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ORIGINAL RESEARCH

Effects of Preoperative Parental Pain Management Educational Interventions on the Postoperative Pain Intensity and Duration of Small Children Who Underwent One-Day Surgery: A Prospective Randomized Controlled Trial

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Abstract

Objectives: To evaluate effects of parental pain management educational interventions on postoperative pain assessment, intensity and duration of small children after a one-day-pediatric surgery. **Methods**: We conducted a prospective randomized, observational study of parental and nurse's pain assessments in children. The Parents' Postoperative Pain Management rating scale (PPPM), Wong-Baker FACES Pain Rating Scale (W-B) or the Numerical Rating Scale (NRS) was used. The children's pain was assessed by parents who were or were not (intervention vs. control groups) preoperatively educated about pain management postoperatively in the hospital and the first three days at home. Nurses who cared for the children postoperatively in the hospital, independently from the parents, assessed the children's postoperative pain with W-B and NRS. **Results:** One hundred and fifty-two parents and their children were included in the study. Complete data were available for 142 parents and their children, with one parent, usually the mother (108 (76.1 %)), being involved at all stages of the study. No differences in children's postoperative pain scores and analgesic use at home were found between the two parental groups (intervention and control groups). Parental pain scores after surgery was strongly positively correlated with pain duration, and analgesic use by their children at home. Pain intensity scores assessed by nurses in the hospital were lower compared to parental pain intensity scores. There was high inter-rater reliability between the PPPM, Wong-Baker, and NRS scales. **Conclusions:** No differences in postoperative pain in children were found between the intervention and control groups of parents. Parents gave higher scores of pain intensity in children than nurses did.

Keywords

Pain rating scales, Small child, Surgery, One-day hospital, Parents, Pain

1. Introduction

Various pediatric pain assessment tools are available in practice today which may rely on self-evaluation or evaluation by nurses, doctors or parents, evaluation of behavioral changes, and the use of biomarkers [1]. In preschool children, self-evaluation of pain can be performed with the Wong-Baker FACES Pain Rating Scale (W-B), among others [2–5]. In schoolchildren, the Numerical Rating Scale (NRS) is a validated pain scale [6–8]. The Parents' Postoperative Pain Management (PPPM) scale has been developed for use by parents in home care and has proven to be useful [9–12].

In the hospital setting, parents showed moderate levels of knowledge, attitudes, and the use of pain relief methods in relation to their child's postoperative pain and pain management [13]. The latest report by Chartrand et al. on the impact of educational preoperative DVDs on parents' and children's pain outcomes in the recovery room revealed that parents in the intervention group gained a greater knowledge of and used more positive reinforcement, distraction and relaxation methods than those in the control group [14].

Not many studies have tested how the education of parents before surgery affects their management of children's postoperative pain in the hospital and at home. Of those, only a few studies have shown that despite educational intervention, postoperative pain management at home was inadequate [15]. The other authors observed a modest impact of such education on parental management of their child's pain [16–18].

Some studies also showed that nurses assess the intensity of children's pain to be lower compared to parents [19–22], while some studies did not report statistically significant differences between nurses' and parents' assessments of pain intensity in children [23].

Therefore, the aim of the present study was to investigate the effects of preoperative parental education, toward the as-

sessment and management of postoperative pain, differences between parental and nurse's pain assessments, and to test correlation between three different pain scales in children who underwent a one-day hospitalization for a surgical procedure in the largest University Medical Centre Ljubljana. We hypothesized that a) preoperative parental education on children's postoperative pain has an impact on parental postoperative children's pain intensity, duration and pain management, b) postoperative parental pain intensity assessments differ from nurses' postoperative pain intensity assessments, and c) that there is a good correlation between the three pain intensity scale scores with the PPPM, W-B, and/or NRS scales.

2. Methods

The study received ethical approval by the Slovenian National Medical Ethics Committee and did not pose any harm to children included in the study (No. 0120-477/2015-2 KME 32/10/15).

2.1 Overall Design of the Study

We conducted a study among parents on children's pain intensity assessment and management in a one-day-surgery hospital in the Department of Pediatric Surgery and Intensive Therapy, Division of Surgery, University Medical Centre Ljubljana.

2.2 Study Context and Participants

Based on a multi-annual review of data, we expected to include approximately 60 children per month who would undergo surgery for minor abdominal and urogenital conditions (inguinal hernia, retention of the testes, or hydrocele) and their parents. That could lead to up to 180 children in a three-month period under optimal conditions.

The inclusion criteria were preschool and schoolchildren, girls and boys, aged 3 to 7 years, who were themselves able to assess the intensity of pain. The observed sex imbalance in our study was due to sex-related differences in elective surgical procedures, like inguinal hernia repair, which has already been shown to be more prevalent in males than in females [24]. However, the ratio between boys and girls was even more strongly in favor of boys due to the inclusion of urogenital surgical problems in boys. During the study period, the sex ratio in our department was approximately 9:1 (male: female).

