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Postoperative Pain in Children: Association Between Anxiety Sensitivity, Pain Catastrophizing, and Female Caregivers' Responses to Children's Pain

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Abstract: This study investigated the association between anxiety sensitivity and pain catastrophizing in children, caregivers' anxiety sensitivity and catastrophizing about children's pain and responses to children's pain, pain intensity reported by children, and pain intensity estimated by caregivers. The participants were 102 children scheduled for outpatient surgery and their female caregivers. Before the operation, caregivers' catastrophizing about children's pain, children's pain catastrophizing, and their anxiety sensitivity were assessed, as well as caregivers' responses to children's pain. Pain intensity reported by children and estimated by caregivers was evaluated after the operation and 24 hours afterward. Analyses were performed via path analysis. The results indicated that children and caregivers characterized by higher levels of anxiety sensitivity reported higher levels of pain catastrophizing and catastrophic thinking about children's pain, respectively. Caregivers with higher levels of catastrophic thinking about the children's pain reported higher levels of solicitousness and higher estimations of the children's pain intensity after the operation. Higher levels of children's pain catastrophizing were associated with more frequent responses of discouragement and higher pain intensity reported after the operation. These findings highlight the relevance of catastrophizing about children's pain and children's pain catastrophizing in the experience of postoperative pain in children.

***Perspective:** Path analysis was used to test a hypothetical model of the associations between anxiety sensitivity, catastrophizing, parental responses, and postoperative pain in children. The results highlight the association between children's and parents' pain catastrophizing and discouragement and solicitous responses and the role of anxiety sensitivity as a traitlike factor associated with catastrophizing.*

***Key words:** Pain catastrophizing, anxiety sensitivity, children, parental responses, postoperative pain.*

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The experience of pain in children is influenced by the individual characteristics of the children and their caregivers. The theoretical model of pain empathy[18,22] proposed that perceiving others in pain is influenced by the characteristics of the person in pain ("bottom-up variables," eg, facial expressions) and by the individual characteristics of the observer ("top-down variables"). The observer's affective responses to facing the child's pain may consist of responses oriented to the self (eg, distress) and responses oriented to the other (eg, sympathy). Recently, the pediatric fear-avoidance model[2] has expanded the model of pain empathy[18,22] and has integrated the main findings of

research on pediatric pain into the theoretical framework of the fear-avoidance model.[77] This model emphasizes the reciprocal influences of child and parent factors in the development and maintenance of chronic pain. It establishes bidirectional relationships between parent psychological responses (eg, catastrophizing about child pain, anxiety sensitivity), child psychological responses (pain catastrophizing, anxiety sensitivity), and parent pain management behaviors in influencing child avoidance behaviors. The model also considers that child avoidance behaviors can directly influence parent psychological responses, which may indirectly influence parent pain management behaviors.

Among the personal characteristics of children and caregivers, anxiety sensitivity (AS) and pain catastrophizing play a central role in the child's experience of pain. AS is a traitlike personality construct defined as fear of anxiety-related sensations, specifically, fear of bodily sensations.[54] AS seems to amplify the intensity of experienced somatic sensations including pain.[58] Using experimental and clinical samples, several studies have investigated the association between AS and the experience of pain in children, showing that increased AS is associated with higher pain intensity,[62-64] impaired quality of life,[65,41] and increased disability.[44] The role of anxiety has been studied in the context of postoperative pain, finding that preoperative anxiety in children and adolescents was predictive of postoperative pain intensity[50] and analgesic consumption.[35,40] Also, children and adolescents who before the operation expected to have high levels of postoperative pain reported more pain after it.[39,40]

Pain catastrophizing is an exaggerated negative orientation toward pain experiences that comprises 3 elements: magnification, helplessness, and rumination thoughts.[60] Greater pain catastrophizing in children is associated with more pain intensity and disability,[70,73] increased pain expression, and social support seeking.[69,74] Only 1 recent study has investigated the role of AS and pain catastrophizing in relation to pediatric postoperative pain, finding that catastrophizing and pain anxiety, but not AS, predicted pain after the operation.[49]

Among the "top-down" influences, parent catastrophizing about children's pain has been associated with higher estimations of their children's pain[24]; for high-catastrophizing parents, observing their child in pain elicits an aversive state of increased self-oriented distress,[9,26,67] leading them to engage in solicitousness and discouragement responses.[8,10,25,27] Regarding AS, an experimental study found that parental AS predicted girls' AS, which in turn predicted the girls' pain intensity ratings.[64] In relation to postoperative pain, although a study found that parental anxiety and anticipated pain did not predict the adolescent's postoperative pain,[40] another study found that parental expectancy mediated the relationship between the child's expected and experienced pain during painful medical procedures.[39]

AS and pain catastrophizing are separate although highly related constructs. They share a common cognitive dimension—namely, a general tendency to catastrophize the meaning of unpleasant physical sensations.[20] One study has provided empirical support for the dimensional and componential structure of a hierarchical organization of pain-relevant negative emotional constructs.[66] This hierarchical model includes both pain catastrophizing and AS.[66] This conceptualization assumes that the componential constructs are interrelated and also considers that each component shows unique predictive variance for specific responses. In children and adolescents, AS has been found to be a unique predictor of pain catastrophizing.[47,62]

Parental behavior also influences the child's experience of pain. When parents focus on symptoms (solicitousness) and display negative responses (discouragement), their children show higher distress and report higher pain intensity.[11,13,14,32,42] Furthermore, children with high levels of emotional distress will be more affected by their parent's overprotective or critical behaviors.[13,51,76,80]

To our knowledge, the association between children's and caregivers' AS and pain catastrophizing, caregivers' responses to children's pain, pain intensity reported by children, and pain intensity estimated by caregivers has not been studied in relation to pediatric postoperative pain. The present study investigated associations between these variables in a sample of children who had undergone outpatient elective surgery.

