Percutaneous vs. paddle lead spinal cord stimulation and device revision

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BACKGROUND

Paddle leads are widely believed to be more durable than percutaneous leads, but that belief rests on pre-2010 implants.

Rechargeable generators, novel waveforms, and multi-column arrays have changed the exposure, and a 2025 systematic review found no guidance for choosing lead type. A modern real-world comparison was missing.

OBJECTIVE

Compare percutaneous vs. paddle leads on device revision, explant, and persistent opioid therapy in the current device era.

METHODS

Retrospective cohort, TriNetX US Collaborative Network, 2016–2023. Postlaminectomy syndrome (M96.1) or CRPS-I (G90.5).

Because SCS is staged and the trial lead is always percutaneous, patients were anchored on first generator implant (CPT 63685), not lead placement. Lead type followed the code billed within 7 days: percutaneous (63650) or paddle (63655).

Outcome capture began on day 8 so the staged implant was not counted as failure. 1:1 propensity matched on 22 characteristics (all SMD < 0.03).

Primary outcome: lead-level revision or removal (63661–63664) at 12 and 24 months. Inpatient encounter = positive control; URI and cataract = falsification.

RESULTS

6,492 percutaneous and 4,483 paddle patients met criteria; matching produced 4,179 per arm with all standardized differences below 0.03.

1.25 HR

More lead-level revision

24-month hazard of lead-level revision with percutaneous leads, ~20% higher than paddle

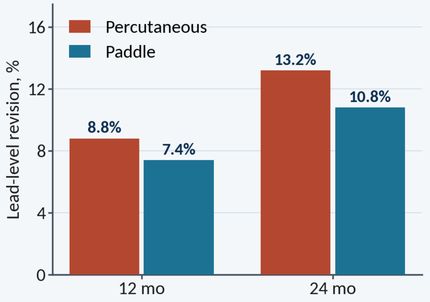


Fig 1. Lead-level revision higher with percutaneous at 12 mo (8.8% vs 7.4%) and 24 mo (13.2% vs 10.8%, HR 1.245, p=0.001).

1.11 RR

Explant does not differ

Explant did not differ at 24 months: the effect is reintervention, not device abandonment

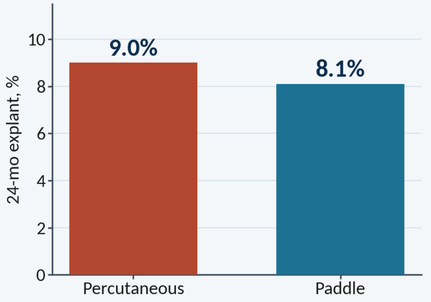


Fig 2. 24-mo explant 9.0% vs 8.1% (RR 1.113, ns). Revision without explant = reintervention on the lead.

1.25 RR

Persistent opioid therapy

Persistent opioid therapy at 6–12 mo, unchanged after rematching on opioid potency

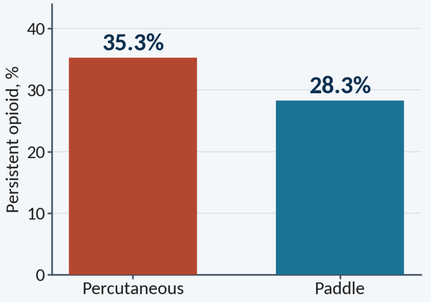


Fig 3. Persistent opioid 35.3% vs 28.3% (RR 1.247), essentially unchanged after potency rematch (1.239).

0.21 RR

Arm assignment confirmed

Positive controls confirmed arm assignment; falsification endpoints null and opposite

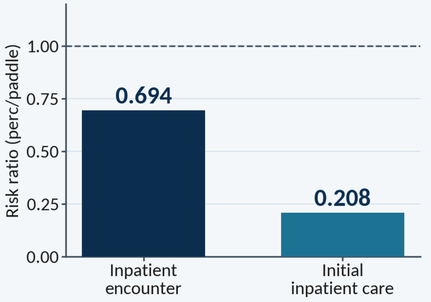


Fig 4. Positive controls separate (inpatient RR 0.694, initial inpatient care 0.208, both p<0.001). Falsification floor ~16%.

CONCLUSIONS

Percutaneous leads carried a modestly higher rate of lead-level revision than paddle leads through 24 months, roughly 20% on the hazard scale, **with no difference in explant**. The effect is far smaller than historical claims estimates and only narrowly exceeds the residual-confounding floor set by the falsification endpoints, so it is best read as a small difference in lead reintervention rather than device abandonment.

Whether it reflects true lead failure or a lower procedural threshold for revising a percutaneous lead cannot be separated in procedural claims data.

The prespecified five-code composite (which also included generator revision) was null at 12 months; the lead-only signal is significant at both windows.

KEY REFERENCES

1. Babu et al. Outcomes of percutaneous vs paddle lead SCS (MarketScan). Neuromodulation. 2013.

2. Dhruva et al. SCS vs conventional medical management. JAMA Neurol. 2022.

3. 2025 systematic review: no guidance for lead-type selection.

CONTACT

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Scan for the full abstract and contact details.

Devoid of patient-identifiable information; exempt from IRB review per Tulane University School of Medicine policy.