Convenience sampling was used for inclusion of parents and children in the study and randomization and allocation were performed using a pre-determined schedule.

2.3 Data Collection

2.3.1 The waiting list for one-day surgery

The waiting list data for one-day surgery of elective surgical procedures was stored in an outpatient clinic. Children were included on the waiting list according to the principle of "first come, first enrolled".

2.3.2 Admission for surgery and recruitment into the study

On admission, the examining physician explained the nature of the study and asked parents for permission to include both the child and a parent in the study on postoperative pain assessment and management (convenience sampling). Written consent had to be signed by a parent or the legal representative of the child prior to inclusion in the study.

2.3.3 Randomization and allocation

After parents gave written consent, a systematic approach to randomization was used [25]. The parents were blinded as to which group they had been allocated to on admission. Parents and children were divided into two groups: an *intervention group*, and *control group*. In an *intervention group* parents received all the written and oral information about postoperative pain management in hospital and at home in the form of a comprehensive leaflet about pain, analgesics, assessment of pain by three different pain assessment scales, treatment with analgesic drugs in hospital and at home, as well as nonpharmacologic approaches to reduce pain, by a nurse. A *control group* of parents, did not receive such information, but only short oral information before leaving the hospital. On admission, the group randomization and allocation were performed as follows (see Fig. 1): on the first two days of the week, the parents were allocated to the intervention group, and on the last two days of the week, they were allocated to the control group. The next week's allocation was changed so that on the first two days the parents were allocated to the control group, and on the last two days, to the intervention group. The third week's allocation regime was the same as in the first week, and so on. This regime ensured that the mixing of groups was avoided.

2.3.4 Follow-up

After the parents and children were discharged home, parents were required to monitor the pain intensity in their children for the first three days and complete the pain assessment scales, which had to be mailed back to our address within the two weeks following surgery.

2.3.5 Study duration and cessation of the study

The study lasted five months (February 1, to June, 30) 2016 and was stopped two weeks after the last participants were included and sent the completed forms back.

2.4 Instruments

2.4.1 Assessment of pain intensity in hospital

After the surgery, the parents showed the child one of the pain measurement scales, either the W-B or the NRS scale (according to the age and cognitive development of the child). In preschool children, evaluation of pain was assessed by the Wong-Baker FACES scale [2]. In schoolchildren (older than 6 years of age), the NRS was used. [6–9]. Parents showed the assessment pain scale to the child and asked them to indicate the intensity of their pain on the pain scale. The completed evaluation pain sheets were collected and placed in a collection envelope for each participant separately. The first assessment