A hypothetical model was tested (Fig 1). It was postulated that the higher the children's and caregiver's AS, the higher the children's pain catastrophizing and the caregiver's catastrophizing about children pain, respectively.[20,47,62,66] Children's and caregiver's AS were assumed to be correlated.[64] Also, higher caregiver's and children's catastrophizing were postulated to be associated with more frequent responses of solicitousness and discouragement and less frequent responses of

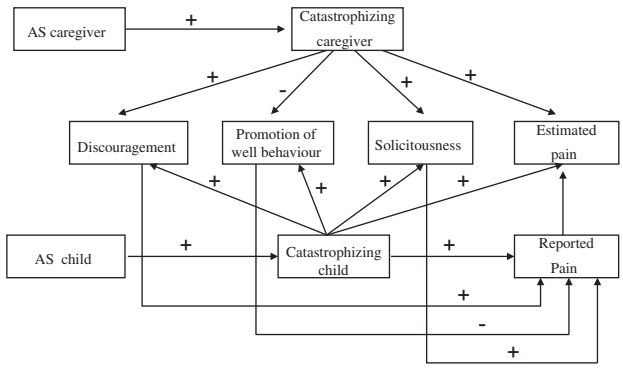

Figure 1. Hypothetical model. Abbreviations: AS caregiver: caregiver's anxiety sensitivity; AS child: child's anxiety sensitivity; Catastrophizing caregiver: caregiver's catastrophic thinking about child pain; Catastrophzing, child: child's pain catastrophizing; Discouragement: caregiver response to child pain of discouragement; Promotion of well behavior/coping: caregiver response to child pain of promotion of well behavior/coping; Solicitousness: caregiver response to child pain of solicitousness; Reported pain–1: reported pain intensity by the child after the operation; Reported pain–2: reported pain intensity by the child 24 hours after the operation; Estimated pain–1: caregiver subjective estimation of child pain intensity after the operation; Estimated pain–2: caregiver subjective estimation of child pain intensity 24 hours after the operation.

promotion of well behavior/coping.[10,25,27,69,74] The pain intensity perceived by caregivers in the children will be positively associated with the caregivers' catastrophizing about children's pain (top-down influences) as well as with the children's pain catastrophizing and the pain intensity reported by them (bottom-up influences).[24,61] Finally, the pain intensity reported by children was postulated to be positively associated with their pain catastrophizing[70,73] as well as with the caregiver's responses to the children's pain.[11,13,14,32,42]

Methods

Participants

The participants were a convenience sample of consecutive children scheduled for elective outpatient surgery and their caregivers. The inclusion criteria were 1) elective outpatient surgery of intermediate severity or grade 2, that is, procedures with an approximate duration between 45 minutes and 2 hours, with a blood loss minor to 500 mL and with minor peritoneal soiling such as inguinal hernia repair[7,17] (these procedures were previously considered as "major surgery" but with advances in surgery and anesthesiology they require only limited medical care and, in most cases, no hospitalization; this criterion was chosen to avoid variations in pain due to differences in the type of surgery); 2) the ability of the children and caregivers to understand the assessment instruments; 3) Status 1 according to the Physical Status Classification System of the American Society of Anaesthesiologists,[1] that is, "a normal healthy patient" with no organic, physiologic, biochemical, or psychiatric disturbance; the pathologic process for which the operation is to be performed is localized, and does not entail a systemic disturbance; 4) the children's and caregivers' informed consent to participate in the study; and 5) children at least 9 years of age because of the age range of application of the assessment instruments. Three child-caregiver couples were excluded from the study for the following reasons: their inability to understand the assessment instruments because of the caregiver's deficient knowledge of the Spanish language and the mental retardation of the child. All the participants approached consented participation and only 1 parent-child dyad was eliminated because it was not possible to contact them after surgery. The initial sample was composed of 107 children and their caregivers. One hundred two caregivers were women and only 5 were men. Because differences in some of the sex-related variables included in the study have already been described,[76] the male caregivers and their children were excluded from the study.

The final sample was composed of 102 children (48 girls, 54 boys) with a mean age of 10.45 years (standard deviation = 1.26, range 9–13 years). They were scheduled for medium elective outpatient surgery: hernioplasty, 48.6%; surgical cleaning procedures, 21.5% (ie, cures to clean infections after gall bladder operations or debridement of major burns); circumcision, 9.8%; removal of tissue for biopsy, 5.9%; lipoma removal, 4.9%; implantation or removal of fracture fixation devices, 3.9%; tonsillectomy, 1.9%; and "others," 3.5%. The final sample of caregivers was composed of 102 women, mainly mothers (n = 95), and the remainder were grandmothers or aunts. Fifty-five percent belonged to nuclear families, with a medium socioeconomic status (58.9%), and worked in the tertiary sector (18.7%) or were industrial workers (17.8%).

