Association between children's emotional/behavioral problems before adenotonsillectomy and postoperative pain scores at home

Johan M. Berghmans, Marten J. Poley, Jan van der Ende, Francis Veyckemans, Stephanie Poels, Frank Weber, Bert Schmelzer, Dirk Himpe, Frank C. Verhulst, Elisabeth Utens.

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ABSTRACT

Background: Children undergoing adenotonsillectomy are at risk of severe postoperative pain and sleep problems. Little is known about the specific child risk factors for these problems.

Aims: To assess the occurrence of postoperative pain, sleep problems and medication adherence and assess the influence of internalizing and externalizing problems on postoperative pain.

Methods: This prospective cohort study included 160 children, aged 1.5 – 5 years undergoing day-care adenotonsillectomy. Parents rated their child's pain with the Parents' Postoperative Pain Measure and their child's sleep problems with Vernon's Post Hospital Behavioral Questionnaire during the first 3 days and at day 10 postoperatively. Emotional/behavioral problems (i.e., internalizing and externalizing behaviors) during the past 2 months were assessed using the Child Behavior Checklist. Regression analysis was used to assess whether children's pain intensity at home was associated with internalizing/externalizing problems, after controlling for age, preoperative child state anxiety, parental state anxiety, parental need for information and socioeconomic status.

Results: Applying a threshold of ≥ 6 on the Parents' Postoperative Pain Measure the incidence of moderate to severe pain was 57.6% at day 1, 53.5% at day 2, 35.4% at day 3, and 4.8% at day 10. During the first 3 postoperative nights 37.1 % of the children woke up. Internalizing problems (β=. 343; *P*=.001) and parental need for information (β=.207; *P*=.011) were independently associated with higher pain scores at home during the first 3 days (R^2= .225).

Conclusions: Following adenotonsillectomy, children often experienced moderate to severe pain and sleep problems during the first 3 days at home. Preoperative internalizing problems and parental need for information were independently associated with increased pain at home. Screening for these problems can help to identify vulnerable children and adapt the perioperative analgesic strategy accordingly (which includes preparation, information and prescription of pain analgesics).

Keywords: Anesthesia, Anxiety, Child, Pain Postoperative, Risk Factors, Tonsillectomy

INTRODUCTION

Inadequate postoperative analgesia for children following day-care surgery is a major issue[1-3]. Adenotonsillectomy is a procedure after which children may experience much pain, as well as functional limitations and sleep problems for more than one week[4]. This may be the result of poor pain management as many parents do not to expect protracted postoperative pain[4]. Furthermore, parents often have misconceptions about pain medication, although they are able to recognize and assess their child's pain[5]. Alternatively, the prescribed analgesic regimen could be inadequate, refused by the child (bad taste, opposition) and parents may have received insufficient information[1,5]. Finally, parental anxiety, which seems to be related to preoperative need for information[3,6,7], socio-economic status[3] and cultural factors[1] are also known predictors of the children's pain levels[3].

Surprisingly little is published about specific child factors in relation to postoperative pain. What is known is that children often refuse to take pain medication, e.g. because it scares them, because it tastes bad, or swallowing is painful[1]. Furthermore, increased perioperative situational anxiety, which is more often seen in younger children[8,9], has been associated with higher postoperative pain scores[7,10]. In addition, children's pre-existing emotional/behavioral problems (specifically internalizing problems) are associated with children's situational anxiety during induction[9].

It is still unknown to what extent children's preoperative factors contribute to their postoperative pain experience after discharge. More knowledge on this issue would enable us to attune perioperative care and especially pain management at home towards individual needs.

Apart from postoperative pain, children have often sleep problems following surgery[10]. Sleep problems have not been thoroughly investigated so far, although a recent consensus statement for core outcome domains and measures for pediatric acute and chronic/recurrent pain in clinical trials recommended this[11].

Aims of this study: 1. to assess the level of postoperative pain in hospital, pain medication adherence at home, as well as pain and sleep problems at home in children aged 1.5 to 5 years undergoing adenotonsillectomy, during the first three days and at day ten after discharge; and 2. to assess whether emotional/behavioral functioning is related to postoperative pain during the first three days after discharge.

METHODS

This was a prospective observational cohort study in young children (and their parents) undergoing adenotonsillectomy at the Queen Paola Children's Hospital in Antwerp (Belgium) between April 2013 and January 2016.

This observational study was registered at http://www.trialregister.nl/trialreg/admin/rctview.asp?TC=3955 , and is reported following the STROBE statement and performed conform the Declaration of Helsinki. It was approved by the local Institutional Review Board (approval N°4157 B009201317117).