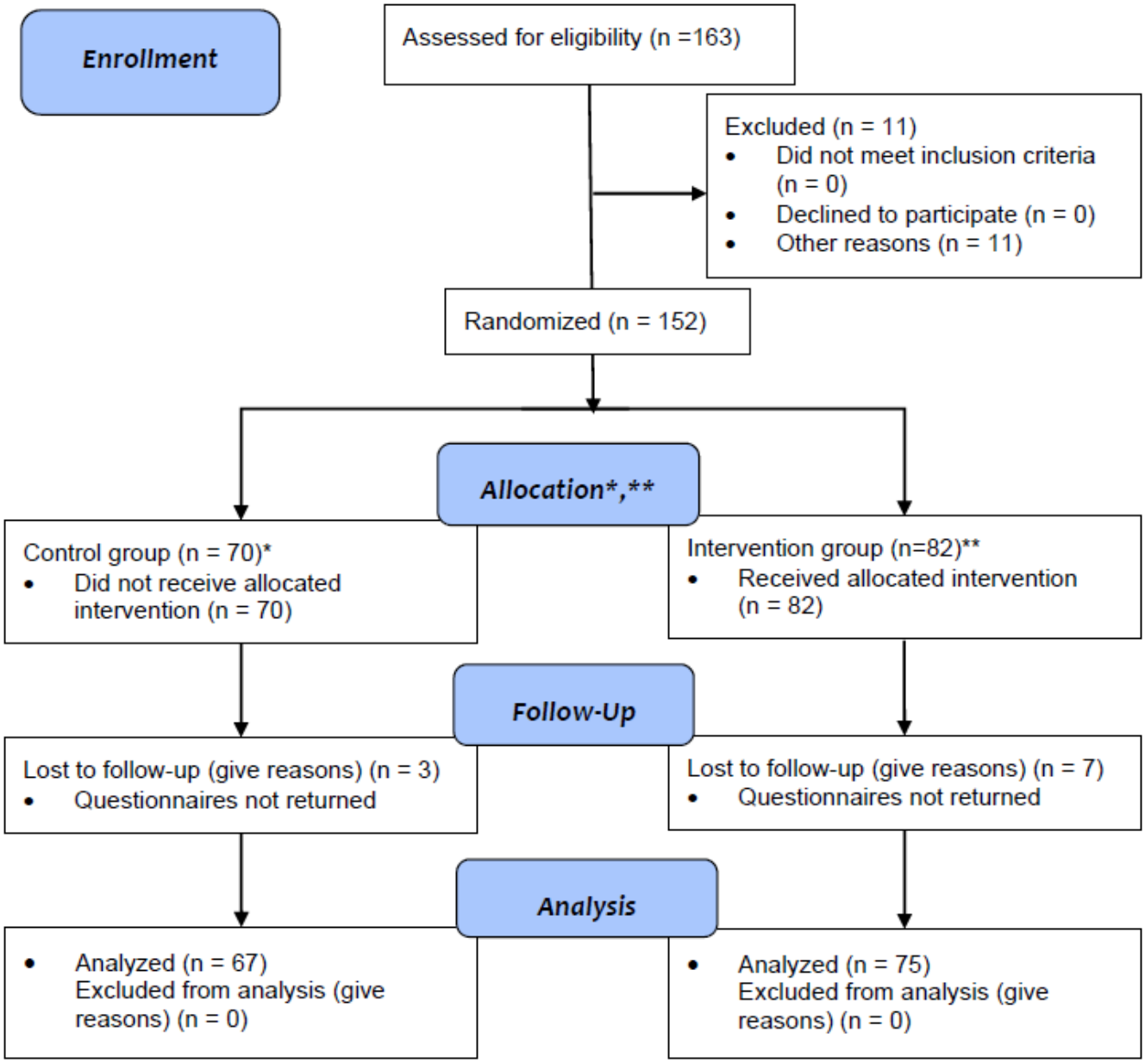

FIGURE 1. CONSORT flow diagram of recruitment, randomization and allocation.
** Allocation of parents in Control group in the 1. week: Thursday, Friday; 2. week Monday, Tuesday. Allocation was repeated in the same way in the 3. and 4. week and all subsequent weeks as it was in the 1. and 2. week. ** Allocation of parents in Intervention group in the 1. week: Monday, Tuesday; 2. week Thursday, Friday. Allocation was repeated in the same way in the 3. and 4. week and all subsequent weeks as it was in the 1. and 2. week.*

was performed when the child drank the first sips of fluid after surgery and the second before leaving the hospital.

The nurse's pain assessment was completed independently by the nurse who was in charge of the one-day surgery pediatric patients during her working day. They used tha same pain scales either the W-B or the NRS scale (according to the age and cognitive development of the child).

2.4.2 Assessment of pain intensity at home

At home, the assessment of the child's pain was only made by the parent before bedtime. In preschool children, evaluation of pain was assessed by the Wong-Baker FACES scale, while NRS was used in schoolchildren older than 6 years of age.

Assessment in home care was also performed with the Parents' Postoperative Pain Management (PPPM) scale [9–12] (Appendix Table 1). The Parents' Postoperative Pain Measure is a 15-item behavioral checklist covering complaining, crying, playing, doing the usual things, eating, groaning, etc. based on non-verbal pain cues that children show following surgery (e.g., whining or complaining more than usual, holding the sore part of his/her body). All 15 items are shown in detail in Appendix Table 1.

TABLE 1. Demographic characteristics of parents and children in the intervention and control groups and prior experience in pain management.

	Control group (n = 67)	Intervention group (n = 75)	p-value
Parents' gender			
Male	17 (25.4)	17 (22.7)	0.706[a]
Parents' education			
Elementary	2 (3)	2 (2.7)	0.862[b]
Professional qualification	4 (6)	2 (2.7)	
College	22 (32.8)	24 (32.9)	
Secondary School	19 (28.4)	19 (26)	
University	20 (29.9)	26 (35.6)	
Average age of parents (SD; years)	36.6 (6.2)	36.6 (6)	0.955[c]
Children			
Male gender	64 (95.5)	64 (85.3)	0.042[a]
Average age of children (SD; months)	68.6 (42.1)	71.7 (38.7)	0.646[c]
Prior surgery and pain treatment	18 (26.9)	17 (22.7)	0.562[a]
Prior trauma and pain treatment	16 (23.9)	13 (17.3)	0.334[a]
Knowledge of pain	24 (35.8)	22 (29.3)	0.41[a]

Legend: Frequencies and percentages are shown unless otherwise indicated. SD = standard deviation, [a] *= chi-square test;* [b] *= odds ratio;* [c] *= t-test.*

2.4.3 Assessment of pain frequency

The frequency of pain was calculated from the frequency of analgesic medication use in the hospital and at home.

2.4.4 Duration of pain

The indicator of pain duration was the presence of pain on the third day at home. Children with pain assessment > 0 were included in the group with pain of longer duration and the others in the group with a shorter duration of pain.

