

Factors Predicting Parent Anxiety Around Infant and Toddler Postoperative Pain

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ABSTRACT

BACKGROUND AND OBJECTIVES: Understanding of parent anxiety and its effect on infant postoperative pain is limited. We sought to identify psychological factors associated with preoperative anxiety for parents of infants and toddlers undergoing elective surgery and to determine whether parent anxiety is associated with child postoperative pain.

METHODS: This was a prospective cohort study of consecutively eligible patients aged ≤ 18 months undergoing craniofacial surgery and their parents. Preoperative parent assessment included anxiety, coping, parent health locus of control, and self-efficacy. Postoperative inpatient child pain scores and medication use were collected. Analyses included hierarchical multivariable logistic and linear regression models.

RESULTS: Parents ($n = 71$, 90% female) of young children (mean age 6.6 months) undergoing cleft lip or palate ($n = 59$) or cranial vault repair ($n = 13$) were enrolled. Maladaptive coping (odds ratio 1.3; 95% confidence interval, 1.1–1.6), low parent self-efficacy (odds ratio 2.4; 95% confidence interval, 1.3–4.5), and external locus of control (odds ratio 1.74; 95% confidence interval, 1.1–2.9) were independently associated with high parental anxiety. The adjusted odds of moderate/severe parent anxiety was 3.6 (95% confidence interval, 1.5–9.1) higher with each SD increase in maladaptive coping. High parental anxiety was correlated with significantly higher hospital mean child pain scores (1.87 points on 0–10 scale; 95% confidence interval, 0.42–3.70; $P = .045$).

CONCLUSIONS: Coping and self-efficacy are modifiable factors that contribute to parent anxiety before and during hospitalization and may be targets for intervention. Infants and toddlers undergoing elective craniofacial surgery with highly anxious parents may be at greater risk for higher postoperative pain.



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When children undergo surgery, many parents, perceiving a threat to their child, feel anxious.¹ This anxiety, which may be present before, during, and after their child's surgery, may focus on their child's overall safety, side effects and risks of anesthesia, concerns about pain or comfort, and uncertainty about outcomes.²⁻⁴ A moderate level of such anxiety may increase vigilance and drive helpful behaviors. When parent anxiety is excessive, however, the anxiety may become a barrier to caring for one's child and oneself, causing distress, child and family anxiety, delayed return to normal activity, and harm to the developing nervous system.⁵⁻¹⁰

The role of parents in this setting is critical, given the dependence of infants and toddlers on their parents to recognize and manage pain and to promote comfort.¹¹ Unlike other pediatric settings, though, there is limited understanding of psychological parent factors that may contribute to parent preoperative anxiety.^{12,13} These characteristics include maladaptive coping,^{14,15} low pain management-related self-efficacy,^{16,17} and lack of internal (self) health care locus of control (HLOC).^{2,18,19} There also has been limited study of the relationship between parent anxiety and infant postoperative pain. Better understanding of the role of preexisting parent psychological factors, including anxiety, and their impact on postoperative pain in very young children has the potential to inform design of parent-focused interventions affecting some of the estimated 250 000 US infants annually who undergo electively timed surgery.²⁰

We accordingly conducted a prospective cohort study of families with children <18 months old undergoing elective craniofacial surgery. Our primary hypothesis was that potentially modifiable parent factors, such as poor coping, low self-efficacy, and external parent HLOC, would be associated with high preoperative parent anxiety. Our secondary hypothesis was that children of parents with greater preoperative anxiety would have higher pain scores and increased opioid receipt during the early (<24 hours) inpatient postoperative period.

METHODS

Study Design

We performed a prospective cohort study of parents of young infants and children (<18 months old) undergoing elective surgery at single urban craniofacial center with a consistent presurgical orientation process. This study was approved by the New York University School of Medicine Institutional Review Board.