Inclusion/exclusion

All children aged 1.5 – 5 years undergoing day-care adenotonsillectomy were eligible. The following inclusion criteria applied: 1. written informed consent of parents; 2. American Society of Anesthesiologists (ASA) physical status I-II; 3. parents having a good understanding of Dutch language.

Excluded were: children with known developmental delay, children with a Body Mass Index above the 95th percentile for children of the same age and sex, and children who had a subsequent bleeding requiring re-intervention.

Parents received information at the preoperative Ear, Nose and Throat surgery consultation and informed consent was obtained by a research nurse on the day of surgery.

Demographic and medical data

On the day of admission demographical/medical data were collected by a research nurse. Parental education served as an indicator of socioeconomic status[12] classified into: 1. elementary school; 2. secondary school; 3. higher education or university.

Surgical technique

A common conventional cold dissection followed by bipolar diathermy for hemostasis was used.

Anesthesia procedure

All children and parents received a standardized preparation including a preoperative educational video. One parent was present during induction of anesthesia (parents chose themselves who would accompany the child) and no premedication was given - as is common practice at the Queen Paola Children's Hospital. The anesthesia management consisted of: 1. inhalation induction with sevoflurane 8 vol.% in a fresh gas flow of

6/8 liters/minute with a fractional inspired oxygen concentration (FiO_2) of 50% in air; 2. maintenance with sevoflurane: end-tidal concentration of 2.5-3 vol.% in FiO_2 of 50%; 3. opioids (fentanyl – Fentanyl-Janssen®: two mcg/kg and if necessary additionally pethidine – Pethidine®: 0.5 mg/kg, IV); 4. α_2 - adrenergic agonist (clonidine – Catapressan® : two mcg/kg, IV); 5. dexamethasone – Aacidexam-Aspen®: 0.15 mg/kg. IV; 6. Ondansetron – Ondansetron-Fresenius Kabi®: 0.1 mg/kg, IV; 7. fluid administration of Hartmann-solution (10 ml/kg/h, during surgery); 8. if necessary the muscle relaxant atracurium – Tracrium® (0.5 mg/kg, IV) was administered. During anesthesia ECG, O_2-saturation, *end-tidal* CO2, inhalation gas concentration, non-invasive blood pressure measurement (5 min. interval) were monitored.

For descriptive purposes intra-hospital postoperative pain management was assessed and it consisted of paracetamol (20 mg/kg, IV) and ketorolac - Taradyl® (0.5 mg/kg, IV). Intra-hospital postoperative rescue pain management consisted of tramadolhydrochloride - Tramadol HCL® 2 mg/kg, IV.

All children were extubated while being awake, transferred to the Post Anesthesia Care Unit and thereafter to the ward for 6 hours before discharge home.

Description of pain management at home

The parents received oral and written standardized pain management instructions with the recommendation to strictly adhere to prescribed regimen for the first three days. The regimen consisted of oral paracetamol – Perdolan® (syrup 15 mg/kg four times a day) and oral Ibuprofen – Nurofen® (syrup 5 mg/kg four times a day) 'by the clock'. Parents were asked to register medication adherence in a diary during the first three days and again at day 10. Good adherence was defined as having administered at least 16 of the 24 prescribed pain medications during the first three postoperative days.

On day 1, day 3 and day 10 a research nurse contacted the parents by phone and the parents were encouraged to ask questions whenever needed.