2.4.5 Questionnaire forms used by parents

2.4.5.1 Parental prior experience of pain in their child

Parental prior experience of pain in their children was obtained from the Questionnaire form (developed by the corresponding author SG and VE and tested for validity and variability) where parents answered three "yes-no" questions. The three questions to be answered by parents were: 1. "Has your child ever had an operation and needed analgesic drugs?", 2. "Has he ever been injured and needed analgesic drugs?", and 3. "Have you ever been educated about postoperative pain and how to manage it?"

For assessment, we had to first test the validity and reliability of experience and prior attitudes to pain and pain therapy. If the measurement is valid, then it is expected that parents with a child who underwent a surgical procedure in hospital were informed about pain management from the hospital staff. The results support this assumption because there is a moderate, but statistically significant relationship between a child undergoing a prior operative procedure in hospital and prior receipt of information about the child's postoperative pain management (Cramer's V = 0.44; $p < 0.001$). The Kuder-Richardson Formula 20 score (KR-20) of 0.61 indicates an appropriate level of measurement reliability. There is also a moderate correlation between the question measuring prior knowledge about postoperative pain management ("yes-no" answer) and the scale measuring the current attitude about pain management (4 items) in the parents from the control group (eta = 0.47), indicating good concurrent measurement validity.

2.4.5.2 Parental attitudes and management of children's postoperative pain measures

Parental attitudes and management of children's postoperative pain measures were adapted as a Questionnaire from the Position paper on Postoperative acute pain management in children used at the University Medical Center and validated by VE. Using four questions, we wanted to measure the cause, symptoms, intensity, and treatment of pain. The parental management of pain was measured by eight questions dealing with options for the treatment of pain, the duration of pain and postoperative pain management, and influences of pain on postoperative complications. All items are listed in Table 2 in the Results section. We used a five-point Likert item scale ranging from "Strongly disagree" (1), "Disagree" (2), "Neither agree nor disagree" (3), "Agree" (4), to "Strongly agree" (5) as possible answers to the questions.

Exploratory factor analysis by the PAF method and varimax rotation was used to check the validity of measured parental attitudes and knowledge about the child's postoperative pain. Four items had high loadings (0.63 – 0.73) on knowledge about the pain factor and eight items had high loadings (0.48 – 0.79) on attitudes towards pain management factors. Two factors explained 59.7 % of the total variance. Cronbach's α was computed to test the reliability of measurements. The value of Cronbach's α of 0.86 for the attitudes towards pain

TABLE 2. Parental attitudes toward pain and pain management.

	Mean (SD)
Attitudes toward pain	
Do you agree that you…	
… can recognize the signs and symptoms of pain. (n = 141)	4.1 (0.79)
… are able to identify the probable cause of pain and the site of the pain? (n = 141)	3.9 (0.79)
… know the ways to reduce pain. (n = 141)	3.9 (0.77)
… know how to determine the intensity of pain? (n = 141)	3.7 (0.83)
Pain management	
Do you agree that …	
…parents should be actively involved in addressing postoperative pain together with health professionals? (n = 141)	4.6 (0.68)
…the education of parents on postoperative pain by health professionals is indispensable as a sign of quality health care? (n = 141)	4.6 (0.76)
…managing postoperative pain improves the child's well-being and satisfaction? (n = 141)	4.5 (0.68)
…pain management leads to a faster and shorter recovery of the child after surgery? (n = 141)	4.4 (0.77)
…it is necessary to follow postoperative pain in the home environment and return information to health workers? (n = 141)	4.3 (0.82)
…it is necessary to use analgesics and other non-pharmacologic measures for reducing postoperative pain? (n = 141)	4.3 (0.84)
…that pain management means fewer postoperative complications? (n = 140)	4.1 (0.93)
…after the operation the patient should not have any pain at all? (n = 141)	3.3 (1.23)

management factor and 0.80 for the knowledge about pain factor indicate high measurement reliability.

TABLE 3. Analgesic therapy at home (N = 105 children).

	no	yes	NSAID	acetaminophen
Day 1	50 (47.6)	55 (52.4)	3	52
Day 2	70 (66.7)	35 (33.3)	3	32
Day 3	93 (88.6)	12 (11.4)	0	12

Legend: NSAID – non-steroidal anti-inflammatory drugs.

2.4.6 Statistics

Descriptive statistics of the measured variables included frequencies and percentages for categorical variables and the arithmetic mean and the standard deviation for continuous variables. The comparison in parents and children characteristics included in the control and intervention group was made by t-test, chi square test or likelihood ratio test as appropriate. Multiple linear regression was used to test the relationship between parental knowledge of postoperative pain and pain intensity during home care. The comparison of the assessment of the intensity of the child's postoperative pain between the intervention and control groups of parents, between parents and nurses, and between the groups of children according to whether they still had pain on the third day at home (the indicator of pain duration) was performed with the t-test for independent samples. The Chi-square test was used to assess the association between the persistence of pain on the third day of home care and the intervention group. Inter-rater reliability of the Wong-Baker, NRS, and PPPM scales was evaluated using the intraclass correlation coefficient (ICC(2)). Data were analyzed with the SPSS software package, version 23.0. Statistical significance was determined at an α-level = 0.05.

