Brief Report: Behavioral Correlates of Postoperative Pain in Toddlers and Preschoolers

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Objective: To investigate the association between preoperative parent and child behaviors and postoperative pain in toddlers and preschoolers.

Method: Participants were 74 pediatric patients (59 boys, 15 girls), scheduled for inguinal hernia or hydrocele repair, and their parents. Children ranged in age from 12 to 64 months (M = 33.7 months, SD = 14.7 months). Child and parent behaviors were assessed 30 minutes prior to surgery using the Behavioral Observation Scale (BOS), a modified version of the Dyadic Prestressor Interaction Scale (Melamed & Bush, 1985). Postoperative pain was assessed using an observational measure, the Toddler-Preschooler Postoperative Pain Scale (TPPPS) (Tarbell, Cohen, & Marsh, 1992).

Results: Postoperative pain was negatively related to parents' provision of surgery-relevant information during the preoperative observation period.

Conclusions: Preoperative interventions for young children should include information about the surgery experience.

Key words: postoperative pain; presurgical preparation; toddlers; preschoolers.

Although postoperative pain is a common outcome for pediatric surgery patients (Alex & Ritchie, 1992; Mather & Mackie, 1983; Palermo & Drotar, 1996), few studies have identified behavioral/psychosocial correlates of postoperative pain. Previous research has identified child factors associated with postoperative pain in school-age children and adolescents (Palermo & Drotar, 1996), and parent factors associated with procedure-related behavioral distress in preschoolers and school-age children (Blount, Sturges, & Powers, 1990; Melamed & Bush, 1985). To our knowledge, no study has investigated the association between preoperative behaviors and postoperative pain in toddlers and preschoolers.

Identifying parent and child behaviors associated with postoperative pain would promote the most effective use of medical and behavioral interventions and would inform the development of preoperative interventions for young children.

Cognitive-developmental factors contribute to toddlers' and preschoolers' exhibiting more behavioral distress during painful medical procedures than older children (Katz, Kellerman, & Siegel, 1980). For instance, toddlers and preschoolers typically do not understand the short-term nature of a painful stimulus (Peterson, 1989), may view an invasive procedure as a punishment (Harbeck & Peterson, 1992), and have a limited range of coping skills to prevent or mitigate pain (Reissland, 1983). Consequently, toddlers and preschoolers are likely to experience anticipatory anxiety (Katz et al.,...
appraise invasive procedures as assaultive and threatening (Rudolph, Dennig, & Weisz, 1995), and not engage in volitional, deliberate coping efforts (Reissland, 1983). These emotional and behavioral sequelae may exacerbate the experience of pain.

Pain is defined as the sensory perception of tissue damage and the related emotional and behavioral responses (Rudolph et al., 1995). Self-report, considered the "gold standard" of pain assessment, is not feasible for prelingual children and is often not obtained reliably from preschool children (McGrath, 1990). Pain in toddlers and preschoolers is typically assessed by behavioral observation, with behavioral distress functioning as a proxy for pain (McGrath, 1990). The identification of behaviors considered to be unique markers of pain, such as a particular type of facial grimace and reflexive withdrawal (Craig & Grunau, 1991; Craig, McMahon, Morison, & Zaskow, 1984), should enhance the ability of behavioral scales to measure pain-specific behavioral distress. Several observational measures of pain that incorporate pain-specific behaviors have been developed (Grunau & Craig, 1987; Grunau, Johnston, & Craig, 1990; McGrath, Johnson, Goodman, Schillinger, Dunn, & Chapman, 1985), including one designed specifically to assess toddlers' and preschoolers' postoperative pain, the Toddler-Preschooler Postoperative Pain Scale (TPPPS) (Tarbell, Cohen, & Marsh, 1992).

Recent advances in pain assessment pave the way for research on postoperative pain in toddlers and preschoolers. The aim of this study was to identify parent and child preoperative behaviors associated with postoperative pain in young children. Due to the exploratory nature of this study, no specific hypotheses were posed.

Method

Participants

Participants were 74 pediatric patients (59 boys, 15 girls), scheduled for inguinal hernia or hydrocele repair, and their parents. Patients were 12 to 64 months old ($M = 33.7$ months, $SD = 14.7$ months). Children with additional significant medical or neurological disorders or prematurity were excluded. Ethnicity of the subjects was predominantly non-Hispanic White (95%). Parents' written consent was obtained before children were enrolled in the study.

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<th>Table I. Behavioral Observation Scale (BOS): Definitions of the Behavioral Categories</th>
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<td>Self-Comforting</td>
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**Behavioral Observation Scale (BOS).** The BOS is a modified version of the Dyadic Prestressor Interaction Scale (Melamed & Bush, 1985). The BOS was developed on the basis of clinical observations of children and parents in the outpatient surgery holding area used in this study. The BOS assesses five child behaviors (Attachment, Exploration, Nonpain-Related Behavioral Distress, Self-Comforting, and Social-Affiliative Play) and five parent behaviors (Attachment, Distraction, Informing, Reassurance, and Restraint). Definitions of the BOS behavior categories are presented in Table I. The BOS was completed by trained observers who scored the presence of each behavior over each of the six, 5-minute preoperative observation intervals.