Measures

Child Measures

Anxiety Sensitivity. The Spanish version of the Childhood Anxiety Sensitivity Index was used.[56,57] This is an 18-item questionnaire where respondents indicate the degree to which they fear the negative consequences of anxiety symptoms. The results of validation studies provide evidence for the internal consistency, time stability, and construct validity of the instrument.[38,56]

Pain Catastrophizing. The Pain Catastrophizing Scale for Children (PCS-C)[19] consists of 13 items describing different thoughts and feelings that children may experience when they are in pain. Children rate how frequently they experience each of the thoughts and feelings when they are in pain using a 5-point scale (0 = "not at all" to 4 = "extremely"). The instrument yields a total score that can range from 0 to 52, and 3 subscale scores for rumination, magnification, and helplessness. The PCS-C has been shown to be a reliable and valid instrument in children aged between 9 and 15 years.[19] The instrument had not been adapted into Spanish when this study was being developed and was thus translated into Spanish using the forward-backward translation method. First, the forward translation was done by a member of the research team who is familiar with terminology of the area covered by the instruments, is familiar with the English language, and whose native language is Spanish. Second, a bilingual expert panel reviewed the translated instrument. The panel was made up of the original translator, another member of the research team, and an expert with experience in instrument development. The panel was provided with published materials related to the instruments. The use of some words and expressions was questioned and alternatives were suggested and discussed until the members of the panel reached a consensus. Third, the instrument was translated back into English by an independent professional translator, whose native language is English and who had no knowledge of the questionnaire. Only a few discrepancies arose, which were discussed by the expert panel until a satisfactory version was reached. The total score of this translated version showed high internal consistency (α = .89).

Postoperative Reported Pain Intensity. The Spanish version of the Faces Pain Scale–Revised[29] was used.[45] This is a 6-point scale designed to measure children's level of perceived pain intensity. The child's task is to choose the face that best reflects the intensity of the pain she/he has experienced. A numeric value from 0 to 10 (0–2–4–6–8–10) is assigned to each face. The end points are explained as "no pain" and "very much pain." The instrument has shown adequate reliability and validity.[45]

Caregiver Measures

Anxiety Sensitivity. The Anxiety Sensitivity Index[52] is a 16-item questionnaire where respondents indicate the degree to which they fear the negative consequences of anxiety symptoms on a 5-point Likert-type scale. The Spanish version of the Anxiety Sensitivity Index is fully equivalent to the original.[55] The results of validation studies provide cross-cultural evidence for construct validity and the concurrent validity of the Spanish Anxiety Sensitivity Index.

Caregiver Catastrophic Thinking About Child Pain. The Pain Catastrophizing Scale for Parents (PCS-P) was used. This instrument is an adaptation of the adult Pain Catastrophizing Scale (PCS)[60] and the PCS-C.[19] The PCS-P consists of 13 items describing different thoughts and feelings that parents may experience when their child is in pain. Parents rate the extent to which they experience each of the thoughts and feelings when their child is in pain using a 5-point scale (0 = not at all to 4 = extremely). The PCS-P yields a total score that can range from 0 to 52, and 3 subscale scores for rumination, magnification, and helplessness. The total score was used in the present study. This instrument has shown adequate reliability and validity.[23] A Spanish version of the instrument was not available when this study was conducted and thus, with the permission of the authors, it was translated into Spanish using the forward-backward translation method following a process similar to that described for the PCS-C. The translated version showed high internal consistency (α = .91).

Caregiver Subjective Estimation of Child Pain Intensity. Caregivers were asked to rate the child's pain on a scale ranging from 0 to 10, with 0 indicating no pain and 10 indicating the worst pain imaginable. There is mixed evidence about the validity of numerical rating scales of children's pain by others (eg, parents, nurses), and several studies concluded that they do not accurately reflect the child's pain experience[3,36]; nevertheless, for the purpose of the present study we were interested in the "subjective" estimation of children's pain by the parents and, with this aim, these rating scales are adequate.[43]

Caregiver Response to Child Pain. The Inventory of Parent/Caregiver Responses to the Children's Pain Experience (IRPEDNA) is a self-administered questionnaire with 3 subscales: 1) solicitousness (15 items reflecting parental positive and negative reinforcement of the child's pain, eg, "spend as much time with child as possible" or "take over child duties and responsibilities"); 2) discouragement (10 items reflecting parental ignorance/discounting of the child's pain and criticizing the child's pain as excessive, eg, "not listen to the child" or "get angry and tell child not to complain so much"); and 3) promotion of well behaviors and coping (12 items reflecting parental promotion of children's adaptive behaviors; eg, "advise the child to relax and breathe deeply" or "use humor to take her/his mind of the discomfort"). The IRPEDNA was chosen because this measure was specifically designed to be used not only in parents and caregivers of children with chronic pain but also in parents and caregivers of healthy children experiencing everyday pain. The respondents are asked to answer how often they enact each of the reactions included in the inventory when their child is in pain on a 5-point response scale (0 = never; 1 = hardly ever; 2 = sometimes; 3 = often; 4 = always). Mean item scores were calculated for each subscale yielding total scores ranging from 0 to 4 for each subscale. The instrument has shown adequate reliability and validity.[32,76]

Procedure

Four Venezuelan hospitals located in the urban area of Ciudad Bolívar participated in the study. One of the hospitals was public, 1 was semiprivate, and 2 were private.

The study protocol was approved by the institutional ethical review boards of the hospitals that participated in the study. A pilot study was conducted at these 4 hospitals with 10 patients who fulfilled the inclusion criteria. The aims of the pilot study were twofold: to determine the most suitable time to evaluate postoperative pain and to detect any problems the participants might have in understanding the assessment instruments. The 2 most suitable times to evaluate postoperative pain were the interval between the moment when the effects of surgical anesthesia wore off and before postsurgical analgesia began and 24 hours after surgery. According to the anesthesiologists and the results of the pilot study, pain considerably diminished 24 hours after surgery and had completely disappeared 48 hours after surgery in all cases. The pilot study showed that there were large differences between the participants in their reading and writing skills, which could influence their answers to the instrument; thus, it was decided to apply the instruments orally. All the participants correctly understood the instructions and assessment instruments when applied orally.