3. Results

Of the total 163 assessed for eligibility, 11 children and parents were excluded because the parents decided not to participate in the study after they have already given written consent. Of the remaining 152 parents and children included in the intervention group, seven parents and children were lost to follow-up because the questionnaires were not returned. For the same reason, three children and parents were lost to follow-up in the control group (Fig. 1).

Finally, complete data were obtained for 142 children and their parents of whom 34 (23.9%) were fathers and 108 (76.1%) were mothers. The structure of parental groups was comparable in terms of sex, age, education, and the age of the child. In the intervention group, there were slightly more girls (14.7%) than in the control group (4.5%) (p = 0.042) (Table 1).

We also asked parents about their previous experience with their child's pain, previous knowledge about pain, and knowledge about pain management. The possible answers were binary, i.e., "yes-no" answers. No statistical difference was found between the intervention and control groups (Table 1).

TABLE 4. Pain intensity as assessed by parents and nurses immediately after the surgical procedure for children with persisting pain compared to children without pain on day 3 at home.

		Parents				Nurses			
Pain scale	Presence of pain at home day 3	n	Mean (SD)	t	p-value	n	Mean (SD)	t	p-value
W-Br	no	19	3.18 (2.98)	-2.29	0.025	18	2.31 (2.49)	-1.08	0.285
	yes	50	5.02 (2.98)			47	3.03 (2.41)		
NRS	no	16	4.66 (2.55)	-0.69	0.492	16	1.91 (1.70)	-1.23	0.224
	yes	36	5.19 (2.61)			38	2.68 (2.27)		

Legend: W-B – Wong-Baker FACES scale; NRS –Numerical Rating Scale.

3.1 Parental attitudes toward pain and pain management

Descriptive statistics on parental attitudes toward pain and pain management are presented in Table 2. For the most part, the parents agreed regarding their ability to recognize the signs and symptoms of pain (M = 4.1; SD = 0.79) and to identify the probable cause and site of pain (M = 3.9; SD = 0.79). Similarly, they assessed that they know how to reduce pain (M = 3.9; SD = 0.77). Self-evaluation showed the lowest agreement regarding their ability to determine the intensity of the pain (M = 3.7; SD = 0.83).

In terms of pain management, parents agreed most strongly with the statement that parents should be actively involved in addressing postoperative pain (M = 4.6; SD = 0.68) and that the education of parents about postoperative pain by healthcare professionals was indispensable (M = 4.6; SD = 0.76). The results showed the lowest agreement with the statement that after the operation the patient should not have any pain (M = 3.3; SD = 1.23).

3.2 Peri- and postoperative pain intensity measurements in the hospital and at home

The average pain intensity after surgery, before discharge home, and during the first three days at home steadily declined, regardless of which pain scales were used (Fig. 2). Parental pain intensity assessment in preschool children, as measured by the W-B scale, decreased from an average value (SD) of 4.46 (3.08) immediately after surgery to 3.46 (2.27) before discharge, remained practically unchanged on the first day at home 3.42 (2.20), and then dropped to 2.59 (2.12) on the second, and 1.96 (1.88) on the third day. Parents' pain intensity assessment in schoolchildren, as measured by NRS, decreased from an average value (SD) of 5.03 (2.58) immediately after surgery to 3.63 (2.52) before discharge, remained practically unchanged on the first day at home 3.58 (2.47), and then dropped to 2.75 (2.14) on the second and to 1.64 (1.76) on the third day. Parents' pain intensity assessments measured by the PPPM scale for the preschoolers and schoolchildren decreased from an average value (SD) of 6.76 (4.23) on the first day at home to 4.91 (4.10) on the second day and 3.25 (3.06) on the third day.

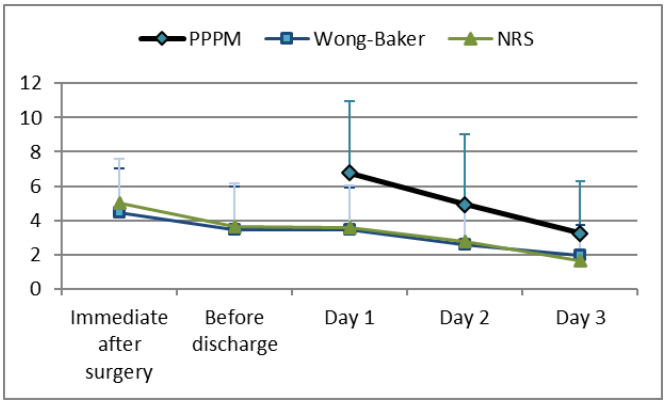

FIGURE 2. Peri- and postoperative pain intensity measurements by parents in hospital and at home for parents only.
Legend: PPPM – Parents' Postoperative Pain Measure scores; W-B – Wong-Baker FACES scale; NRS –Numerical Rating Scale.