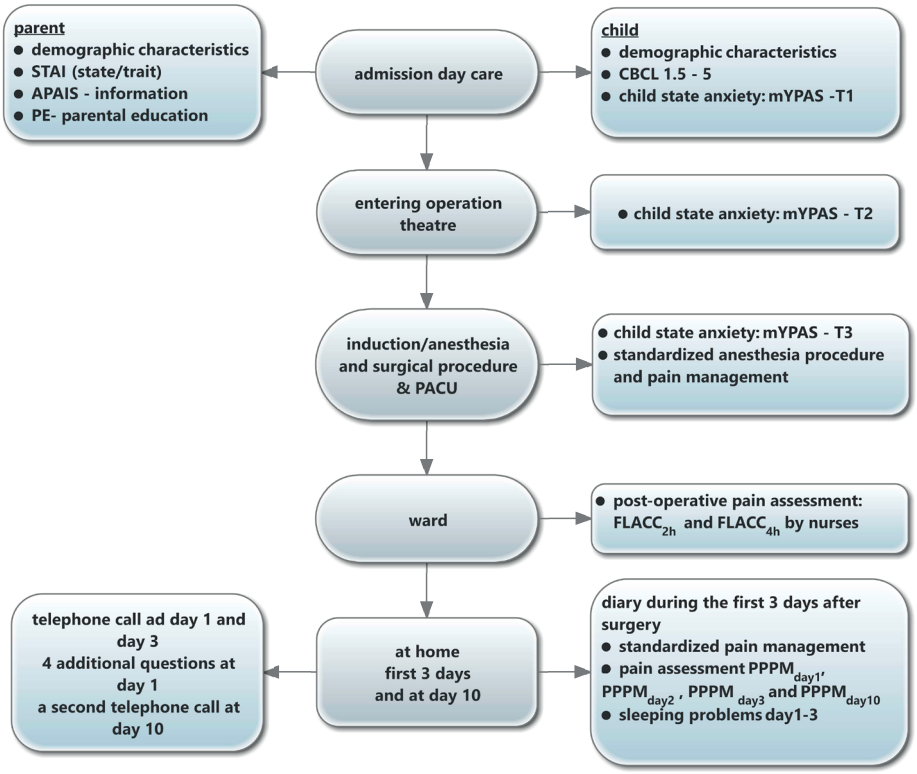
At day 1, the research nurse asked: 1. Are you satisfied with the information about postoperative care?; 2. Are you worried about your child's general well-being?; 3. Do you have any questions regarding your child's pain management?; 4. Did your child vomit or feel nauseated?

Assessment tools

Child pain assessment tools (see Figure 1)

Pain in hospital was assessed by a nurse at 2 hours and 4 hours postoperatively using the Face, Legs, Activity, Cry and Consolability (FLACC) scale. This scale has an excellent inter-rater reliability and validity in the postoperative phase[11,13]. By adding the scores at 2 hours and 4 hours a $FLACC_{sum\text{-}score}$ was computed.

Figure 1 Flowchart diagram of the different moments of assessment



STAI: Spielberger's State-Trait Anxiety Inventory; APAIS-info, Amsterdam Perioperative Anxiety Information scale – information part; CBCL/$1^{1/2}$-5: Child Behavior Checklist; mYPAS: modified Yale Preoperative Anxiety scale; FLACC: Face, Leg, Activity, Cry, Consolability scale; PPPM: Parents' Postoperative Pain Measure.

Pain at home was measured using the 15-item Parents' Postoperative Pain Measure (PPPM)[14], a recommended tool[11] validated for children aged from 1 to 12 years. The total score of this observational checklist ranges from 0 to 15. The PPPM has good specificity (80%) and sensitivity (88%) to detect children with postoperative pain. The internal consistency as reflected by Cronbach's alpha was 0.88 at day 1 postoperatively. Clinically significant pain has been defined as a PPPM score ≥ 6 (each day)[14].

On the day of surgery, a research nurse instructed the parents how to use the PPPM and asked them to complete it every evening during the first three days and at day 10 postoperatively. A mean PPPM score [mean-score $PPPM_{1-3}$] was calculated based on the separate PPPM scores during the first three days.

Postoperative sleep problems

During the first three days postoperatively and at day 10, parents answered four questions about their child's potential sleep problems based on Vernon's Post Hospital Behavioral Questionnaire (PHBQ)[15]. Questions addressed whether the child made a fuss about going to sleep, was afraid of the dark, had trouble getting asleep, and woke up at night. The responses (five response categories) were dichotomized into: sleep problems or no sleep problems.

Other child assessment tools

Emotional/behavioral problems of the child during the past two months were assessed, in hospital prior to surgery by the accompanying parent, using the internationally well-validated Child Behavior Checklist (CBCL/$1^{1/2}$-5)[16]. The CBCL/$1^{1/2}$-5 consists of 100 problem items (response categories 1-3). Summary scores on internalizing problems (subscales: emotionally reactive, anxious/depressed, withdrawn, somatic complaints), externalizing problems (subscales: attention problems and aggressive behavior), and a total problem score were calculated. Higher scores indicate more emotional/behavioral problems. Good validity and reliability of the CBCL/$1^{1/2}$-5 have been confirmed for the Dutch-translated version.