**TPPPS.** The TPPPS (Tarbell et al., 1992) was developed as a clinical tool to measure pain in toddlers and preschoolers in the acute postoperative period. A trained observer rates the child's behavior.
across seven items that represent three behavioral categories: (1) Vocal Pain Expression (Verbal Pain Complaint/Cry, Groan/Moan/Grunt, and Scream); (2) Facial Pain Expression (Open Mouth/Lips Pulled Back at Corners, Squint/Close Eyes, and Brow Bulge/Forehead Furrow); and (3) Bodily Pain Expression (Restless Motor Behavior/Rub or Touch Painful Area). These items were derived from preliminary studies involving observations of young children and from other observational studies of children's pain behavior (see Tarbell et al., 1992).

The TPPPS total score is generated by adding the number of pain behavior items occurring over a 5-minute observation period. Total scores range from 0 to 7, with higher scores indicating more pain. If children are observed for several intervals, then the mean TPPPS score is derived by dividing the sum of the TPPPS scores by the number of observation intervals. The TPPPS has been found to possess good internal and interrater reliabilities (Tarbell et al., 1992). Evidence of the scale's validity is provided by the sensitivity of the scale to analgesic regimen, the convergence of TPPPS scores and nurse and parent ratings of postoperative pain, and the associations found between TPPPS scores and perioperative vital signs (Tarbell et al., 1992).

**Procedures**

Participants were recruited either at the child’s pre-surgical physical examination, occurring within the week prior to surgery, or in the preoperative waiting area on the day of surgery. Trained raters used the BOS to record parent and child behaviors for six, 5-minute preoperative observation intervals. The first interval began when the child put on his or her hospital gown. Behavioral observations were made continuously for 25 minutes (i.e., five intervals). Observations were stopped when the child was out of the observer's view for any reason. These interruptions were typically momentary, and all were under five minutes. When observations were interrupted, recording resumed when the child returned and behaviors were coded as part of the interval that started before the child left. The sixth interval began with the child's departure to the operating room and included the first few minutes of anesthetic induction in the operating room. Mothers were present for an average of 5.3 of the preoperative observation intervals, and fathers were present for an average of 4.0 intervals. When both parents were present, the BOS parent behaviors were coded as present if either one or both of the parents engaged in the specified behavior. Interrater reliabilities were calculated for the BOS for 22 child-parent dyads, determined on the basis of the availability of two raters to record the data. Interrater reliabilities were derived using Cohen's (1960) \( \kappa \) statistic, with a criterion of .50 used to indicate reliable correspondence (Helzer, Robins, Taibleson, Woodruff, Reich, & Wish, 1977). With the exception of Parent Distraction (\( \kappa = .46 \)), which was subsequently excluded from further analyses, \( \kappa \) values for all BOS behaviors reflected reliable correspondence (range = .56-.84).

Children were observed for 30 minutes postoperatively with the TPPPS. Postoperative observation began when the child awoke from anesthesia. The occurrence of each behavior was recorded for each of six consecutive 5-minute intervals. Children in this study were observed for an average of 5.7 intervals. Observations were discontinued if the children fell asleep (i.e., lay down on their gurney, closed their eyes, were physically inactive, and unresponsive to questions by the nursing staff or parent). This happened for five subjects only, each of whom had been observed for a minimum of three intervals. Raters started recording a new interval if the child later awoke within the 30-minute time period after initial awakening (the criteria for awakening were the reverse of those for falling asleep). Interrater reliabilities for the TPPPS were calculated for 38 of the subjects, chosen on the basis of the availability of two raters at the time the child was scheduled for surgery. All \( \kappa \) values for the TPPPS behaviors reflected reliable correspondence (range = .53-.78). Mothers were present for an average of 4.2 postoperative observation intervals and fathers were present for an average of 1.3 intervals. Because only one parent was allowed in the recovery room at a time, parents took turns staying with the child.

**Results**

**Preoperative Behaviors and Postoperative Pain**

For all analyses, BOS scores were expressed in terms of the percentage of the six intervals in which the behavior occurred. Table II presents the means and standard deviations of BOS behaviors. The mean TPPPS score across the six postoperative intervals was 2.1 (SD = 1.6, range = 0-7).
Table II. Means and Standard Deviations of BOS Scores Expressed in Terms of the Percentage of Intervals in Which the Behavior Occurred