3.3 Peri- and postoperative analgesic therapy in hospital and at home

We received data about analgesic therapy during the operation, in the recovery room, and on the hospital ward for 149 children. In the operating room, 79 children received Chirocaine locally in the wound, 31 received a caudal block, and 17 children received a penile block. In the operating room, at the end of the operation, 38 children received piritramide, 61 children metamizole, and 37 children acetaminophen. In the recovery room, 69 children received piritramide. On the hospital ward, 52 children received metamizole, and 46 children received acetaminophen. Before discharge, 81 children received metamizole, and 31 children acetaminophen. The data on analgesic therapy at home are presented in Table 3.

3.4 The relationship between the intensity of pain immediately after surgery and the intensity and duration of pain at home as assessed by parents and nurses

The relationship between the intensity of postoperative pain and the duration of pain was evaluated by dividing the children into two groups according to the presence of pain on the third day at home (pain score > 0, which was an indicator of the persistence of pain). We wanted to know whether the intensity of pain immediately after surgery in children who no longer

TABLE 5. Relationship between parental preoperative education (intervention group) and control groups of pain and pain intensity.

	Average severity of pain at home - Wong-Baker			Average severity of pain at home - NRS			Average severity of pain at home - PPPM		
	B	t	p-value	B	t	p-value	B	t	p-value
Constant	2.51	6.65	< 0.001	2.46	5.37	< 0.001	46	8.54	< 0.001
Parental education (intervention group)	0.36	0.76	0.448	0.63	1.14	0.261	0.32	0.49	0.624
Any previous education about postoperative pain and pain management	0	0	0.996	-0.24	-0.36	0.722	0.69	0.89	0.373
Their child had ever had an operation and needed analgesic drugs?	-0.03	-0.04	0.969	0.16	0.24	0.808	0.02	0.03	0.978
Their child had ever been injured and needed analgesic medicines?	-0.12	-0.18	0.858	-0.33	-0.49	0.628	0.08	0.1	0.924

Legend: PPPM – Parents' Postoperative Pain Measure scores; W-B – Wong-Baker FACES scale; NRS –Numerical Rating Scale.

had pain on the third day was on average lower than in children who still experienced pain on the third day. The average intensity (SD) of pain in preschool children, assessed by the W-B scale, after surgery was 3.18 (2.98) for those who were without pain on the third day at home, and 5.02 (2.98) in the other group. The difference in the average pain intensity was statistically significant (p = 0.025). The average intensity (SD) of pain in schoolchildren, assessed with the NRS scale, immediately after the surgery was 4.66 (2.55) for those who were without pain on the third day at home, and 5.19 (2.61) in the other group. The difference in the average pain intensity was not statistically significant ($p = 0.492$). (Table 4).

There was no statistically significant difference between the two groups in average pain intensity as assessed by nurses (Table 4).

3.5 Intervention group, control group, and post-operative pain

The relationship between preoperative education about post-operative pain received (control and intervention groups) and average pain intensity during home care was assessed using multiple linear regression (Table 5). The experience of parents with a child who had previously received pain therapy and prior knowledge of parents about postoperative pain were included in the regression as control variables. We found that there was no statistically significant relationship between the received education on postoperative pain (intervention and control groups) and the average intensity of pain the child experienced in home care measured by either the Wong-Baker or NRS and the PPPM scale (p = 0.624) when controlling for parental prior experience and knowledge about postoperative pain.

The proportion of children with pain assessment greater than 0 on the Wong-Baker scale or NRS on the third day at home was approximately the same in both the intervention (parental education) and the control groups (p = 0.836) (Table 6). The proportion of children with pain intensity higher than 0 according to PPPM was approximately the same in the intervention (parental education) and control groups (p = 0.976) (Table 6). The proportion of children receiving analgesics at any time during home care in the intervention group (parental education) and the control group on pain management was approximately the same (p = 0.522) (Table 6). The proportion of children receiving analgesics on day 3 at home was approximately the same in both the intervention (parental education) and control groups (p = 0.523) (Table 6).