Participants

Consecutive parents of infants and toddlers <18 months of age undergoing cleft lip or palate (GLP) repair or cranial vault repair (CVR) from June 2013 until October 2015 were screened by the clinical team for eligibility in a single urban tertiary care center. Only parents who intended to stay at the child's bedside overnight were offered enrollment because they would play key role in their child's care and this was a study of parent-child interaction around pain and anxiety. Exclusion criteria included lack of a preoperative visit with the craniofacial pediatric nurse practitioner to reduce preparation variability, enrollment within 5 days of the procedure (because the focus of this study was to understand baseline anxiety), lack of English or Spanish proficiency, and presence of parent intellectual disability (which would have led to challenges in assessment of psychological characteristics).

Assessment Procedures

Parents were surveyed in person or over the phone by trained research assistants in English or Spanish. Assessment of parent psychological and sociodemographic factors was completed ≥ 5 days before the child's scheduled procedure. Inpatient child pain scores and pain medication receipt were extracted from the electronic medical record. Study data were collected and managed in the REDCap electronic data capture tools hosted at the New York University School of Medicine.²¹

Measures

There were 3 primary study variables: nonanxiety parent psychological factors, parent anxiety, and child pain.

Parent Psychological Measures

Several parent characteristics were assessed preoperatively, including coping, self-efficacy, and HLOC.

Coping style, or the mechanisms by which a person processes a stressful event such as child illness,⁹ was assessed via the brief COPE scale.²² This scale measures 14 coping responses collapsed into adaptive and maladaptive categories.

Self-efficacy, the confidence in executing behaviors,²³ was assessed via the investigator-developed Parent Self-Efficacy: Child Pain scale (Cronbach's α .81). Parents stated their agreement level with 4 items regarding their confidence in implementing behaviors to control their child's pain indicate on a 6-item Likert scale where 1 = "very sure you could not" and 6 = "very sure you could." A related de novo scale, Parent Anxiety/Self Efficacy: Child Pain, had similar properties, but items reflected domains related to parent anxiety about performing child pain-related tasks (Cronbach's α .853) (Supplemental Materials).

Parent HLOC is the variation in beliefs about external and internal determinants of health outcomes for one's child. Parents completed 4 of the 6 subscales that make up the Parent Health Locus of Control Scales¹⁶: Divine Influence (external spiritual or religious), Fate Influence (external control, due to chance), Professional Influence (external control by health care professional), and Parental Influence (internal control of health care by self). Scales for Media and Child Influence were not included because they reflected domains regarding older children.

Parent anxiety was measured preoperatively at baseline via the Hospital Anxiety and Depression Scale (HADS),²⁴ a validated measure of anxiety and depression in the health care setting. Scores range from 0 to 21, with defined anxiety levels as follows: normal = <8, borderline = 8 to 10, moderate anxiety = 11 to 14, and severe anxiety = ≥ 15 . Given sample size and clinical relevance, we collapsed these levels into a binary variable, normal or borderline (HADS < 11) and moderate or severe (HADS ≥ 11) anxiety categories.

Child Pain Measures

Child pain scores were assessed by nursing staff via the validated Face, Legs, Arms, Consolability, and Crying (FLACC) observational pain score.²⁵ Consistent with the inpatient unit protocol, scores were collected at least every 4 hours for the first 24 hours after admission or until discharge, whichever came first (postoperative day [POD] 0–POD1). As part of routine care and reflecting the more extensive and intracranial nature of the surgery, participants undergoing CVR spent the immediate postoperative day, POD0, in the PICU before being transferred to the Medical–Surgical floor, typically for a 3 days' overall stay compared with 1 day CLP stay.

Pain scores recorded within 2 hours of another pain score (typically to assess impact of intervention) and pain scores recorded while the child was recovering from anesthesia in the post anesthesia care unit were excluded. Child pain scores were evaluated as both inpatient mean and maximum pain scores (continuous) and the presence of any severe (defined as FLACC > 6) pain (dichotomous).