Every week, the surgeons informed the researchers about the dates of the scheduled operations that fulfilled the inclusion criteria. On arrival at the outpatient surgery unit, patients and their caregivers were approached by a trained clinical psychologist. First, the purpose and methods of the study were explained. Second, they were asked for their informed consent to participate and their sociodemographic variables were recorded (age, sex, level of education, and socioeconomic status). The participants were aware that their participation was voluntary, that the information collected was confidential, and that this information would be linked to a number alone and not to their name. Just before the operation, while the patients and their caregivers were in the waiting room of the operating theatre, the researchers assessed the caregivers' and children's level of pain catastrophizing and AS as well as the caregivers' responses to the children's pain. The caregivers and the children were interviewed separately to avoid information bias. In addition, the pain rating scales were explained to the caregivers and children and applied to guarantee that the children were not in pain before the operation. As mentioned, the pain intensity perceived by the children and caregivers was evaluated after the operation, when the effects of the anesthesia

had worn off, and by telephone interview 24 hours after the operation. The evaluation period lasted for 18 months and the information was always collected by the same researcher (V.M.-A.), a clinical psychologist with extensive experience.

All the operations were performed under general anesthesia or profound sedation; during the operation, regional block techniques were used and lidocaine infiltrations at 1% and nonsteroidal anti-inflammatory drugs were administered. After the operation, nonsteroidal anti-inflammatory drugs (diclofenac, 2 mg/kg every 8 hours for 5 days or ibuprofen, 10 mg/kg, every 8 hours for 5 days) and antibiotics (amoxicillin, 50 mg/kg per day every 8 hours; amoxicillin plus clavulanic acid, 50 mg/kg per day every 8 hours; ampicillin, 50 mg/kg per day every 8 hours; metronidazole, 45 mg/kg per day every 8 hours) were prescribed to all the patients. None of the patients presented postoperative complications that might have required subsequent hospitalization.

Data Analysis

Statistical analyses were carried out with the SPSS 15.0 package (SPSS Inc, Chicago, IL) and path analysis using LISREL 8.30 software.[34] First, mean scores, standard deviations, and correlation coefficients for all variables were calculated. Correlations were assessed following the guidelines proposed by Cohen,[15] where low correlations are in the range .10–.29, moderate correlations .30–.49, and high correlations .50–1.

Second, to consider the possible influence of the child's sex, differences by sex in all the variables included in the study were examined using the Mann-Whitney test (Supplementary Table 1). No significant differences were found in any of the variables.

The fit of the hypothetical model (Fig 1) was tested via path analysis. The data were checked prior to the analyses and we found that some variables were not normally distributed. Thus, the estimation method used was maximum likelihood because this method is effective for any distribution of the data if the analyses are performed on covariance matrices and the matrix of fourth-order moments is provided.[4] The covariance matrix used in this study is shown in Supplementary Table 2.

The goodness-of-fit indexes (GFIs) of the whole model were Satorra-Bentler chi-square,[5] the comparative fit index[5] (CFI), the non-normed fit index[6] (NNFI), and the root mean-square error of approximation (RMSEA). Satorra-Bentler chi-square is a chi-square fit index that corrects the statistic under distributional violations; to reduce the sensitivity of chi-square to sample size, the index is divided by the degrees of freedom.[5] Ratios of 3 or smaller are indicative of an acceptable fit of the model.[37] The CFI and NNFI measure the proportional improvement in fit by comparing a hypothesized model with the null model as the baseline model. The CFI and NNFI range from 0 (absolute lack of fit) to 1 (perfect fit), and fit is considered to be good when the values are more than .90.[31] The RMSEA is an absolute misfit index; the closer it is to zero, the better the fit. Values less than .08 indicate an adequate fit and values less than .06 indicate a good fit.[30,31]

The following exogenous variables were included: caregiver's AS, children's AS, and children's age. Endogenous variables were as follows: caregiver's catastrophic thinking about children's pain; children's pain catastrophizing; caregiver's response of discouragement to children's pain; caregiver's response of promotion of well behavior/coping to children's pain; caregiver's response of solicitousness to children's pain; reported pain intensity by the children after the operation; reported pain intensity by the children 24 hours after the operation; caregiver's subjective estimation of children's pain intensity after the operation; and caregiver's subjective estimation of children pain intensity 24 hours after the operation. Causal paths were defined according to the hypothetical model displayed in Fig 1. Path coefficients should not be interpreted as correlation coefficients. A path coefficient (eg, .80) connecting 2 variables (A and B) means that if A increases by 1 standard deviation from its mean, B would be expected to increase its own standard deviations from its own mean by .80 while holding all other relevant connections constant. With a path coefficient of −.16, when A increases by 1 standard deviation from its mean, B would be expected to decrease its own standard deviations from its own mean by .16 while holding all other relevant connections constant.

To control the possible influence of child's age, it was included as a covariate in the initial model. All residual variances were assumed to be uncorrelated and all exogenous variables were assumed to be correlated.

Results

Descriptive Statistics

Mean scores, standard deviations, and correlation coefficients for all measures are presented in Table 1. It is noteworthy that regarding pain intensity after the operation, caregivers and children reported a moderate level of pain that decreased by approximately 3 points 24 hours after the operation.

