



Pilot Study Assessing Analgesic Effects of Peri-Auricular Nerve Stimulation Post-Ambulatory Rotator Cuff Repair

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INTRODUCTION

Peripheral nerve blocks help manage shoulder surgery pain but are short-acting, often causing rebound pain. Catheters extend relief but pose infection risks and require more resources. Long-acting liposomal bupivacaine has mixed results.

Peri-Auricular Nerve Stimulation (PANS) targets nerves like the auriculotemporal, glossopharyngeal, and occipital, modulating neurotransmitters for analgesia. Auricular stimulation, linked to acupuncture, reduces opioid use post-kidney donation. FDA-approved for opioid withdrawal, a recent study found it effective for postoperative pain after single-shot nerve blocks in ambulatory shoulder surgery. Patients reported low pain, minimal opioid use, and ease of home use.

This study evaluates PANS in primary rotator cuff repair, assessing pain, opioid use, and nausea against a historical control. Preliminary pilot results are available.

STUDY DESIGN

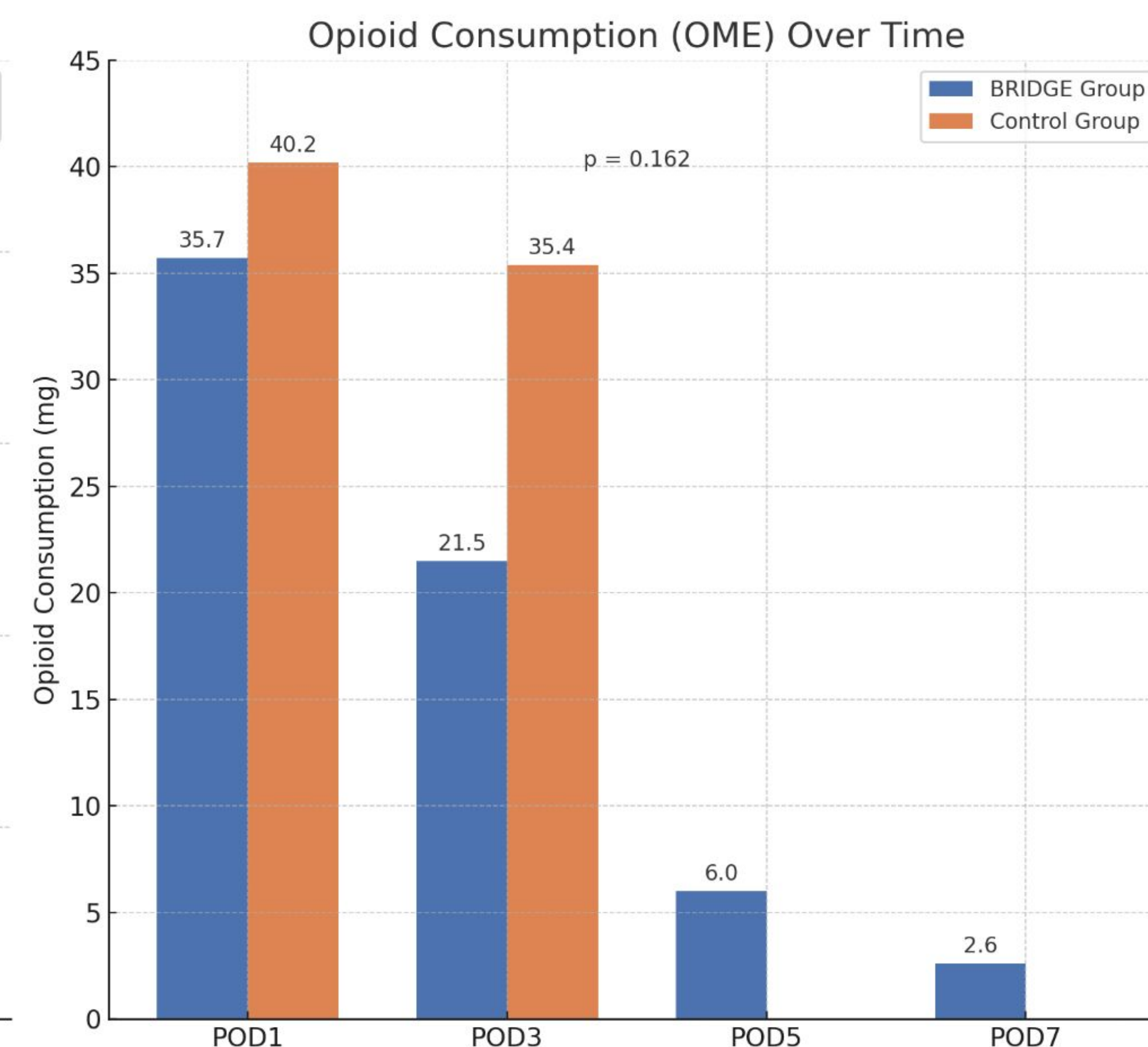
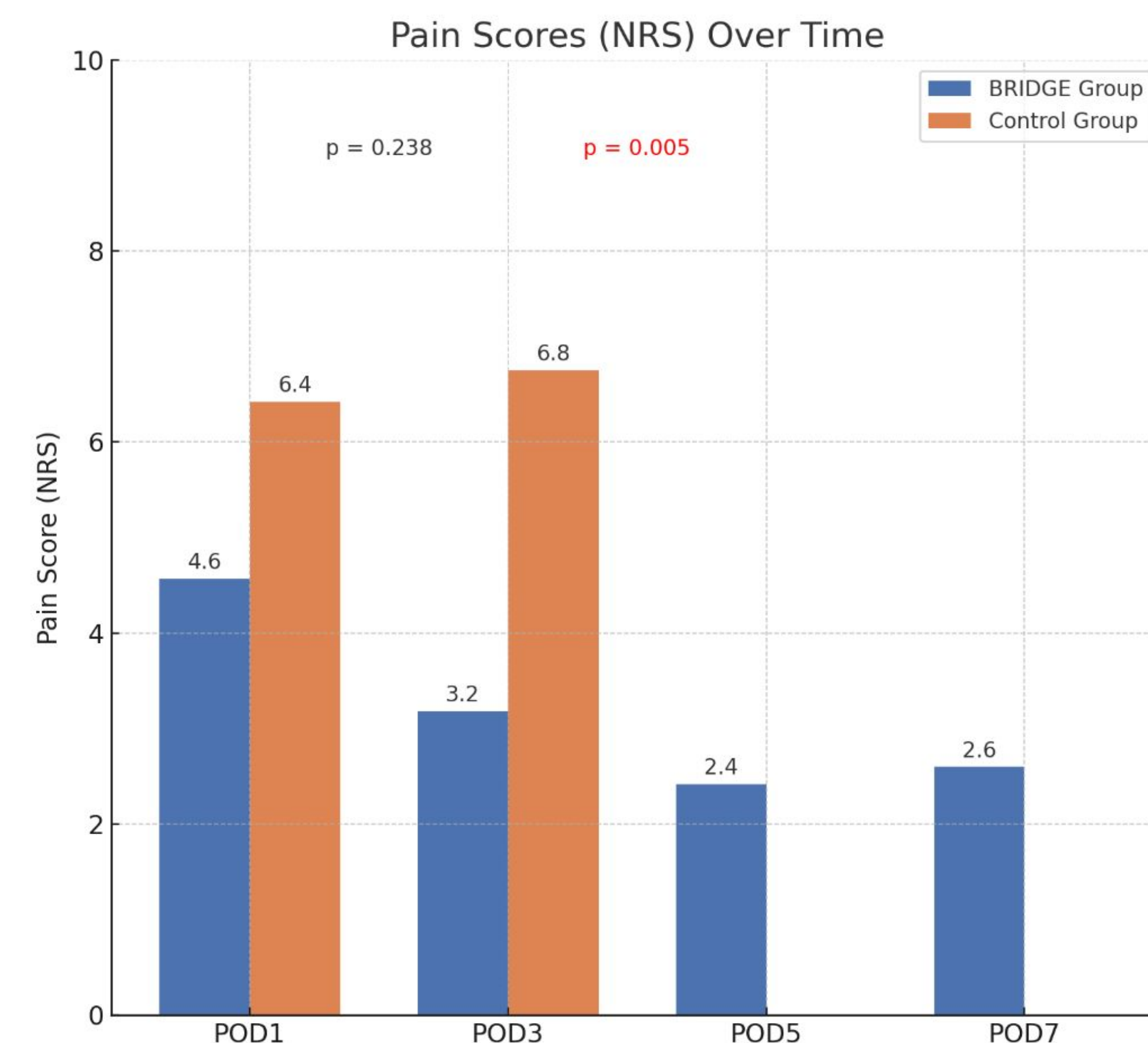
Adult patients undergoing arthroscopic ambulatory rotator cuff repair with interscalene block and propofol sedation were recruited. Informed consent was obtained. Multimodal analgesia included acetaminophen, ketamine, and dexamethasone. Exclusion criteria included pediatric patients, chronic pain or opioid dependence (>20 OMEs/day), contraindications to nerve blocks, or chronic respiratory disorders. Interscalene block was performed with 12–14 mL of 0.5% bupivacaine under ultrasound guidance. Postoperatively, the Peri-Auricular Nerve Stimulation device ("NSS-2 BRIDGE®") was placed on the ipsilateral ear. Skin was aseptically prepared before attaching four electrodes. The device was activated immediately before placement, with stimulation expected to last five days. Patients reported perceiving mild electrical pulses near the ear, which typically diminished over time. Postoperative instructions included daily electrode maintenance and removal on day five. Follow-ups occurred via email on postoperative days 1, 3, 5, and 7 to assess pain, opioid use, side effects, and device issues. Satisfaction was measured on day 7.