The type, dose, and frequency of pain medications were extracted from the medical record as a secondary indicator of pain. All subjects were admitted with the same postoperative order set for as-needed acetaminophen and oxycodone, with precalculated weight-based dosing. We calculated the amount of acetaminophen and morphine equivalents received after admission to the inpatient unit in milligrams per kilogram per hour, averaged over duration of inpatient admission until discharge, as both continuous and then dichotomized as high or low opioid use based on median split.

Pertinent Covariate Measurements

Parent-reported sociodemographic information including age, marital status, socioeconomic status, race, and ethnicity, as well as child factors including age, gender, birth order, comorbidities, exposure to anesthesia, previous hospitalizations including history of NICU stay, and type of surgery were compared between low- and high-anxiety parents. We calculated social

class status according to the Barratt Simplified Measure of Social Status, an updated version of the Hollingshead Four Factor measure, which incorporates level of education and occupation.²⁶

Given that knowledge, beliefs, and attitudes can influence confidence and behavior, we included a measure of pain management knowledge, the Parent Pain Management questionnaire,²⁷ a 30-item true/false assessment. We removed items related specifically to epidural use or child age >2 years to yield 15 questions (Cronbach's α .397).

Statistical Analysis

Associations Between Parent Psychological Factors and Parent Anxiety

To assess associations between parent psychological factors and baseline parent anxiety, we used Fisher's exact test to examine the relationship of each psychometric factor with preoperative parent anxiety as both a continuous and binary variable.²⁴ We then included all significant ($P < .10$) variables associated with parent anxiety into a multivariate model and used likelihood ratio testing to create a final model, adjusting for surgery type and child age.

Association Between Parent Anxiety and Child Pain

We then evaluated associations between baseline parent anxiety and inpatient child postoperative pain scores and opioid use. Because of differences in postoperative recovery environments and risk stratification of surgery revealed on exploratory analysis, CLP and CVR were analyzed separately. We used multivariable linear regression models for mean and maximum pain scores and inpatient opioid use to adjust for child age (a priori based on literature). For CVR, given small sample size, nonparametric tests (Kruskal–Wallis) were used.

Power Analysis and Statistical Software

For our primary aim, we determined a priori that a sample size of 82 dyads would be needed to detect a correlation of

0.3 between each of the psychological factors and parent anxiety (80% power, 2-sided α .05), our primary outcome.

All analysis was performed in Stata version 14.1 (Stata Corp, College Station, TX). Sample size calculations were made in PASS 2005 (NCSS, Silver Spring, MD).

RESULTS

Out of 88 eligible parent–child pairs, 79 dyads enrolled (89.8%), with 8 subjects lost to follow-up, leaving 71 available for analysis (Fig 1). Ninety percent of parents were mothers, with an average age of 34.2 years (SD = 4.93). The mean age of infants was 6.6 months (SD = 3.8), with 63% male. Among infants and toddlers undergoing craniofacial surgery, there were 58 patients with CLP, with 29 cleft lip repairs and 29 cleft palate repairs, and 13 patients undergoing CVR. Four patients with CLP did not stay overnight and were excluded from the pain analysis. Overall, demographic and child and parent factors were similar between parent anxiety categories (Table 1).

Psychological Predictors of Parent Preoperative Anxiety

Mean scores of psychological tests for parent maladaptive coping, low self-efficacy around child pain management, and external (Fate) locus of control were significantly different between parents with

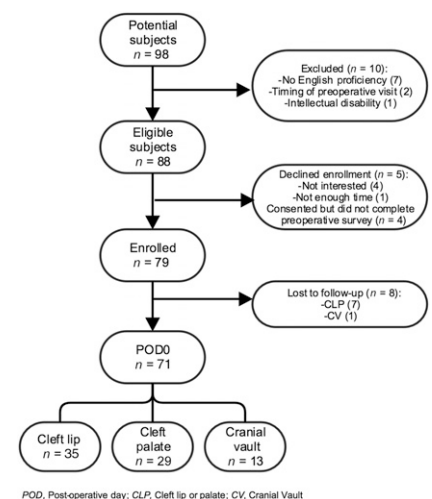


FIGURE 1 Diagram of subject inclusion, enrollment, and completion.