Table 1 also shows the bivariate correlation matrix for all variables. As can be observed, AS and pain catastrophizing were highly associated in the children and the caregivers. The caregivers' AS and pain catastrophizing about the children's pain showed positive significant moderate correlations with solicitous responses, and low and moderate correlations, respectively, with the pain intensity that they perceived in the children just after the operation. Regarding the association of the caregiver's responses to pain intensity, the discouragement responses showed low positive correlations with the pain intensity reported by the children in the 2 assessments and no association with the caregiver's estimated pain intensity. In contrast, the promotion of coping and solicitous responses showed low positive correlations with the pain intensity estimated by the caregivers in

Table 1. Means, Standard Deviations (SDs), and Pearson Correlations

Variables	Range	Mean (SD)	2	3	4	5	6	7	8	9	10	11	12
1. AS, child	19–51	33.28 (7.30)	.54**	.47**	.37**	.14	.15	.21*	.23*	.10	.16	−.06	.05
2. Catastrophizing, child	6–42	21.33 (8.67)	—	.30**	.54**	.22*	.14	.28**	.21*	.13	.20*	.05	.07
3. AS, caregiver	2–52	16.30 (8.62)		—	.50**	.16	.07	.23**	.06	.08	.19*	.12	.00
4. Catastrophizing, caregiver	2–48	17.63 (10.10)			—	.08	.16	.35**	.16	.00	.36**	.08	.15
5. Discouragement	0–4	.85 (.56)				—	−.09	−.16	.10	.10	−.04	−.02	.17
6. Promotion of well behavior/coping	0–4	2.94 (.41)					—	.53**	−.03	.01	.15	.14	−.24*
7. Solicitousness	0–4	2.85 (.45)						—	−.04	.01	.15	.19	−.09
8. Reported pain–1	2–10	5.49 (2.17)							—	.24*	.62**	.07	−.02
9. Reported pain–2, child, second measure	0–10	2.82 (1.92)								—	.26**	.70**	.04
10. Estimated pain–1	0–10	5.20 (2.39)									—	.32**	.01
11. Estimated pain–2	0–10	2.16 (1.65)										—	−.04
12. Age, child	9–13	10.45 (1.26)											—

Abbreviations: AS: anxiety sensitivity; Catastrophizing, caregiver: caregiver's catastrophic thinking about child's pain; Catastrophizing, child: pain catastrophizing; Discouragement: caregiver's response to child's pain of discouragement; Promotion of well behavior/coping: caregiver's response to child's pain of promotion of well behavior/coping; Solicitousness: caregiver's response to child's pain of solicitousness; Reported pain–1: reported pain intensity by the child after the operation; Reported pain–2: reported pain intensity by the child 24 hours after the operation; Estimated pain–1: caregiver's subjective estimation of child's pain intensity after the operation; Estimated pain–2: caregiver's subjective estimation of child's pain intensity 24 hours after the operation.
NOTE. The numbers in the upper row correspond to the variables in rows 1 to 12.
*$P < .05$.
**$P < .01$.

the 2 assessments and no association with the pain reported by the children.

The children's AS showed a low significant positive correlation with the solicitous responses, and the children's pain catastrophizing showed low significant positive correlations with solicitous and discouragement responses. In addition, the higher the children's AS and pain catastrophizing, the higher their perceived pain intensity after the operation. Furthermore, the children's pain catastrophizing showed a low significant positive association with the pain intensity reported by the caregivers after the operation.

It is noteworthy that the pain intensity reported by the children and the pain intensity estimated by the caregiver after the operation and 24 hours afterward were highly correlated. The child's and the caregiver's AS showed a moderate positive significant correlation. The children's and the caregivers' pain catastrophizing showed a high positive significant correlation.

Path Analysis

Table 2 shows the standardized coefficients of the initial model. As shown in Table 3, the various GFIs calculated for the initial path analysis indicated that the estimated model provided a poor fit to the data.

In line with the recommendations regarding the Lagrange Multiplier Test,[5] the following modifications were sequentially made to the initial model: 1) All paths of the initial model that were not statistically significant were deleted. For this reason, the variables promotion of well behavior/coping responses and the child's age were excluded from the model. 2) Error covariances were added between the child's pain catastrophizing and the caregiver's pain catastrophizing (.34) and between the measures of the caregiver's estimated pain intensity after the operation and 24 hours afterward (.19). The correlations between these residuals are accounted for by the fact that they are very similar instruments in the case of pain catastrophizing and the same instrument in the case of estimated pain intensity. The modification indexes did not suggest including additional relationships between the variables. Fig 2 represents the final model.

To avoid clutter, the correlations between all the exogenous variables have been omitted from Fig 2. The caregiver's and child's AS had a moderate positive relationship ($r = .47$); there was a small correlation between the child's AS and the child's reported intensity after the operation (.08) and another small correlation between the caregiver's AS and the child's reported pain intensity after the operation (.10).

All path coefficients were statistically significant ($P < .05$). As can be seen in Table 3, the various GFIs calculated for the path analysis indicated that the estimated model provided a good fit to the data. The Satorra-Bentler chi-square divided by the degrees of freedom was smaller than 3, which was indicative of an adequate fit of the model. The CFI and NNFI had values higher than .90, indicating an adequate fit. In addition, the RMSEA was .05; values less than .06 are indicative of a good fit.

As can be observed (Fig 2), both the caregiver's and child's AS yielded 2 statistically significant path coefficients to the caregiver's catastrophic thinking about the child's pain and to the child's pain catastrophizing, respectively; individuals characterized by higher levels of AS reported higher levels of pain catastrophizing.

The caregiver's catastrophic thinking about the child's pain yielded 2 statistically significant path coefficients. The first was to the response of solicitousness to the child's pain; thus, caregivers with higher levels of catastrophic thinking about the child's pain reported higher levels of solicitousness responses. The second was to the caregiver's subjective estimation of the child's pain intensity after the operation; that is, caregivers showing higher levels of catastrophic thinking about the child's pain reported higher estimations of the child's pain intensity after the operation.