GROUP CHARACTERISTICS

Characteristic	Historical Controls (N=27)	Study Group (N=15)	Statistical Test	Null Hypothesis	p-value	Conclusion
Age (Mean ± SD)	56.2 (7.8)	58.3 (6.4)	Independent t-test or Mann-Whitney U test	No significant difference in age between groups.	0.38	Indifferent
Male (%)	55.5%	60%	Chi-square test or Fisher's exact test	The proportion of males is the same between groups.	0.79	Indifferent
Side (R-L %)	48%–52%	53%–47%	Chi-square test or Fisher's exact test	The distribution of right vs. left side is the same between groups.	0.62	Indifferent
BMI (Mean ± SD)	32.3 (7.8)	30.5 (8.1)	Independent t-test or Mann-Whitney U test	No significant difference in BMI between groups.	0.48	Indifferent
PS1 (%)	3.7%	6.7%	Chi-square test or Fisher's exact test	The proportion in PS1 category is the same between groups.	0.46	Indifferent
PS2 (%)	67.7%	73.3%	Chi-square test or Fisher's exact test	The proportion in PS2 category is the same between groups.	0.52	Indifferent
PS3 (%)	29.6%	20%	Chi-square test or Fisher's exact test	The proportion in PS3 category is the same between groups.	0.34	Indifferent

RESULTS

Measure	Day	BRIDGE Group Mean (SD)	Control Group Mean (SD)	Difference	T-Test (p-value)	ANOVA (p-value)
Pain Scores (NRS)	POD1	4.57 (2.9)	6.42 (2.58)	-1.85 (28.8%)	0.238	0.662
	POD3	3.18 (2.2)	6.75 (2.01)	-3.57 (52.9%)	0.005	<0.001
	POD5	2.42 (2.1)	—	—	—	—
Opioid Consumption (OME)	POD7	2.6 (1.7)	—	—	—	—
	POD1	35.7 (37.1)	40.2 (28.5)	-4.5 (11.2%)	0.706	—
	POD3	21.5 (20.9)	35.4 (25.7)	-13.9 (39.2%)	0.162	—
	POD5	6.0 (17.2)	—	—	—	—
	POD7	2.6 (1.7)	—	—	—	—



ANALYSIS AND DISCUSSION

Pain Scores:

- **POD1:** No statistically significant difference in pain scores between groups (**p = 0.238**).
- **POD3:** A **highly significant reduction** in pain scores in the Peri-Auricular Nerve Stimulation group compared to controls (**p = 0.005; ANOVA p < 0.001**).
- **POD5 and POD7:** No control data available for comparison, but the Peri-Auricular Nerve Stimulation group scores show continued improvement.

Opioid Consumption:

- **POD1:** No statistically significant difference in opioid consumption between groups (**p = 0.706**).
- **POD3:** Despite a noticeable reduction in opioid consumption in the Peri-Auricular Nerve Stimulation group compared to controls, the difference did not reach statistical significance (**p = 0.162**).
- **POD5 and POD7:** No control data available, but the Peri-Auricular Nerve Stimulation group shows a steady decline in opioid usage.

Discussion:

In this pilot trial, we found a **significant reduction in pain scores** on **postop day 3** and a **modest reduction on postop day 1** for patients utilizing the Peri-Auricular Nerve Stimulation device, when compared to a historical control group. Although there was a reduction in opioid consumption, the difference did not reach statistical significance.

The device is simple to apply and wear, though three patients did remove the device early — two due to ear soreness, and one due to malfunction after the device was exposed to water during a shower, with a sensation thereafter of continuous stimulation that was unpleasant for the patient.

The **Peri-Auricular Nerve Stimulation device** may be potentially useful as an addition to current multimodal analgesic techniques for **postoperative pain management**.

This pilot study provides promising results that warrant further investigation in larger, controlled trials.

REFERENCES

1. Abdallah FW. Perioperative analgesia and outcomes. Anesth Analg. 2015;120:1114.
2. Hussain N. Management of chronic pain in the elderly. Anesthesiology. 2021;134:147.
3. Chelly JE. Complementary and integrative medicine: An evolving field. J Complement Integr Med. 2021. doi: 10.1515/jcim-2021-0208.
4. Ilfeld BM. Advances in regional anesthesia and pain management. Reg Anesth Pain Med. 2022;47:581.

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