A trained research nurse completed the modified Yale Preoperative Anxiety Scale (mYPAS)[17] at three moments: 1. on admission (mYPAS-T1); 2. in the holding area (mYPAS-T2); 3. during induction (mYPAS-T3). This structured observational instrument assesses five domains: activity, emotional expressivity, state of arousal, vocalization and use of parents (number of items 4 or 6). It has good-to- excellent reliability and validity. Kain *et al*[17] reported that the instrument has: 1. good inter- and intra-observer agreement (κ statistics ranged between 0.63 and 0.90); 2. high concurrent validity (r = 0.79 with the STAI for children); and 3. high construct validity. A mean summary score [$mYPAS_{mean}$] was calculated from the scores for the three measurement moments.

Parental assessment tools

Parents completed the Spielberger's State Trait Anxiety Inventory[18] to assess their own state anxiety (current situational state) and trait anxiety (general disposition to anxiety). The Dutch-translated version has been validated[18].

Parents' attitude towards receiving information was assessed with two items of the Amsterdam Preoperative Anxiety Information Scale (APAIS)[19]: 1. I would like to know as much as possible about the anesthetic; 2. I would like to know as much as possible about the procedure. A summary score was based on scores on both items (each with response categories on a 5-point Likert scale). A score between 2 – 4 means no/little information need; 5 – 7 average information need and scores between 8 – 10 a high information need [19]. A score ≥ 5 is interpreted as having a positive attitude towards receiving information.

Statistical analysis

Baseline demographic and psychological data of children and parents are presented as means ± standard deviations (for continuous data), as median with interquartile range or as percentages (for categorical data). Skewness and kurtosis indicated that the data were normally distributed. This was further checked by Kolmogorov-Smirnov tests and Q-Q plots.

An a priori power analysis for multiple regression (mean-score $PPPM_{1-3}$ as outcome parameter) was performed using GPOWER version 3.1.9.2., based on a fixed model (model parameters are fixed or non-random quantities). This analysis showed that 147 children were needed to detect a medium effect size, (reflected by Cohen's f^2= 0.15), with a power of 0.9 and an α of 0.05, using 10 predictors. Allowing for approximately 10% loss to follow-up, a sample size of 160 was considered sufficiently large for this study's aims.

Linear regression analyses

Univariate linear regression was initially conducted to identity variables individually associated with increased pain at home. The mean $PPPM_{1-3}$ score was used as dependent variable. Based on their theoretical relevance from previous publications, the following independent variables were considered: child's age, parental state anxiety, parental trait anxiety, parental need for information, parental education (recoded into dummy variables), child's state anxiety, preoperative internalizing problems (CBCL), preoperative externalizing problems (CBCL) and preoperative total problems (CBCL).

After that, a multiple regression model was constructed to assess whether internalizing and externalizing problems explained pain at home. To avoid multicollinearity issues, independent variables that correlated highly with other independent variables were excluded from the regression analyses. This implies that the CBCL total problems score (which highly correlated with both internalizing and externalizing problems) and pa-

rental trait anxiety (which highly correlated with parental state anxiety) were excluded. The remaining independent variables were entered into two blocks. First, the following variables already mentioned above were entered into the model: child's age, child's state anxiety, parental state anxiety, parental need for information, and parental education. Second, internalizing/externalizing problems of the CBCL were added to see what these variables add to the strength of the model, after the previous variables had been controlled for.

All analyses were performed with IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.

