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ORIGINAL ARTICLE

Relaxation-guided imagery reduces perioperative anxiety and pain in children: a randomized study

Laura Vagnoli[1] · Alessandra Bettini[1] · Elena Amore[1] · Salvatore De Masi[2] · Andrea Messeri[3]

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Abstract

Several studies have shown the efficacy of psychological interventions in reducing preoperative anxiety in children undergoing surgery. This study aims to investigate the effectiveness of a specific non-pharmacological technique, the relaxation-guided imagery, in reducing both preoperative anxiety and postoperative pain in a sample of 60 children (6–12 years old) undergoing minor surgery who were randomly assigned to the experimental group ($N = 30$) or the control group ($N = 30$). The first group received the relaxation-guided imagery, before the induction of general anesthesia; the second group received standard care. The levels of preoperative anxiety and postoperative pain were assessed using, respectively, the modified Yale Preoperative Anxiety Scale and the Face, Legs, Activity, Cry, and Consolability Scale. The results showed a statistically significant difference between groups, with less anxiety and less pain for children included in the experimental group ($p < .001$; $p < .001$).

Conclusion: Results suggest that relaxation-guided imagery reduces preoperative anxiety and postoperative pain in children. Future studies should focus on developing protocols and studying the eventual reduction of administered drugs for anesthesia and pain.

What is Known:
- *Literature suggests the usefulness of relaxation-guided imagery in reducing anxiety and pain in the perioperative period.*
- *Stronger evidences are needed to support the application of relaxation-guided imagery as routine care in pediatric surgery.*

What is New:
- *To our knowledge, this is the first randomized study to investigate the efficacy of relaxation-guided imagery in reducing preoperative anxiety and postoperative pain within a single pediatric sample.*
- *The present study provides stronger evidence in an area that is lacking in research.*

Keywords Child · Imagery · Relaxation therapy · Minor surgical procedures · Pain, postoperative · Anxiety

Abbreviations

CG	control group
EG	experimental group
FLACC	Face, Legs, Activity, Cry, and Consolability Scale
m-YPAS	modified Yale Preoperative Anxiety Scale

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✉ Laura Vagnoli
laura.vagnoli@meyer.it

Alessandra Bettini
alessandra.bettini@meyer.it

Elena Amore
elena-amore@live.it

Salvatore De Masi
salvatore.demasi@meyer.it

Andrea Messeri
andrea.messeri@meyer.it

[1] Pediatric Psychology, Meyer Children's Hospital, Via G. Pieraccini 24, 50139 Florence, Italy

[2] Clinical Trial Office, Meyer Children's Hospital, Via G. Pieraccini 24, 50139 Florence, Italy

[3] Pain Service & Palliative Care, Meyer Children's Hospital, Via G. Pieraccini 24, 50139 Florence, Italy

Introduction

Surgery is a stressful event for children, whatever the type of intervention [30]. Negative consequences, such as nausea, insomnia, nightmares, and emotional and behavioral distress (e.g., eating and sleeping disorders, enuresis, aggressive behavior), are experienced by several children during the presurgical period [8, 11, 14, 30, 55] and after being discharged from hospital [12, 21]. Moreover, high levels of preoperative anxiety are usually associated with high levels of postoperative pain and the need for analgesics [9, 21]. Postoperative pain is considered the major complaint of pediatric patients following ambulatory surgery and can cause significant long-term effects, such as sensitization/hyperalgesia phenomena and chronic pain [6]. On the contrary, effective pain treatment reduces surgical mortality and morbidity and promotes quicker healing [34].

The American Academy of Pediatrics recommends a combination of pharmacological and non-pharmacological techniques to manage pediatric pain [10]. Specific non-pharmacological interventions, such as breathing, relaxation and imagery, are suggested in the management of preoperative anxiety and postoperative pain [2, 48].

Despite this suggestion, there is a lack of randomized controlled trials, and non-pharmacological techniques are not always incorporated into everyday patient care, highlighting the need for additional research to provide stronger evidence and promote its integration into care routines [9, 35, 53]. Moreover, studies generally combine more than one intervention, highlighting the need to determine the impact of each specific non-pharmacological technique [13, 25, 53]. To our knowledge, no studies in literature investigated the effectiveness of the relaxation-guided imagery technique to reduce both preoperative anxiety and postoperative pain within a single sample in the specific context of pediatric surgery. Relaxation-guided imagery is expected to determine a statistically significant reduction in levels of both preoperative anxiety and postoperative pain.

Materials and methods

Participants

The patients were recruited from March 2017 to May 2018 at Meyer Children's Hospital in Florence, Italy. Through daily consultation of the surgery ward schedule, eligible outpatient children were enrolled on the day of surgery.

Power analysis was performed on the bases of Vagnoli et al. (2005) [50] that reported preoperative anxiety scores with mean 68.25 and standard deviation ± 28.42. Preoperative anxiety was measured with *Modified Yale Preoperative Anxiety Scale* (m-YPAS), also used in the current study. Considering α error = 5%, power $(1-\beta)$ = 80%, and sample size of 58 subjects, 29 subjects in each group are required in order to reach a 30% reduction of preoperative anxiety in the experimental group.

