, interrupting pain signaling through Melzack and Wall's gate control theory.[1] It has seen a recent resurgence driven by percutaneous techniques, ultrasound guidance, and new implantable, a mechanism more focal and less invasive than SCS or DBS that also provides more potent, long-lasting relief. It is applied widely to treat many different types of pain; this systematic review evaluates its efficacy and safety across five anatomical domains.



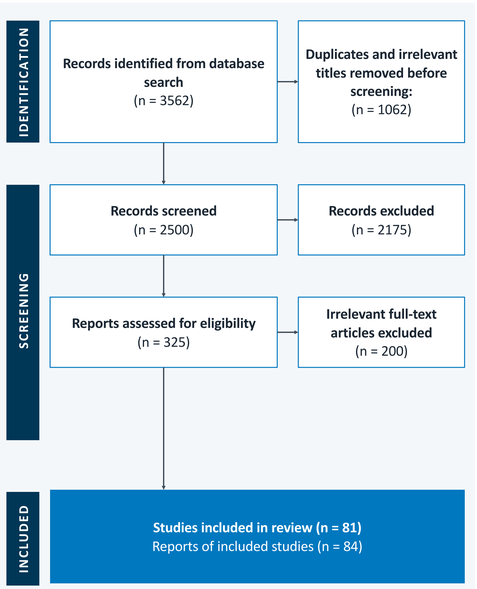
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02 Objectives

1. **Primary:** Evaluate the efficacy and safety of implantable peripheral nerve stimulation for chronic pain across five anatomical domains: headache/ craniofacial, trunk/axial, musculoskeletal, pelvic/ genitourinary, and extremity/neuropathic pain.
2. **Secondary:** Appraise risk of bias and industry funding across peripheral nerve stimulation literature to contextualize reported treatment effects.

03 Methods & Study Selection

Incorporated a PRISMA-guided database search of RCTs, observational studies, case series, and case reports of implantable PNS for chronic pain. Studies were grouped into five anatomical domains. Risk of bias was assessed by RoB 2.0 (RCTs) and ROBINS-I (non-randomized), plus a funding and sponsorship domain for all studies.



Sources: PubMed, Embase, Cochrane · **Last search:** September 2025

Figure 1. PRISMA 2020 flow diagram of study selection.

04 Results

2,633
Participants across studies

53% v. 6%
PNS vs. medical management patients that achieve ≥ 50% relief[2]

4.6%
Overall infection rate

Table 1. Summary of main efficacy and safety findings in all studies across five anatomical domains.

Pain condition	Patients (n)	≥50% responders (studies; pooled n/N)	Pain intensity, NRS/VAS (studies; mean → mean)	Lead migration (studies; n/N)
Back and Thoracic	≈716	16 studies; 285/434 (66%)	10 studies; 7.1 → 3.0 (58%↓)	14 studies; 12/479 (2.5%)
Genitourinary / pelvic	≈326	14 studies; 197/305 (65%)	10 studies; 7.4 → 2.5 (66% ↓)	4 studies; 4/107 (3.7%)
Headache	≈625	11 studies; 314/576 (55%)	7 studies; 7.4 → 4.3 (≈42% ↓)	8 studies; 80/575 (13.9%)
Musculoskeletal	≈174	10 studies; 116/142 (82%)	2 studies; 7.8 → 1.5 (81% ↓)	3 studies; 4/100 (4.0%)
Neuropathic	≈792	19 studies; 222/331 (67%)	9 studies; 7.8 → 3.1 (60% ↓)	3 studies; 36/239 (15.1%)
Overall	≈2,633	70 studies; 1,134/1,788 (63%)	38 studies; ~7.4 → 3.1 (59% ↓)	32 studies; 136/1,500 (9.1%)

05 Risk of Bias

Region	Study	D1	D2	D3	D4	D5	D6	Funding
Head & face	Dodick 2015	?	?	−	−	−	−	−
	Mekhail 2017	+	?	+	+	+	+	−
	Saper 2011	?	?	−	?	−	−	−
	Schoenen 2013	+	+	+	+	+	+	−
	Serra 2012	?	?	−	−	?	?	+
Trunk / axial	Eldabe 2019	+	?	−	−	−	+	−
	Gilligan 2023 (2-yr)	+	?	−	−	−	+	−
	Gilligan 2023 (3-yr)	+	?	−	−	−	?	−
	Gilligan 2024	+	?	−	−	−	−	−
	Schwab 2025	+	?	−	−	+	+	−
MSK	Gongora-Rodriguez 2024	+	−	?	+	+	+	+
Pelvic / GU	Istek 2014	?	?	−	−	+	?	+
	Peters 2007	?	?	?	−	?	?	−
Neuropathic	Deer 2016	+	+	−	?	?	+	−
	Gilmore 2019	+	+	+	+	+	+	−
	Hatheway 2026	?	?	−	−	?	?	−
	Kapural 2024	?	?	+	?	+	+	−

+ Low ? Unclear − High

D1 Sequence generation **D2** Allocation concealment **D3** Blinding of participants/personnel
D4 Blinding of outcome assessors **D5** Incomplete outcome data **D6** Selective reporting

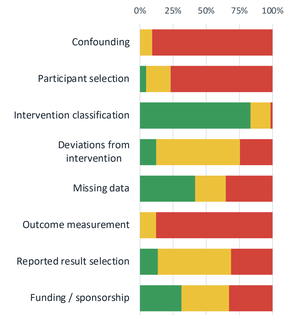


Figure 3. Left: RCTs (17 reports), Cochrane RoB 2. Right: non-randomized studies, ROBINS-I (% of studies assessed per domain).

05 Discussion

- PNS effectively provided pain relief in its applications across all five domains, and serious complications were rare with no reported permanent neurologic injury.
- However, most studies were uncontrolled, and pain-related outcomes are largely unblinded and self reported. Industry funding or author conflicts affected 42% of all studies (14 RCTs).
- **Limitations:** Devices, nerve targets, stimulation settings, and follow-up varied widely, which prevented meta-analysis and direct comparison between systems.

06 Conclusions

- **PNS produced clinically meaningful, often durable pain relief in all five domains**
- **Both temporary and permanent approaches worked, and some 60-day systems gave relief that lasted after lead removal.**
- **Needs larger blinded, multicenter RCTs with standardized outcomes and long-term follow-up**

Key References

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Disclosures: None

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