Table 2. Initial Model: Standardized Coefficients

	Age Child	AS Caregiver	AS Child	Catastrophizing Caregiver	Catastrophizing Child	Discouragement	Promotion of Well Behavior/ Coping	Solicitousness	Reported Pain–1	Reported Pain–2
Age, child		—	—	—	—	—	—	—	—	—
AS, caregiver		—	—	—	—	—	—	—	—	—
AS, child		—	—	—	—	—	—	—	—	—
Catastrophizing, caregiver	.15	.48*	—	—	—	—	—	—	—	—
Catastrophizing, child	.04	—	.49*	—	—	—	—	—	—	—
Discouragement	.16	—	—	−.08	.24*	—	—	—	—	—
Promotion of well behavior/coping	−.27*	—	—	.16	.07	—	—	—	—	—
Solicitousness	−.14	—	—	.30*	.12	—	—	—	—	—
Reported pain–1	−.06	—	—	—	.23*	.04	−.02	−.09	—	—
Reported pain–2	.02	—	—	—	.08	.08	−.03	.09	—	—
Estimated Pain–1	−.02	—	—	.31*	−.10	—	—	—	.62*	—
Estimated Pain–2	−.09	—	—	.15	−.11	—	—	—	—	.69*

Abbreviations: AS: anxiety sensitivity; Catastrophizing, caregiver: caregiver's catastrophic thinking about child's pain; Catastrophizing, child: pain catastrophizing; Discouragement: caregiver's response to child's pain of discouragement; Promotion of well behavior/coping: caregiver's response to child's pain of promotion of well behavior/coping; Solicitousness: caregiver's response to child's pain of solicitousness; Reported pain–1: reported pain intensity by the child after the operation; Reported pain–2: reported pain intensity by the child 24 hours after the operation; Estimated pain–1: caregiver's subjective estimation of child's pain intensity after the operation; Estimated pain–2: caregiver's subjective estimation of child's pain intensity 24 hours after the operation.
NOTE. Empty cells correspond to relationships not included in the hypothetical model.
*$P < .05$.

The children's pain catastrophizing yielded 2 statistically significant path coefficients. The first was to the caregiver's response of discouragement to the child's pain; higher levels of children's pain catastrophizing was associated with more frequent responses of discouragement. Second, children characterized by higher levels of pain catastrophizing reported higher pain intensity after the operation. The final adjusted model also highlighted that there was an indirect association between the child's catastrophizing and the pain intensity estimated by the parents after the operation through the pain intensity reported by the children after the operation.

The pain intensity reported by the children after the operation and 24 hours later yielded 2 statistically significant path coefficients to the caregiver's estimation of the child's pain after the operation and 24 hours later, respectively. Higher levels of reported pain intensity by the children were associated with higher levels of estimated pain intensity by the parents.

Discussion

In a sample of children undergoing elective outpatient surgery, this study investigated the association between caregivers' AS and pain catastrophizing about their children's pain, their responses to their children's pain, and their estimation of their children's postoperative pain. We also studied the association between the child's AS, pain catastrophizing, the responses of their caregivers to their pain, and their reported pain intensity. The findings of the present study can be readily summarized. Children who had higher AS also reported higher catastrophizing. Similarly, caregivers with higher AS reported higher catastrophizing about their children's pain. Caregivers with higher levels of catastrophic thinking about their child's pain reported higher levels of solicitousness responses and reported higher estimations of the child's pain intensity after the operation. Higher levels of child's pain catastrophizing were associated with more frequent responses of discouragement and higher pain intensity reported after the operation. Finally, higher levels of reported pain intensity by the children were associated with higher levels of estimated pain intensity by the parents after the operation and 24 hours later.

Table 3. Structural Models: GFIs

	$\chi 2/df$	NNFI	CFI	RMSEA
Initial model	2.10	.69	.86	.11
Final model	1.24	.92	.94	.05

NOTE. χ^2/df, Satorra-Bentler chi-square divided by degrees of freedom.

The final adjusted model clearly highlights the relationship between the child's and the caregiver's AS and pain catastrophizing, a finding that has been consolidated in several studies.[46,53,66] As postulated, our results indicated that the child's and the caregivers' AS exerted its influence through catastrophizing. In relation to pediatric pain, the results concerning the relationship of both constructs to the experience of pain are contradictory; when the joint influence of both constructs was investigated, 1 study found that AS but not pain catastrophizing was significantly associated with children's pain,[62] whereas another study found that pain catastrophizing but not AS was significantly associated with the reported pain intensity.[49] Those previous studies examined the independent relative influence of AS and pain catastrophizing on the experience of pain. In contrast, the present research conceptualized AS as a distal higher-order factor for pain catastrophizing—a proximal factor. Nevertheless,

