American Pain Society
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PUBLISHED BY ELSEVIER

The Journal of Pain, Vol 18, No 6 (June), 2017: pp 605-614
Available online at www.jpain.org and www.sciencedirect.com

Critical Reviews

Prevalence and Predictors of Chronic Postsurgical Pain in Children: A Systematic Review and Meta-Analysis

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Abstract: **Emerging research suggests that pain may persist longer-term for many children after major surgery, with significant effects on their health outcomes. This systematic review identified the prevalence of chronic postsurgical pain (CPSP) in children after surgery, and determined presurgical biomedical and psychosocial risk factors associated with CPSP prevalence or severity. Prospective studies assessing CPSP 3 to 12 months after surgery in children 6 to 18 years of age published in English in MedLine, EMBASE, PsycINFO, and Cochrane Database of Systematic Reviews since 1996 were eligible for inclusion. Of 16,084 abstracts yielded by the search, 123 full articles were assessed for eligibility, and 12 studies were included in the review. Overall quality of included studies assessed using the Quality in Prognostic Studies tool was low. On the basis of 4 studies with a total of 628 participants across all surgery types, median prevalence of CPSP across studies was 20% (25th percentile = 14.5%, 75th percentile = 38%) at 12 months after surgery. Presurgical pain intensity, child anxiety, child pain coping efficacy, and parental pain catastrophizing were the only presurgical factors identified as predictive of CPSP. Biological and medical factors assessed were not associated with CPSP in any study. Well designed studies examining prevalence and predictors of CPSP are critically needed in children.**

Perspective: ***In this systematic review, the median prevalence of CPSP in children was 20% across studies. Presurgical pain intensity, and child and parent psychosocial factors predicted CPSP. Additional resources and interventions are needed for youth who report persistent pain after surgery.***

Key words: *Postoperative pain, chronic pain, child, pediatric, persistent pain, operative.*

Close to 5 million children undergo surgery in the United States each year, and many experience significant pain and distress during the initial days and weeks of recovery. Approximately one-half of children report moderate-severe pain in the hospital after surgery.[5] However, relatively less is known about the short- and long-term recovery of children after surgery. Children often continue to report pain for months after surgery, and emerging research suggests that pain may persist longer-term for many children.

Chronic postsurgical pain (CPSP) is defined as pain lasting >3 months after surgery, that is not otherwise associated with preexisting problems or postoperative complications.[9] CPSP is reported in 10 to 50% of adults undergoing major surgery.[8,9] CPSP in adults is associated with higher functional disability, increased missed work days, and higher levels of depressive symptoms. Recent studies have investigated long-term outcomes in children undergoing surgery, showing that CPSP is associated with poorer health outcomes and with greater functional disability after surgery.[22]

This study was funded by the Eunice Kennedy Shriver National Institute of Child Health and Human Development of the National Institutes of Health under award number K23HD078239 (PI: Jennifer A. Rabbitts); Tonya M. Palermo is supported by NIH K24HD060068.

The authors have no conflicts of interest to declare.

Supplementary data accompanying this article are available online at www.jpain.org and www.sciencedirect.com.

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1526-5900/$36.00

http://dx.doi.org/10.1016/j.jpain.2017.03.007

The biopsychosocial model of pain is central to our understanding of factors involved in the development and maintenance of CPSP. Several presurgical risk factors for CPSP have been consistently identified in adults undergoing surgery, including biological factors (older age, female sex), medical factors (greater presurgical pain), and psychosocial factors (higher levels of presurgical anxiety and pain catastrophizing).[7-10] In children, the psychosocial framework also includes the role that parents play in their child's recovery from surgery. Specifically, parents' cognitions and behaviors around their child's pain directly influence their child's experience of symptoms and can influence their child's own pain perceptions and cognitions.[16,19] Studies have reported that parent anxiety and sleep patterns before surgery predict pain intensity 2 weeks after surgery.[21] Parent as well as child factors have also been identified as important in the development of CPSP in children.[4,17,22] It is imperative that we gain understanding of the biopsychosocial risk factors to implement targeted interventions to improve children's recovery after surgery.

To date, the prevalence of CPSP has not been determined in children undergoing surgery. Risk factors that might precede CPSP and that are relevant for children undergoing surgery have also not been identified and summarized. Therefore, we conducted a systematic review and meta-analysis to: 1) identify the prevalence of CPSP in children 3 to 12 months after surgery, and 2) determine presurgical biomedical (age, sex, baseline pain severity) and psychosocial risk factors (child anxiety, child pain catastrophizing, child depression, parent anxiety, and parent pain catastrophizing) associated with CPSP prevalence or severity. We hypothesized that similar rates of CPSP would be found for children and adolescents at 3 to 12 months after surgery as has been reported in adults. In addition, we expected to find several biopsychosocial predictors of CPSP including older child age, female sex, greater baseline pain intensity, and higher levels of presurgery emotional distress in the child and parent.

Methods

Inclusion Criteria

Types of Participants

We included studies of children 6 to 18 years undergoing surgery. Children had to receive general or regional anesthesia at a hospital or surgery center. Diagnostic and noninvasive procedures were excluded. Studies investigating children undergoing cancer surgery (malignant) or with a neurological disability were excluded because of multiple confounding factors in these populations. Age 6 years was chosen as the lower bound as the age at which children reliably self-report pain.[25] Studies extending beyond the eligible age limits were considered for inclusion if most participants were within the eligible age range, or if data were reported separately for children in the eligible age range.

Types of Studies

We only considered studies that were published, peer-reviewed reports, written in English. Non-English studies were excluded because we did not have resources to interpret foreign language articles. We considered different study designs including cross-sectional, case series, case-control, and cohort studies that included more than 10 participants. Single case reports, retrospective studies (eg, chart review), and intervention studies were excluded. Only studies that reported pain between 3 and 12 months after surgery were eligible for inclusion.

Types of Outcomes

Prevalence of CPSP Pain

The primary outcome was the presence of pain 3 to 12 months after surgery. We did not define the cutoff for pain presence but rather abstracted the definition used in each individual study. We abstracted presence of pain as well as severity of pain. If multiple reports of pain were assessed in this period, each was extracted. If self-report was not available, we extracted parent report or nurse report of child pain.

Risk Factors for CPSP Pain

Biological (age and sex), medical (baseline pain severity and location), and psychosocial (presurgical child anxiety, child pain catastrophizing, child depression, child sleep patterns, parent anxiety, and parent pain catastrophizing) factors were extracted. Only risk factors that were assessed in the presurgery period were extracted and included in the analyses.

Search Strategy

Cochrane Database of Systematic Reviews, MedLine, EMBASE, and PsycINFO were searched for peer-reviewed studies published from January 1996 to June 2016. This cutoff was chosen on the basis of major advances in surgical and anesthetic techniques occurring in the early 1990s making historic reports less relevant to current practice. A MedLine search strategy was developed first and was adapted for other search engines (see Supplementary Appendix 1). Our search strategy includes terms for children/adolescents, surgery, and pain. The reference list of each included study was manually searched for additional reports potentially meeting inclusion criteria. We also conducted a citation search for each included study to identify other potential studies for inclusion.

Data Collection and Analysis

Study Selection

One reviewer screened the abstracts to identify potential studies. A second reviewer screened 10% of all abstracts. There was a high level of agreement (99.4%) on screening. Two reviewers then assessed the full articles of potentially eligible studies for inclusion in the systematic review. Disagreements were discussed and resolved with a third author.