TABLE 1 Demographics and Baseline (Preoperative) Parent Psychometric Factors

	Mean/ <i>N</i> (%)	SD	Parent Preoperative Anxiety Category		<i>P</i> , Fisher's exact/Student <i>t</i> test
			No or Mild Anxiety, HADS <11	Moderate or Severe Anxiety, HADS ≥11	
<i>N</i>	71	—	55	16	—
Child					
Mean age, mo	6.6	3.0	6.7	6.1	.546
Feeding tube ^a	9	—	7 (78%)	2 (22%)	.999
NICU stay ^a	23	—	20 (87%)	3 (13%)	.496
Type of repair					
Cleft lip or palate	58	—	48 (83%)	10 (17%)	.024
Craniosynostosis	13	—	7 (54%)	6 (46%)	—
Parent					
% Female	90	—	88.9	93.8	.569
Mean age, y	34.2	4.9	34.5	33.1	.340
Mean socioeconomic status (<i>n</i> = 64) ²⁶	51.1	10.8	51.0	51.4	.896
Race					
White	70.0	—	66.1	81.3	.796
Black	7.0	—	8.0	6.3	—
Asian	5.2	—	5.4	0	—
Hispanic	11.3	—	10.7	12.5	—
Other	7.1	—	8.9	0	—
Parent pediatric pain knowledge (0–15), mean score ²⁷	9.4	2.1	9.3	10	.335

^a History of feeding tube and NICU stay missing for *n* = 16.

moderate or severe and no or mild preoperative anxiety (HADS ≥11) (Table 2). When we included these 3 factors in a hierarchical multivariable regression model predicting moderate or high anxiety, only maladaptive coping remained as a significant predictor of high parent anxiety. The adjusted odds of high parent anxiety were 3.6 (1.5, 9.1) higher with each SD unit

increase in maladaptive coping z score (Table 3).

Preoperative Anxiety Predicting Child Postoperative Pain

In multivariate linear regression, among 54 patients with CLP who were admitted postoperatively, mean child pain score, adjusted for child age, was 1.1 points higher

(95% confidence interval, 0.02–2.12; *P* = .034) for children whose parents had moderate or severe preoperative anxiety compared with those with parents with no or mild preoperative anxiety (Fig 2). There was no association of mean acetaminophen or mean opioid use with parent preoperative anxiety category (Table 4). In patients undergoing CVR (*n* = 13), there

TABLE 2 Bivariable Analysis of Baseline or Preoperative Parent Anxiety With Other Baseline or Preoperative Parent Psychological Characteristics

Parent Psychological Scale (Reference Range)	Mean Score (SD)	No or Mild Anxiety, HADS <11 (<i>n</i> = 56)	Moderate or Severe Anxiety, HADS ≥11 (<i>n</i> = 16)	<i>P</i> , Student's <i>t</i> Test
Coping ²²				
Adaptive (0–60)	48.9 (5.3)	49.1	47.9	.408
Maladaptive (0–40)	19.3 (6.0)	18.2	23.3	<.001
Self-efficacy pain management, mean (0–6)				
Anxiety	3.7 (1.1)	3.8	3.3	.203
Low confidence	2.2 (1.0)	1.9	2.9	<.001
Parent HLOC, ¹⁶ (0–6)				
Parent	5.3 (0.6)	5.4	5.2	.187
Professional	3.8 (0.9)	3.8	3.8	.830
Fate	3.0 (1.3)	2.8	3.6	.031
Divine	3.6 (1.7)	3.4	4.2	.074

TABLE 3 Results of Complete Adjusted Logistic Regression of Moderate or Severe Parent Preoperative Anxiety (HADS ≥ 11) With Other Psychological Factors, Scaled

Parent Characteristic	aOR, High Parent Preoperative Anxiety (HADS ≥ 11), (95% CI)
Maladaptive coping	2.8* (1.1, 7.5)
Low self-efficacy: child pain	1.6 (0.7, 3.8)
HLOC: fate	1.5 (0.7, 3.0)

aOR, Adjusted odds ratio; CI, confidence interval.

