

# Use of Electrical Neuromodulation for Treating Chronic Pain Syndromes in the Pediatric Population

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## ABSTRACT

**Objectives:**  
To characterize the existing clinical experiences of implantable electrical neuromodulation interventions for treating chronic pain syndromes in the pediatric population.

**Design:**  
Systematic review using PRISMA methodology.

**Data sources:**  
PubMed, EMBASE, and reference lists from January 1966 through July 2020.

**Study Selection:**  
Clinical studies using invasive electrical neuromodulation for managing chronic pain in persons <18 years of age.  
**Data extraction and analysis:**  
Two reviewers independently extracted relevant demographic and clinical parameters from each study.

**Results:**  
A total 11 studies describing experiences of treating 19 children were included. All studies were observational and low level of evidence. The cohort was mostly adolescent (18/19), suffered from CRPS (14/19), refractory to other measures of management (16/16), and received spinal cord stimulation (17/20). Most patients with CRPS (13/14) reported significant pain relief and functional recovery, which included recovered range of motion, ambulation, and return to school and sports. Neuromodulation limitations included suboptimal/lost analgesia (3/19), lead/device revision (3/19), and subcutaneous infection (1/19).

**Conclusions:**  
Our findings support the judicious use of invasive neuromodulation strategies to optimize recovery potential in children with refractory pain conditions but also highlight the need for further investigation. Important differences between adults and children that require exploration include relapse rate and anatomic considerations dictating lead placement and risk of migration.

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## INTRODUCTION

- Chronic pain syndromes in children can carry significant threats to psychological well-being, functional impairments, and severe disability<sup>1</sup>.
- Unfortunately, many standard of care analgesics, which include opiates in refractory conditions, can have sedative and psychotropic properties that can be poorly tolerated in the pediatric population<sup>1</sup>.
- In past decade, several high-level studies have demonstrated the utility of implantable electrical neuromodulation interventions for treating various chronic pain syndromes, reducing medication requirements, and even restoring functional capacity<sup>2</sup>.
- While these studies have largely explored neuromodulation in adults, similar research within the pediatric setting is lacking<sup>2</sup>.

## METHODS AND MATERIALS

**Objectives:**  
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Systematic review using PRISMA methodology.

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**Data extraction and analysis:**  
Two reviewers independently extracted relevant demographic and clinical parameters from each study.

## RESULTS

- Total 11 studies (n=19)
- All studies were low level of evidence (Figure 2)
- Cohort characteristics:
  - mostly adolescent (18/19)
  - suffered from CRPS (14/19)
  - refractory cases (16/16)
  - received spinal cord stimulation (17/20)
- Most patients with CRPS (13/14) reported significant pain relief and functional recovery (recovered ROM, ambulation, and return to school and sports).
- Neuromodulation limitations included:
  - suboptimal/lost analgesia (3/19)
  - lead/device revision (3/19)
  - subcutaneous infection (1/19).

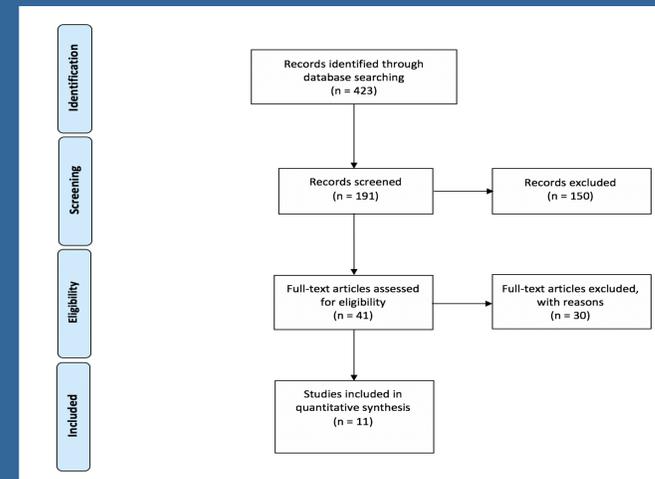


Figure 1. PRISMA Flow Diagram.

## DISCUSSION

- Important differences between adults and children that require exploration include relapse rate and anatomic considerations, such as pubertal growth, in dictating lead placement and risk of migration.

## CONCLUSIONS

Consider judicious use of invasive neuromodulation strategies to optimize recovery potential in children with refractory pain conditions

## REFERENCES

- Guite JW, Sherry DD, Jarvis EW, Lewen M, Khan S, Wickham Kraemer F. Medication use among pediatric patients with chronic musculoskeletal pain syndromes at initial pain clinic evaluation. *Pain management*. 2018 Jan;8(1):15-25.
- Karri J, Joshi M, Polson G, Tang T, Lee, M, Deer T, and Abd-Elsayed AA. Spinal Cord Stimulation for Chronic Pain Syndromes: A Review of Considerations in Practice Management. *Pain physician*. 2020 Nov.

### Bias Domain

- Selection (randomization)
- Performance (cointerventions avoided or similar)
- Detection (outcomes clearly measured)
- Data reporting (outcomes clearly reported)
- Reporting (selective outcome reporting)
- Other (financial biases, etc.)

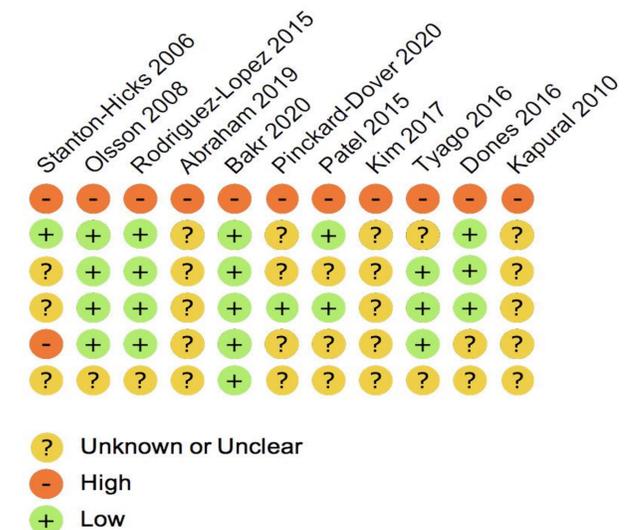


Figure 2. Risk of Bias Summary.