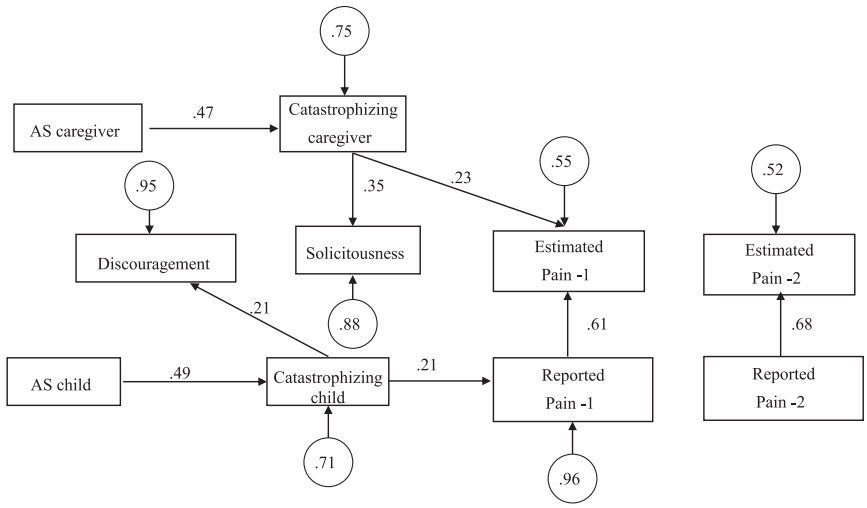

Figure 2. Final model. Rectangles are observed (measured) variables, circles are standardized error variances, straight lines with arrows are presumed causal paths; values over the arrows are standardized path coefficients. All exogenous variables (AS caregiver, AS child, and Reported Pain–2) were assumed to be correlated, but these correlations are omitted from the diagram to reduce clutter. Abbreviations: AS caregiver: caregiver's anxiety sensitivity; AS child: child's anxiety sensitivity; Catastrophizing caregiver: caregiver's catastrophic thinking about child pain; Catastrophizing, child: child's pain catastrophizing; Discouragement: caregiver response to child pain of discouragement; Promotion of well behavior/coping: caregiver response to child pain of promotion of well behavior/coping; Solicitousness: caregiver response to child pain of solicitousness; Reported Pain–1: reported pain intensity by the child after the operation; Reported Pain–2: reported pain intensity by the child 24 hours after the operation; Estimated Pain–1: caregiver subjective estimation of child pain intensity after the operation; Estimated Pain–2: caregiver subjective estimation of child pain intensity 24 hours after the operation.

only longitudinal studies can determine if people high in AS will be prone to pain catastrophizing when faced with the experience of pain. The association between AS, pain catastrophizing, and other fear-related constructs should be studied in children in the same way as it has been investigated in adults,[46,53,66] because it has been suggested that the structure and meaning of AS[12,33,56] and pain catastrophizing[21] differ between children and adults. On the other hand, to our knowledge, the relationship between both the caregiver's AS and their catastrophizing about the child's pain has not been previously studied; according to our results, it seems that the fear of their own somatic sensations would also amplify the intensity of the pain perceived in others through the catastrophic thoughts about the other's pain.

The final adjusted model showed that children's and caregivers' AS were positively correlated (.47). In this line, several studies have found that elevated AS may arise from learning, via parental modeling, that somatic symptoms may be dangerous.[48,58,59,77-79] These results are also in line with the pediatric fear-avoidance model of chronic pain,[2] which suggests that the caregiver's and the children's psychological responses to pain are highly interrelated.

The final model also showed that the pain intensity that the caregivers perceived in their children after the operation was accounted for by a top-down influence—the caregivers' pain catastrophizing—as well as by a bottom-up influence—the pain intensity reported by the children. These results are in line with previous research that found that individuals who scored high on pain catastrophizing perceived more intense pain in others and mainly relied on pain behavior as a basis for drawing inferences about others' pain experience.[23,61] It has been suggested that attentional mechanisms may explain the association between the caregivers' catastrophizing about the child's pain and the estimation of higher pain intensity, because catastrophic rumination may result in sustained attention to the child's pain.[27,67] These attentional mechanisms could also account for the association between parental catastrophizing and solicitous parental response; this was found in the present study and is in line with the results of previous studies.[10,25,27] It is plausible that caregivers who catastrophize about their child's pain strongly focus on their child's pain behavior and are more motivated to engage in solicitousness responses aimed at expressing care and concern.[25] In addition, because previous research has found that observing their child in pain primarily elicits an aversive state of increased self-oriented distress in high-catastrophizing parents, solicitousness might also be oriented to reducing their own distress.[9,26]

According to our results, discouragement responses had a positive association with children's pain catastrophizing (bottom-up influence), supporting the communicative function of children's catastrophizing that suggests that pronounced pain expressions characteristic of high catastrophizers may serve as signals of the need for attention[69,74]; these signals appear to elicit both solicitous and discouraging responses from others.[28,72,76] It has been suggested that because children high in pain catastrophizing show pronounced facial expressions regardless of whether they are experiencing high or low pain intensity, this may lead to a familiarity bias in the observer, increasing the possibility of discouragement responses that entail not taking pain seriously or being hesitant about believing the child.[68,71,75]

The final adjusted model showed that children's pain catastrophizing was also positively associated with heightened pain intensity reported by the children after the operation, which is a consolidated finding.[73] It should also be emphasized that the final model indicated an indirect association between the child's catastrophizing and the pain intensity estimated by the parents after the operation through the pain intensity reported by the children after the operation. This result also supports the communicative function of the child's pain catastrophizing.[69,74] Nevertheless, future research should determine the mechanisms underlying the association between children's pain catastrophizing and increased pain expression; recent evidence suggests that this could also be explained by the difficulty of high catastrophizing children to modulate displays of pain, because they display high levels of pain regardless of the type of audience, whether parents or strangers,[75] and regardless of whether they are alone or with a parent.[68]

Although it was predicted that the caregiver's solicitousness and discouragement responses would be associated with higher pain intensity reported by the children, the present study found no association, which was against expectations and in contrast to the results of previous studies.[9,13,14,51] It has been suggested[8] that when pain is acute, as investigated in the present study, the caregivers' responses, which prioritize pain control, may be adaptive because they foster pain relief. According to our results, when postoperative pain is present, it is likely that the caregivers' catastrophizing about the children's pain, which promotes solicitous responses and parent-child congruency in pain ratings,[24] might serve an adaptive function by promoting adequate help and care from others. It is noteworthy that parent-child congruency in pain ratings was high in the present study. When considering these results, it should be taken into account that the parent's responses were assessed by self-report measures; as self-reported behavior may differ from actual parental behavior,[16] replication of the present findings using observational measures is warranted. Future research should investigate whether children are at an increased risk of developing postsurgical chronic pain when caregivers persist in solicitousness and discouragement responses over time.