RESULTS

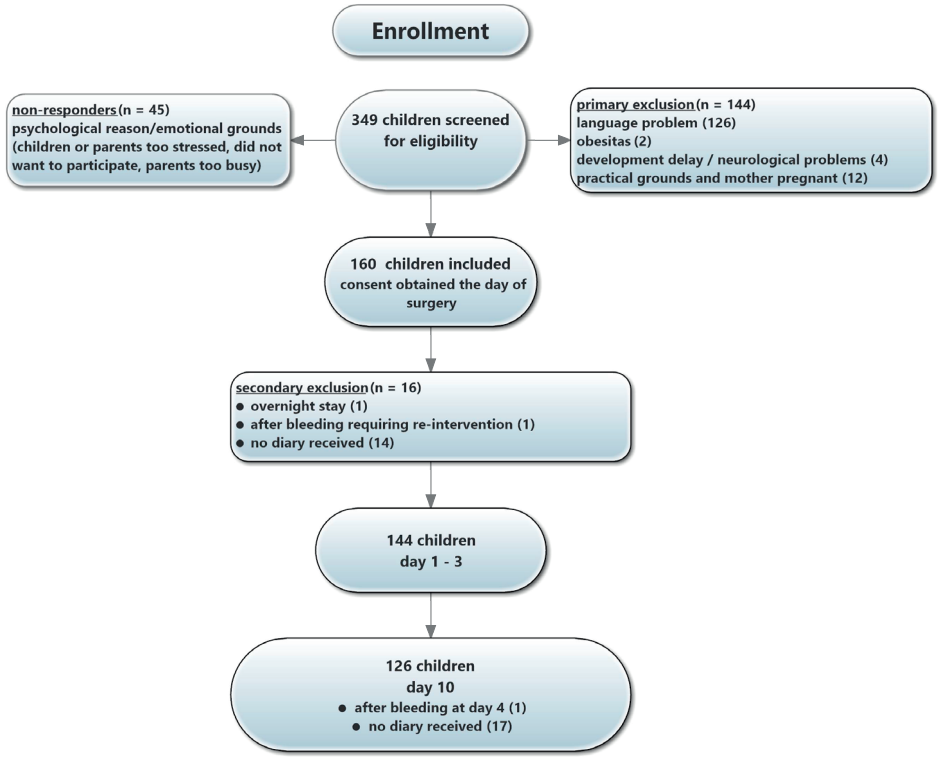
A total of 349 eligible children-parent pairs were screened. Of these, over one third (n = 126) was excluded due to insufficient knowledge of Dutch, while another 18 children had to be excluded for other reasons (obesity, developmental delay and logistic grounds). Of the remaining 205 children, 45 children and parents refused to participate for emotional or practical reasons (parents too busy, children or parents too stressed), corresponding to a response rate of 78%. One child was excluded because of bleeding requiring re-intervention and another stayed overnight. Of the remaining 158 children, the data of 14 children had to be removed from the analyses after three days, as no diaries were received.

Eventually, complete data of 144 children were available for final analysis up to three days. Unless indicated otherwise, the analyses described below refer to those 144 children.

At day 10, complete data were available for 126 (78.8%) children (see exclusion details in Figure 2).

The mean age was 46.4 months (SD ± 11.2); nearly half (49%) were boys; and 107 (74.8%) were accompanied by the mother at induction (Table 1). One hundred seventeen parents (81.3%) had a positive attitude towards receiving information (score APAIS ≥ 5) and 58 (41%) had a high information need (score APAIS ≥ 8). Furthermore, at day 1 postoperatively, 130 (90.3%) parents reported they were satisfied with the information about postoperative accompaniment. Nine (6.3%) parents reported they were worried about the child's general wellbeing at home and 8 (5.9%) parents had some additional questions regarding their child's pain management.

Figure 2 Flowchart of patient inclusion



Pain scores

In-hospital pain

The FLACC scores at 2 hours postoperatively in the ward (median = 0, IQR 0-0) reflected no to mild pain (FLACC score ≤ 3) in 137 children (95.1%) and moderate pain in 7 children (4.9%). The FLACC scores (median = 0, IQR 0-0) 4 hours after leaving the Post Anesthesia Care Unit reflected no to mild pain in 134 children (95.7%), moderate pain in 5 (3.6%) and severe pain in 1 child (0.7%).

Primary outcome: pain at home

Mean PPPM scores decreased over time from 6.5 at day 1 to 1.0 at day 10, consistent with a decrease of postoperative pain intensity over time (Table 2). At day 1, 57.6% of the children had moderate to severe pain versus 4.8% at day 10.

Table 1 Characteristics of the children and the parent complete cases after 3 days postoperatively (n = 144)

	Children	**Accompanying Parent**	
demographic data			
gender boy	71 (49.3%)	gender mother	107 (74.3%)
age, months'	46.4 ± 11.2	parental age, (y)	33.3 ± 5.7
weight, kg	16.5 ± 2.9	parental nationality Belgian	133 (92.6%)
number of siblings ≥ 1	119 (82.6%)		
psychological variables			
[a]CBCL/1 $^{1/2}$-5		[b]parental education	
Internalizing problems	10.3 ± 8.3	PE 1	28 (19.4%)
Externalizing problems	11.4 ± 7.1	PE 2	86 (59.7%)
Sleep problems	2.5 ± 2.6	PE 3	30 (20.8%)
Total problems	33 ± 21.4		
[c]child state anxiety		[d]parental anxiety	
mYPAS-T1	30.7 ± 8.0	state anxiety	42.4 ± 10.1
mYPAS-T2	42.2 ± 17.6	trait anxiety	34.8 ± 8.4
mYPAS-T3	51.6 ± 25.5		
$mYPAS_{mean}$	41.5 ± 14.5	[e]APAIS-info	6.7 ± 2.2
		APAIS 2 – 4	27 (18.8%
		APAIS 5 – 7	59 (40.9%)
		APAIS 8 – 10	58 (40.3%)
[f]pain in hospital			
$FLACC_{sum\text{-}score}$	0 (0 – 0)		
additional opioid pain medication			
during anesthesia			
paracetamol IV	144 (100%)		
ketorolac IV	144 (100%)		
pethidine IV	132 (82.5%)		
after anesthesia: tramadol IV	13 (8.1%)		
at home			
nausea/vomiting day 1 at home	6 (4.2%)	information satisfaction	130 (90.3%)
[g]medication adherence day 1-3	36 (25.2%)		