3.6 Parental and nurse assessment of postoperative pain intensity

When considering postoperative pain immediately after surgery and before discharge to home care, we found that nurses, on average, evaluated a child's pain intensity as being lower compared to parents (p < 0.001 for all scales) (Table 7). For the W-B scale used in preschool children, parental assessment of a child's pain intensity was on average (SD) 4.46 (3.08), while nurse's assessment was lower, with an average rating of 2.78 (2.34). Before being discharged home, the parental average child's pain assessment score was 3.46 (2.27), and the nurses' ali nurse's score 1.25 (1.73). For the NRS, used in schoolchildren, the mean (SD) pain intensity as assessed by parents immediately after surgery was 5.03 (2.58), while nurses' assessments were again lower, with an average rating of 2.51 (2.04). Before discharge home, parents assessed pain intensity with an average rating of 3.63 (2.52) compared to nurses' rating of 1.20 (1.72).

3.7 Inter-rater reliability of pain intensity measures

The inter-rater reliability of pain intensity measures was assessed using the intraclass correlation coefficient ICC (2). We were interested in the consistency of the estimates and the

TABLE 6. Relationship between parental preoperative education (intervention and control group) and the presence of pain on day 3 or use of analgesic at home.

	Study Group		χ^2	p-value
	Control	Intervention		
Pain present on day 3				
NRS or W-B	48/63 (76.2)	41/55 (74.5)	0.043	0.836
PPPM	45/63 (71.4)	42/59 (71.2)	0.001	0.976
Use of analgesic at home				
Any day	62/84 (73.8)	27/34 (79.4)	0.41	0.522
Day 3	8/61 (13.1)	4/44 (9.1)	0.409	0.523

Legend: PPPM – Parents' Postoperative Pain Measure scores; W-B – Wong-Baker FACES scale; NRS –Numerical Rating Scale.

TABLE 7. Mean (SD) pain assessment by parents and nurses in the hospital (results of t-test).

	Nurses	Parents	p
W-B			
Immediate after surgery	2.78 (2.34)	4.46 (3.08)	< 0.001
Before discharge	1.25 (1.73)	3.46 (2.27)	< 0.001
NRS			
Immediate after surgery	2.51 (2.04)	5.03 (2.58)	< 0.001
Before discharge	1.20 (1.72)	3.63 (2.52)	< 0.001

Legend: NRS– Numerical Rating Scale; W-B – Wong-Baker scale.

average correlation between the rates. Table 8 shows the ICC between pain intensity measured with the NRS and PPPM scales and between the W-B and PPPM scales (Table 8). We found that intraclass consistency or correlation was high in both cases, with the values of the coefficients in the NRS and the Wong-Baker scales being 0.70 and 0.71, respectively. The results were statistically significant in both cases.

TABLE 8. Intraclass correlation coefficient (ICC). All pain assessments were done by parents only.

	ICC (95% CI)	p-value
W-B – PPPM	0.71 (0.54 – 0.82)	< 0.001
NRS – PPPM	0.70 (0.49 – 0.83)	< 0.001

Legend: CI = confidence interval; NRS – Numerical Rating Scale; W-B – Wong-Baker scale; PPPM – Parents' Postoperative Management scale.

4. Discussion

Proper management of postoperative pain in children requires validated questionnaires, parental and nurses knowledge, and the appropriate maturity of children to understand pain evaluation. The aim of the present study was to assess parental education, experience, and attitudes toward postoperative pain. In addition, we wanted to assess and compare the Parents' Postoperative Pain Management scale (PPPM) to the W-B and/or NRS scales. We assessed also pain intensity scores performed by nurse cared for the children in the hospital. We formed three hypotheses: a) preoperative parental education on children's postoperative pain has an impact on the parental assessment of children's postoperative pain intensity and pain management, b) the parental postoperative pain intensity assessment differs from the nurse's postoperative pain intensity assessment, and c) there is a correlation between the three pain intensity scale scores on the PPPM, W-B, and/or NRS scales.

Our first hypothesis was that preoperative parental education on children's postoperative pain has an impact on parental management of children's postoperative pain. We were unable to confirm this hypothesis, so we rejected it. Parental education (oral and written information about perioperative pain intensity assessments and pain management) in intervention group did not lead to a reduction in the assessed levels of pain intensity and duration in children and did not affect the use of analgesics.

Our results are consistent with those from other studies that showed that informing or educating parents (orally and in writing) about perioperative pain does not lead to a reduction in the assessment of postoperative pain intensity and duration of the pain in children at home [26–28]. Furthermore, we did not find any differences in the assessment of the intensity or duration of pain, or the use of analgesic therapy between the intervention and control groups of parents. In the study by Hegarty et al., only half of the parents recalled that they had received any information about pain treatment at home [27]. In our study, half of the parents from both the intervention and control groups reported that they had received extensive information on pain, but this knowledge did not affect the parents' postoperative pain management at home.