Finally, 24 hours after the operation, the caregivers seemed to take into account the children's reported pain intensity to estimate the pain in their children. This was the only significant association found regarding this time point and could be explained by the fact that by this time, the pain had almost disappeared.

The present study had several limitations and the results should be interpreted accordingly. First, the sample size was relatively small. Second, only female caregivers participated in the study. Thus, given that there are differences between male and female caregivers in their response to their children's pain[76] and that higher catastrophizing about children's pain has been observed in mothers than in fathers,[26,27] these results are not applicable to male caregivers. Third, the time interval between the 2 measurements of pain intensity was short and the pain caused by the surgical procedures was brief. Fourth, although the scales assessing catastrophizing both for the children and the parents (PCS-C and PCS-P) had been forward- and backward-translated and showed good internal consistency, additional studies of their psychometric properties are necessary. Fifth, the presence of preexisting anxiety disorders in both parents and children, which was neither assessed nor controlled, could be a potentially important confounder given that all the cognitive-affective variables in this study were anxiety-related. In addition, because of the fact that anxiety itself was not measured, it is not possible to know whether anxiety sensitivity is, in and of itself, the distal factor that influences postoperative pain reports or whether anxiety sensitivity is serving as a proxy measure of experienced (particularly state) anxiety. Sixth, it must be taken into account that to avoid the possible influence of educational level on written responses, the instruments were applied orally, which, in turn, could have led to an increase in the influence of social desirability on the responses. Finally, when interpreting these results, it must be taken into account that the measures of catastrophizing and AS were collected after arrival at the outpatient surgery unit. This setting in itself could be a stressful situation for many families and could have influenced their responses to these measures.

Despite these limitations, the current findings extend our understanding of the association between AS, catastrophizing, and parental responses and pediatric postoperative pain, as it is the first study that has investigated these associations within the natural clinical context of elective outpatient surgery in children. Follow-up studies should determine whether the characteristics of these children and caregivers can be used to predict postsurgical associated disability. In addition, in order to clarify the association between AS and pain catastrophizing in this context, future research should include measures of pain-related fear.

Supplementary Data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.jpain.2013.10.007.

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Supplementary Table 1. Comparisons by Sex: Mean Ranks, Mann-Whitney U Test

	Boys	*Girls*	P
Age, child	49.23	54.05	.397
AS, caregiver	48.11	55.31	.219
AS, child	48.78	54.56	.324
Catastrophizing, caregiver	51.74	51.23	.930
Catastrophizing, child	47.58	55.91	.156
Discouragement	46.27	57.39	.058
Promotion of well behavior/coping	50.93	52.15	.835
Solicitousness	50.98	52.08	.851
Reported pain–1	50.48	52.65	.698
Reported pain–2	47.87	55.58	.133
Estimated pain–1	50.26	52.90	.650
Estimated pain–2	50.16	53.01	.616

Abbreviations: AS: anxiety sensitivity; Catastrophizing, caregiver: caregiver's catastrophic thinking about child's pain; Catastrophizing, child: child's pain catastrophizing; Discouragement: caregiver's response to child's pain of discouragement; Promotion of well behavior/coping: caregiver's response to child's pain of promotion of well behavior/coping; Solicitousness: caregiver's response to child's pain of solicitousness; Reported pain–1: reported pain intensity by the child after the operation; Reported pain–2: reported pain intensity by the child 24 hours after the operation; Estimated pain–1: caregiver's subjective estimation of child's pain intensity after the operation; Estimated pain–2: caregiver's subjective estimation of child's pain intensity 24 hours after the operation.

Supplementary Table 2. Covariances Between the Variables Included in the Model

Variables	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
1. Catastrophizing, child	75.18											
2. Catastrophizing, caregiver	47.65	101.94										
3. Discouragement	11.80	5.08	38.51									
4. Promotion of well behavior/coping	5.99	8.01	−2.83	24.51								
5. Solicitousness	16.24	23.88	−6.56	17.77	45.22							
6. Reported pain–1	3.99	3.55	1.36	−.27	−.55	4.73						
7. Reported pain–2	2.10	.01	1.15	.10	.99	.98	3.67					
8. Estimated pain–1	4.14	8.68	−.62	1.78	1.32	3.23	1.18	5.70				
9. Estimated pain–2	.73	1.29	−.18	1.13	2.14	.26	2.21	1.28	2.73			
10. Age, child	.71	1.85	1.32	−1.50	−.76	−.06	.10	.02	−.09	1.60		
11. AS, child	34.23	27.36	6.48	5.34	10.47	3.61	1.45	2.86	−.72	.46	53.35	
12. AS, caregiver	22.03	43.57	8.46	3.16	13.32	1.05	1.33	3.86	1.64	.01	29.85	74.37

Abbreviations: AS: anxiety sensitivity; Catastrophizing, caregiver: caregiver's catastrophic thinking about child's pain; Catastrophizing, child: pain catastrophizing; Discouragement: caregiver's response to child's pain of discouragement; Promotion of well behavior/coping: caregiver's response to child's pain of promotion of well behavior/coping; Solicitousness: caregiver's response to child's pain of solicitousness; Reported pain–1: reported pain intensity by the child after the operation; Reported pain–2: reported pain intensity by the child 24 hours after the operation; Estimated pain–1: caregiver's subjective estimation of child's pain intensity after the operation; Estimated pain–2: caregiver's subjective estimation of child pain intensity 24 hours after the operation.
NOTE. The numbers in the upper row correspond to the variables in rows 1 to 12.