Data are expressed as N. (%); as mean with ± SD or as mean and IQR; [a]CBCL/1 $^{1/2}$-5: Child Behavior Checklist as assessed by the accompanying parent (internalizing, externalizing, sleep- and total problems); [b]PE, parental education: PE 1 (no education or primary school), PE 2 (high school), PE 3 (further studies or university); [c]child state anxiety: modified Yale Preoperative Anxiety scale (mYPAS) at [mYPAS-T1] holding area, at [mYPAS-T2] entrance of the operating theatre and at [mYPAS-T3] during induction, mean summary score $mYPAS_{mean}$ = [mYPAS-T1 + mYPAS-T2 + mYPAS-T3]/3; [d]parental anxiety: Spielberger's State – Trait Anxiety Inventory; [e]APAIS – info, Amsterdam Perioperative Anxiety Information scale – information part; [f]$FLACC_{sum\text{-}score}$; Face, Leg, Activity, Cry, Consolability scale; [g]medication adherence (dichotomized using a cut-off value of 75% of max. allowed number of pain medication at home during the first 3 days postoperative)

Adherence to pain management at home

Prescribed pain medication at home was given according to instructions by only 25.2% (n = 36) of parents during the first three days after surgery. (Table 1)

Sleep problems after surgery

On day 1, 52 (36%) children woke up at night versus 20 (16%) at day 10 (Table 2). On day 1, 21 (15%) children resisted going to sleep and 16 (11%) had trouble falling asleep. At day 10 these problems had almost completely disappeared.

Table 2 Postoperative pain scores and sleep problems at home

Primary outcome	**Day 1**	**Day 2**	**Day 3**	**Day 10**	
Pain at home	**$PPPM_{day1}$**	**$PPPM_{day2}$**	**$PPPM_{day3}$**	**$PPPM_{day10}$**	**$PPPM_{day1-3}$**
Mean (± SD)	6.48 ± 3.87	6.11 ± 4.18	4.51 ± 4.22	1.06 ± 2.47	5.7 ± 3.7
N (%) score ≥ 6	83 (57.6%)	77 (53.5%)	51 (35.4%)	6 (4.8%)	

Secondary outcome	**Day 1**	**Day2**	**Day 3**	**Day 10**
Sleep problems				
Making a fuss about going to sleep at night	21 (14.6%)	20 (14%)	21 (14.6%)	6 (4.7%)
Being afraid of the dark	4 (2.8 %)	7 (4.9%)	4 (2.8%)	1 (0.8%)
Having trouble getting to sleep at night	16 (11.1%)	22 (15.3%)	26 (18%)	5 (3.9%)
Waking up at night	52 (36.1%)	57 (39.9%)	52 (36.1%)	20 (15.8%)

Data are expressed as N. (%); as mean with ± SD. **Primary outcome: pain at home 1. PPPM**: Parents' Postoperative Pain Measure at day 1, ($PPPM_{day1}$), day 2 ($PPPM_{day2}$), day 3 ($PPPM_{day3}$) (n = 144); day 10 ($PPPM_{day10}$) (n = 126) and mean score $PPPM_{day1-3}$ = ($PPPM_{day1}$ + $PPPM_{day2}$ + $PPPM_{day3}$)/3; **Secondary outcome: sleep problems** – after dichotomizing (more problems vs. no problems). Parents had 5 answers options: a. much less; b. less; c. the same; d. more; e. much more as normal. For questions 1 & 2 and 3 the results were dichotomized by having no sleep problems (a + b + c) or having sleep problems (d + e). Regarding question 4 the results were dichotomized by having no sleep problems (c + d + e) or having sleep problems (a + b): number and % present more problems

Univariate regression model

Positive associations were found between the children's level of pain on $PPPM_{1-3}$ and respectively: 1. CBCL internalizing, externalizing, and total problems; 2. parental state anxiety; 3. parental need for information. Standardized regression coefficients ranged from 0.227 to 0.368 (Table 3).