* $P < .05$. Adjusted for surgery type.

were no differences in child mean and median pain scores by parent anxiety level on Kruskal–Wallis tests.

DISCUSSION

Excessive parent anxiety about electively timed infant and toddler surgery has the potential to affect a quarter of a million families annually in the United States. In this prospective study of parents of young children undergoing craniofacial surgery, we identified parent psychological factors (poor coping, low self-efficacy, and external locus of control) associated with higher parent preoperative anxiety. We also found that higher parent preoperative anxiety was linked to higher inpatient infant

postoperative pain scores in the first 24 hours, although the study was underpowered for this secondary outcome.

This work, focused on very young children, supports and expands the findings of similar associations between parent psychological characteristics and child outcomes in perioperative and postoperative settings for older children.^{28–30} Three findings in particular warrant discussion. First, parent maladaptive coping,²² which includes behaviors such as denial, venting, and self-blame, was independently associated with higher parent anxiety in our study. Poor parent coping may directly affect child pain by inhibiting productive activities, such as

tending to a child's needs or asking for help.^{31,32} For parents of infants, this problem is probably magnified and heightened by increasing distress. Interestingly, positive (adaptive) coping was not related to anxiety in our study, although other studies in older children suggest that strong parent coping skills are associated with reduced parent anxiety.^{4,7}

Second, both parental low self-efficacy and external locus of control (which have been established as predictors of parent anxiety and child outcomes in pediatric chronic disease^{33–35}) were associated with parent anxiety in this study. Although this association was rendered nonsignificant in the fully adjusted final model, this change may have been a result of the limited sample size or the lack of variability in anxiety level. Low self-efficacy, or low confidence in ability to be effective, is a modifiable characteristic that may precede anxiety, contributing to a negative feedback loop to lower self-efficacy, heightened anxiety, and poorer performance.²³ Parent self-efficacy for child care can be improved with educational and psychological interventions. Although less mutable, external (Fate) HLOC was also associated with parent anxiety in our study, although not independently of other factors.¹⁸ Additional research integrating both factors in parent counseling for acute pain management could affect short-term action (self-efficacy) and longer-term (locus of control) resilience.

Finally, our findings of higher postoperative pain scores among infants of moderately to severely anxious parents undergoing surgery also support detrimental effects of parent anxiety on child pain, anxiety, and in infants, distress.³⁶ Higher parent anxiety can inhibit capacity to focus on a child's emotional and physical needs, including capacity to comfort and interpretation and management of pain.³⁵ Among infants undergoing vaccination, lower parent anxiety and increased adaptive and decreased maladaptive coping were correlated with decreased infant distress.^{37–39} In older children, parent anxiety also has been correlated with increased medication needs during