The lack of differences between our intervention and control groups could stem from the parents' beliefs in the sufficiency of their knowledge of pain management and their ability to cope with it, as they self-reported in the questionnaire. The reliability of their answers was estimated with Cronbach's coefficient alpha with their score on knowledge of pain reaching the reliability coefficient of 0.86, and pain management attaining a coefficient of 0.80. The majority of our parents had secondary-level or university education, which could further mean that they were well-educated and that they could find appropriate information by themselves. However, our results are in contrast with those of Chartrand et al. They pre-

pared a preoperative educational DVD on parents' educational knowledge, participation, and anxiety and children's distress, pain, analgesic requirements, and length of recovery after one-day surgery. They included 123 parent-child dyads where children underwent ENT (ear, nose, and throat) or dental surgery. Their results showed that the intervention group gained greater knowledge of and used more positive reinforcement and distraction and relaxation methods than those in the control group. Children's postoperative pain was also significantly lower among the intervention group compared to the control group [14]. Helgadottir et al. conducted a study on educating parents on how to distract children and thereby decrease their postoperative pain at home after tonsillectomy. The purpose of this study was to compare the effectiveness of two educational interventions for parents in decreasing postoperative pain in 3–7-year-old children at home. The participants were randomized to pain medication management education (control group) or pain medication management education plus distraction education (experimental group). They found no differences in pain intensity between the two groups of children, but they found a decrease in mean pain behavior scores on the first postoperative day. They concluded that it is important to educate parents about pain distraction in children after operation [16].

Our second hypothesis, that parental assessment of postoperative pain intensity differs from the nurse's postoperative pain intensity assessment, was confirmed. We found that, on average, nurses gave lower postoperative pain intensity assessments than parents on both the W-B and NRS scales immediately after surgery and before discharge from hospital. Since nurses assessed pain intensity to be lower than parents, this could be one of the reasons why we were unable to find a correlation between nurses' assessments of pain intensity and the duration of pain and the use of analgesic therapy in the home environment. Previous similar studies also showed that nurses assess the intensity of children's pain to be lower compared to parents [19–22], although some studies did not report statistically significant differences between nurses' and parents' assessments of pain intensity in children [23].

The role of nurses in pain assessment in the emergency and hospital wards is particularly important. Nurses should be informed, trained, and should continually improve their knowledge of pain assessment. In addition, proven, validated, and age-appropriate scales for pain assessment should be used. Previous studies have shown that nurses usually give lower pain scores in their reports compared to the child's self-assessment, as was also the case in our study. One possible reason for this is that nurses do not consult the child when giving their pain assessment, but instead determine the intensity of children's pain based on their judgment alone [29]. The authors warn that pain intensity should always be assessed not only with validated and age-appropriate pain scales but also by observing clinical signs and symptoms related to stress caused by severe pain (whether the child is immovable and lying on the bed, restlessness, tachycardic, tachypneic, sweating, having a serious facial expression, etc.) [29].

We also confirmed the third hypothesis, that there is a positive correlation in ratings obtained with the W-B, NRS, and PPPM pain scales.

These results indicate that the PPPM scale is suitable for use at home for parental assessment of pain because it correlates well with ratings obtained from the W-B and NRS pain scales as well as with other similar Faces Pain Scale-Revised (FPS-R) as was shown by Wong et al., who found a statistically significant correlation between the PPPM and the FPS-R scale measurements for the first three days after dental procedures in children [30]. As in our present study, other authors showed high correlations between the NRS and W-B scales [8, 31].

The study also has certain limitations. First, this study was done in a selected pediatric population operated on in a day-surgery program for minor abdominal and urogenital procedures. The outcome of pain assessment in other pediatric day-surgery programs (e.g. ENT surgery, minor plastic surgery and trauma surgeries) could yield different results to ours. Second, no information was gathered from parents on biopsychosocial profiles of their families, which would give valuable information on the perception and management of pain in families and how they would face catastrophic pain issues. Third, the nurses included in the study were members of our staff. We cannot exclude the possibility that some bias may have occurred, because nurses became "more educated" through conducting the study and this may have affected the amount and quality of information they may have given to parents in the control group who should have only received "standard care information" on pain management.

5. Conclusions

Pain intensity in the children of parents included in the intervention (educational) group was not lower and shorter in duration compared to the children of parents in the control group. Compared to assessments by nurses, parents gave statistically significantly higher assessments of pain intensity in their children. Assessment with the PPPM scale showed comparable accuracy to assessment with the W-B and NRS scales.

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DECLARATION OF CONFLICT OF INTERESTS

All authors declare that they have no conflict of interest.

AUTHOR CONTRIBUTIONS

SG, DK, BK, and VE conceived the study protocol; DK and SG participated in the design and coordination of the study; DK and SG collected data; DK and SG supervised data collection; VE provided statistical analysis; SG, DK, BK, and VE participated in data interpretation; DK, BK, and SG carried out the literature search; DK, BK, VE, and SG drafted the present manuscript; VE and SG revised the manuscript. All authors read and approved the final version of the manuscript.

CONSENT FOR PUBLICATION

The authors have given full consent for publication.

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DATA AVAILABILITY

The data used to support the findings of this study are available from the corresponding author upon request.

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