Multiple regression model

In first-block analysis, the multiple regression model explained 9.7% of the variance (*P* = .028). Parental state anxiety and parental need for information (APAIS-info) were independently associated with pain scores at home ($PPPM_{1-3}$) (Table 4).

Table 3 Univariate regression model explaining the child's postoperative pain during the first 3 days at home

	Postoperative pain during the first 3 days at home
	mean scores [a]PPPM 1-3
child's age	-.033 (.069)
[b]parent state anxiety	.237 (.004)
[b]parent trait anxiety	.066 (.432)
[c]APAIS – info	.227 (.006)
[d]parental education 1	-.073 (.385)
[d]parental education 3	.009 (.910)
[e]mYPAS$_{mean}$	-.024 (.777)
[f]preoperative internalizing problems (CBCL)	.368 (.000)
[f]preoperative externalizing problems (CBCL)	.255 (.002)
[f]preoperative total problems (CBCL)	.359 (.000)

Data are expressed as standardized regression coefficients; (P- value).
[a]mean scores PPPM1-3: Parents' Postoperative Pain Measure [PPPM1-3 = day 1 + day 2 + day 3]/3; [b]Parent state/trait anxiety, Spielberger's State – Trait Anxiety Inventory; [c]APAIS-info, Amsterdam Perioperative Anxiety Information scale – information part; [d]Parental education recoded in three dummy variables: Parental education recoded 1 = no education, elementary school; Parental education 2 (reference) = secondary school; Parental education 3 = higher education or university; [e]mYPASmean: mean child state anxiety as assessed with the modified Yale Preoperative Anxiety scale (mYPAS), mean scores mYPASmean = [mYPAS(1) + mYPAS(2) + mYPAS(3)]/3; [f]preoperative internalizing/externalizing/total problems, Child Behavior Checklist List (CBCL).

In the second-block analysis, we entered the CBCL internalizing and externalizing problems scores into the regression model. Preoperative internalizing and externalizing problems explain postoperative pain above and beyond the other variables. In the final model, internalizing problems and parental need for information were independently associated with pain scores at home (PPPM$_{1-3}$). A difference of respectively 0.34 SD and 0.21 SD on the PPPM$_{1-3}$ score was associated with 1 SD difference on internalizing problems and parental need for information. Overall, this model explained 22.5% (P = .000) of the variance of pain scores at home.

DISCUSSION

More than 50% of children in this study had moderate to severe pain during the first three days after adenotonsillectomy, which is consistent with previous research[2,4]. On day 10, 3.8% of children still experienced moderate to severe pain. Furthermore, parents reported sleep problems for almost 40% of the children during the first three postoperative days at home.

Table 4 Multiple regression model – associations with the child's postoperative pain as assessed with the Parents' Postoperative Pain Measure during the first 3 days at home ($PPPM_{1-3}$)

	Postoperative pain $PPPM_{1-3}$ (n = 144)							
	Model step 1				**Model step 2**			
Variable	unstandardized B	95% CI for B	standardized β	*P-value*	unstandardized B	95% CI for B	standardized β	*P-value*
Constant	.841	[-4.02, 5.70]		.733	1.523	[-3.10, 6.15]		.516
child's age	.001	[-.055, .057]	.004	.966	-.012	[-.065, .041]	-.037	.647
[a]parent state anxiety	.076	[.014, .138]	.209	.017	.039	[-.021, .099]	.107	.202
[b]APAIS-info	.290	[.006, .573]	.173	.046	.347	[.081, .613]	.207	.011
[c]parental education 1	-.945	[-2.50, .614]	-.102	.233	-.928	[-2.38, .529]	-.100	.210
[c]parental education 3	.259	[-1.26, 1.78]	.029	.736	.633	[-.797, 2.06]	.070	.383
[d]$mYPAS_{mean}$	-.006	[-.049, .038]	-.022	.800	-.026	[-.067, .015]	-.102	.215
[f]preoperative internalizing problems					.152	[.063, .242]	.343	.001
[f]preoperative externalizing problems					.03	[-.072, .132]	.058	.557

Dependent variable: mean scores PPPM1-3: Parents' Postoperative Pain Measure [PPPM1-3 = day 1 + day 2 + day 3]/3;

Model step 1. Predictor variables: 1. Child age; 2. [a]Parent state and trait anxiety with, Spielberger's State-Trait Anxiety Inventory; 3. [b]APAIS-info, Amsterdam Perioperative Anxiety Information scale – information part; 4. [c]Parental education recoded in three dummy variables: Parental education recoded 1 = no education, elementary school; Parental education 2 (reference) = secondary school; Parental education 3 = higher education or university; 5. [d]$mYPAS_{mean}$: mean child state anxiety as assessed with the modified Yale Preoperative Anxiety scale (mYPAS), mean scores $mYPAS_{mean}$ = [mYPAS(1) + mYPAS(2) + mYPAS(3)]/3;

Model step 2. All predictor variables of model 1 + [g]preoperative internalizing/externalizing problems, Child Behavior Checklist ($CBCL/1^{1/2}$-5).