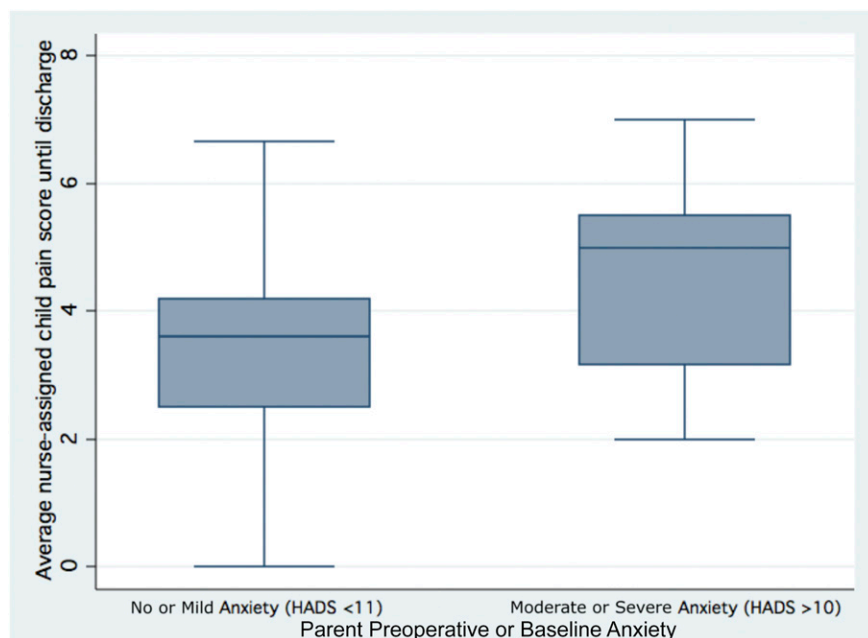


FIGURE 2 Distribution of unadjusted child postoperative nurse-assigned pain scores (FLACC), recorded from arrival to medical–surgical unit to discharge in patients aged 0 to 18 months with cleft lip or palate ($n = 54$), by parent preoperative anxiety category (1.1 points difference in pain score, $P = .045$, 95% confidence interval, 0.02–2.10).

TABLE 4 Analgesia Receipt by Postoperative Cleft Lip or Palate by Parent Preoperative Anxiety Category

Parent Preoperative Anxiety Category	APAP, mg/kg	P, t Test	Received APAP Every 4–6 h (%)	χ^2 Exact	Total ME/kg	P, t Test
No or mild, HADS \leq 10 (n = 41)	40.7 (2.4)	.6511	31 (76)	1.00	0.29 (0.04)	.8856
Moderate or severe HADS >10 (n = 10)	43.2 (4.8)	—	8 (80)	—	0.28 (0.08)	—

APAP, acetaminophen; HADS, Hospital Anxiety and Depression Scale; ME, morphine equivalents.

induction and with postoperative anxiety and pain.^{13,29,31}

Implications

Our findings suggest that routine preoperative and postoperative assessment of family psychological capacity⁴⁰ might help identify parents needing additional support. Alternatively, surgical programs could consider implementing a uniform intervention provided to all parents. Kain and Fortier developed a Web-based, tailored program for young school-age children undergoing ambulatory surgery, targeting perioperative child and parent self-efficacy and anxiety and improving immediate perioperative outcomes.⁴¹ Development of a similar intervention, for parents of infants undergoing elective surgery, that focuses on developmentally appropriate strategies to decrease maladaptive coping and enhance self-efficacy around pain management for families before, during, and after surgery may have short- and long-term benefits.

Limitations

Our findings should be interpreted with 3 main limitations kept in mind. First, our cohort of parents was exposed to only 3 different types of surgery, and although the associations of psychological factors with anxiety were similar for all 3 surgeries, other surgeries may reveal or induce different associations. Second, we were not sufficiently powered to detect a clinically meaningful difference in child pain scores or opioid use between parent anxiety categories our secondary outcomes. Finally, future studies would be strengthened by including more family functioning and child temperament measures and longer-term patient-reported outcomes.

CONCLUSIONS

Based on this prospective cohort study of parents and their young children undergoing craniofacial surgery, parent maladaptive coping, low self-efficacy, and external HLOC appear to be psychological factors associated with parent preoperative anxiety. Higher anxiety in parents may correlate with higher hospital postoperative pain scores in their very young children, although much larger studies are needed to validate a correlation between parent psychological factors and child pain and opioid use. Interventions focused on identifying psychologically at-risk families to extra receive support or proposing skill-based universal interventions for all families both deserve more study as ways to improve comfort of infants, toddlers, and their families in craniofacial and other elective surgeries.

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