<table>
<thead>
<tr>
<th>Child Behavior</th>
<th>M (SD)</th>
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<tr>
<td>Attachment</td>
<td>74 (28)</td>
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<tr>
<td>Exploration</td>
<td>32 (33)</td>
</tr>
<tr>
<td>Nonpain-Related Behavioral Distress</td>
<td>28 (28)</td>
</tr>
<tr>
<td>Self-Comforting</td>
<td>21 (30)</td>
</tr>
<tr>
<td>Social-Affiliative Play</td>
<td>66 (27)</td>
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<table>
<thead>
<tr>
<th>Parent Behavior</th>
<th>M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attachment</td>
<td>76 (26)</td>
</tr>
<tr>
<td>Informing</td>
<td>25 (27)</td>
</tr>
<tr>
<td>Reassurance</td>
<td>27 (25)</td>
</tr>
<tr>
<td>Restraint</td>
<td>19 (23)</td>
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</table>

The association between preoperative behavior and postoperative pain was examined using Pearson zero-order correlations between BOS and TPPPS scores. A Bonferroni criterion p value of .006 (.05 divided by the 9, the number of correlations calculated) was used to determine statistical significance. Postoperative pain was significantly related to Parent Informing, \( r(68) = -.34, p = .004 \), with low postoperative pain associated with more frequent procedural information from parents. Age did not account for this association, as age was not significantly related to TPPPS score, \( r(74) = -.18, p = .14 \). A trend for a positive correlation between TPPPS and Nonpain-Related Behavioral Distress was found, \( r(61) = .29, p = .02 \). TPPPS score was not significantly correlated with any other BOS behaviors.

**Effects of Anesthesiological and Surgical Variables**

Anesthesiological and surgical variables did not account for the relation between Parent Informing and TPPPS score. Parent Informing was not related to the child's receipt of preoperative medication, \( t(66) = 1.53, p = .13 \). In addition, no association was found between Parent Informing and the type of intraoperative analgesia (i.e., none, local, opioid), \( F(2, 70) = 1.48, p = .24 \), or postoperative analgesia (i.e., none, acetaminophen, opioid), \( F(2, 61) = .50, p = .61 \), used.

Some medical variables were associated with TPPPS score. The 14 children who received preoperative medication, primarily anxiolytics, had higher TPPPS scores than the 60 children who did not receive preoperative medication, \( t(72) = -2.48, p < .02 \). More aggressive intraoperative analgesia (i.e., local bupivacaine infiltration and an opioid as compared to either analgesic alone or none at all) was associated with lower TPPPS scores, \( x^2(8, N = 73) = 19.07, p < .001 \). Also, children who received acetaminophen and opioids postsurgically were more likely to have a higher TPPPS scores, \( x^2(6, N = 74) = 19.54, p < .003 \). Surgery duration was not significantly correlated with TPPPS score, \( r(73) = -.09, p = .46 \). (See Tarbell et al., 1992, for further discussion of the relationship of TPPPS scores to medical and surgical factors).

**Discussion**

This study examined the relation between parent and child preoperative behavior and postoperative pain in toddlers and preschoolers. Results indicated that parents' provision of information during the preoperative period was associated with children's level of postoperative pain. Children with the lowest pain scores were given surgery-relevant information in significantly more preoperative intervals than children with the highest pain scores. This result is consistent with evidence that pediatric patients benefit from preparatory information (Atkins, 1986; Siegel & Peterson, 1980) and contrary to the perception among pediatric professionals in-training that preschoolers do not benefit from preparatory information (Peterson, Everett, Farmer, Mori, & Chaney, 1988).

Although previous research has found developmental differences in children's procedure-related distress (Katz et al., 1980), in this study, age was not related to postoperative pain. This finding may be explained by the coding of the TPPPS, which was designed to minimize differences in pain scores attributable to developmental differences in the expression of pain (e.g., verbal pain complaint, a behavior found to be more common in preschoolers, was combined with cry, a more common behavior of the toddlers). Children's receipt of preoperative anxiolytics was associated with postoperative pain, with children who received preoperative anxiolytics evidencing greater postoperative pain. It is possible the association between a child's receipt of anxiolytics and his or her level of postoperative pain could be accounted for by a temperamental characteristic, such as behavioral reactivity. Recent evidence that benzodiazepines are opioid
antagonists offers another explanation for this finding (Gear, Miaskowski, Heller, Paul, Gordon, & Levine, 1997).

Limitations of this study include the low representation of females and ethnic minorities in the sample. In addition, the restriction of behavioral data to observations made in the immediate preoperative period does not account for other potential moderators of child preoperative behavior and postoperative pain. Future research should examine the effects of factors such as parental anxiety, child temperament, and child coping on preoperative behavior and postoperative pain in toddlers and preschoolers. Also, future research should control for anesthesiological and analgesic practices.

The main finding of this study, that parental provision of information to their child was negatively related to postoperative pain, speaks to the importance of developing and implementing developmentally appropriate interventions that provide toddlers, preschoolers, and parents with information about the surgery experience. In addition, the trend for a positive correlation between children's nonpain-related behavioral distress and postoperative pain suggests that toddlers and preschoolers who evidence a high level of behavioral distress may be at risk for postoperative pain and may benefit from preparatory intervention.

Acknowledgments

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References

Peterson, L. (1989). Coping by children undergoing stressful medical procedures: Some conceptual, method-