Note: model 1 (R^2 = .097; *P* = .028) and model 2 (R^2 = .225; *P* = .000); ΔR^2 = .128

Pre-existing internalizing problems (emotionally reactive, anxious/depressed, withdrawn, somatic complaints) were independently associated with higher pain scores during the first three postoperative days after adenotonsillectomy. This finding remained even after controlling for the child's age, the child's state anxiety, parental state anxiety and parental education. In addition, parental need for information was also associated with pain scores at home.

The finding that children's preoperative internalizing problems were associated with higher pain scores at home suggests that children showing anxiety/depression, withdrawn behavior, somatic complaints and emotional reactiveness, are at high risk for increased postoperative pain experience. This is consistent with previous studies in which higher levels of internalizing problems were associated with recurrent abdominal pain[20] and headache in children[21]. On the other hand, an earlier study in children undergoing tonsillectomy found no association between preoperative CBCL scores and postoperative pain, which may be related to the small study size (n = 43)[22].

Furthermore, parents with a higher need for information reported more postoperative pain for their children. A majority of parents (81%) had a positive attitude towards receiving information, 40% had a high need for information (APAIS ≥ 8) and a vast majority (92 %) seemed to be satisfied with the information given. The finding that higher parental state anxiety was related to a higher parental need for information is consistent with literature[6,19].

Remarkably, only one quarter of the parents adhered to the prescribed pain management, consistent with previous findings[2,4]. Our results may indicate that parents can recognize their child's pain but do not give pain medication accordingly. Although a majority of parents were satisfied with the information provided, it may have been too general and not attuned to what parents needed to know about the importance of adherence to the medication regimen. Still, their knowledge on this issue, including the side effects of the medication, was not assessed. Future research should unravel why parents would not adhere to a pain medication regimen for their child.

In this study, many of the children showed postoperative sleep problems, which is consistent with previous findings[10]. From a clinical perspective it is important to inform parents that these postoperative sleep problems may occur.

Several strengths of this study deserve mention. We included a large sample of children in a vulnerable age category (1.5 to 5 years). Furthermore, anesthetic and pain management was standardized, both in-hospital and at home. Lastly, internationally validated

instruments such as the FLACC and PPPM were used, as advocated by PedIMMPACT[11] recommendations. Still, some limitations regarding pain assessment in young non-verbal children should be addressed. Firstly, psychological traits might have an impact on assessment tools' pain outcomes as compared to how they affect the patients' actual experience of pain. Secondly, the validity of pain assessment tools in children under the age of five is poor and children's pain self-report should be preferred[11,23]. Furthermore, although parents might be reliable as assessors, they may tend to overestimate the severity of the child's pain[23].

On the other hand, this is a single centre study, which implies that it may have limited generalizability. Then, as the study used information from a single informant (a parent), it may be vulnerable to common method variance[24]. Since one informant competed the questionnaires, scores may be biased (e.g. if a parent "overestimates" the child anxiety, he/she will presumably do so on all questionnaires, which may elevate correlations just by the fact that one informant completed them).

Furthermore, it is not known to what extent other parental characteristics, such as parental stress and pain catastrophizing thoughts, could have influenced the results.

As this study shows, children with internalizing problems are at risk for higher pain at home after day-care adenotonsillectomy and are at risk for sleep problems. Moreover, children who undergo a medical procedure might be at risk for developing post-traumatic stress symptoms[25]. This should be investigated in children with prolonged postoperative pain and in children with more emotional problems, since posttraumatic stress symptoms may harm psychosocial functioning.

In conclusion, the take-home messages of this study are: 1. including some form of psychological screening in the preoperative evaluation of children can be beneficial as pre-existing internalizing problems are a risk factor for higher postoperative pain at home; 2. providing parents with specific information regarding their child's pain management at home is essential to enhance adherence to the prescribed medication regimen.

DISCLOSURES

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3. Conflict of interest: Dr F. Verhulst published the Dutch translations of ASEBA from which he receives remuneration. Dr F. Veyckemans is section editor for Pediatric Anesthesia. The other authors have no conflict of interest.

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