Total sample includes 60 consecutive children, who satisfied the following inclusion criteria: aged 6 to 12 years old, scheduled to undergo general anesthesia for minor surgery (hernias, phimosis, and endoscopies/biopsies-gastroscopies and colonoscopies), and classified as physical status I–II according to the *American Society of Anesthesiologists* (*ASA*) standards. Exclusion criteria were as follows: the participation in any type of psychological presurgical preparation program, premature birth, cognitive and/or developmental impairment, non-Italian speaking children (to avoid any misunderstanding of instructions given during the relaxation-guided imagery procedure), and patients who received any premedication (to exclude any behavioral effects due to the drugs administered that can alter their response to the technique). Also, patients with chronic illness were excluded to avoid possible influence of the multidimensional factors associated with chronic condition, such as recurrent pain experiences and hospitalization.

The age range was chosen on the basis of evaluation instruments indications (5 to 12 years old), but children under 6 years of age were excluded because relaxation-guided imagery technique is not considered appropriate for their cognitive development [26].

Study protocol was approved by the Hospital Ethics Committee. Eligible children were evaluated, respecting the inclusion and the exclusion criteria, and randomized after obtaining informed consent from parents and agreement from children. None of the eligible children refused to participate in this study.

Enrolled children were randomly assigned by the research psychologist, following simple randomization procedures using computerized random number generator to one of two treatment groups:

1—Experimental group EG (n = 30): all patients received the relaxation-guided imagery technique and were accompanied to the operating room (OR) by a parent, as routine care, who stayed with them during the anesthesia-induction process [40].

2—Control group CG (n = 30): the children were accompanied to the OR by a parent, as routine care, who stayed with them during the anesthesia-induction process. They did not receive the relaxation-guided imagery technique.

Children in both groups could choose the accompanying parent, to stay with him/her in surgery ward and in the waiting room and have him/her close during the whole induction process.

Procedure

Relaxation-guided imagery is composed of a combination of behavioral interventions (relaxation of the body) and

cognitive interventions (guided imagery), which is non-invasive, self-regulative, and appropriate for children and adolescents [25, 27, 28]. It consist of three "active" phases that generates new internal experiences, unlike the passive act of relaxing: (1) *Body relaxation*, helps the child to focus on the body and progressively release muscle tension from the feet to the head by taking deep breaths; (2) *Imagery*, a spontaneous or deliberate mental reconstruction of sights, sounds, smells, tastes, and feelings as if they are actually occurring. During this phase, the child is asked to visualize a favorite place, whether real or not, using the same words for each participant; and (3) *Return to reality*, the child remains in the chosen place for a while, knowing that it could be visit any time he/she wants, then, contact with the surrounding environment is gradually resumed until the child opens his/her eyes.

Children assigned to the EG were approached by the research psychologist in the surgery ward and were asked if they wanted to receive the relaxation-guided imagery technique to help them feel better. The psychologist who performs the relaxation-guided imagery is part of the surgery équipe being in charge of surgery patients and is specifically trained with 2 years of Master of Degree in Pain Therapy and significant clinical experience in delivering non-pharmacological techniques. The relaxation-guided imagery was thought to the child 1 h before surgery as a training, explaining the process and doing the technique required about 15 min for each patient. At the end of the training, the psychologist left the surgery ward, and once the child arrived in OR, the same psychologist came to repeat the technique immediately before the induction of anesthesia. The aim of the training performed in the surgery ward was to help the child to familiarize with the technique and its characteristics.

Two independent observers, psychologists with a significant backgrounds in behavioral research related to their experience in the pediatric hospital setting, knowledge of child behavior, and use of specific instruments to codify patients emotional reactions, evaluated child's anxiety during the induction of anesthesia in the OR and his/her postoperative pain 2 h after returning to the surgery ward, immediately after waking up and before starting to take paracetamol three times per day.

Anesthesia induction was performed by a pediatric anesthesiologist using a standardized oxygen/nitrous oxide/sevoflurane technique for both EG and CG. After the induction, a peripheral block was performed in accordance with the surgical procedure. The maintenance of anesthesia was conducted with oxygen/nitrous oxide/sevoflurane through laryngeal mask.

Immediately before leaving the induction room, rectal paracetamol (40 mg/kg) was administered to all patients, and an intravenous line was placed. Rectal paracetamol was chosen in order to achieve pain control for the postsurgery. Postoperative analgesia continued with paracetamol three times per day in accordance with our postoperative pain control protocols. An additional rescue dose (tramadol 1 mg/kg per os) is administered when pain reaches a score above 4 in the pain measurement.

Instruments

Two different observational scales were used to assess levels of preoperative anxiety and postoperative pain: *Modified Yale Preoperative Anxiety Scale* (*m-YPAS*) is useful to evaluate the behavior of the child (5 to 12 years old) in the induction room. The m-YPAS is a behavioral checklist developed by Kain et al. to measure the state anxiety of young children [20]. It consists of 27 items divided into five categories: activity, emotional expressivity, state of arousal, vocalization, and use of parents. Each category receives a score on a 4-point-scale (6 for vocalization) according to patient's behavior. The m-YPAS score ranges from 23 to 100, with higher scores indicating greater anxiety. This scale has good-to-excellent inter-rater (from 0.68 to 0.86) and intra-observer (from 0.63 to 0.90) reliability, high concurrent, and construct validity. Thus, it is considered an appropriate tool for measuring children's anxiety in the preoperative holding area and during the induction of anesthesia [20]. The coding method used for the present study was the Italian translation by Vagnoli and colleagues [50].

Face, Legs, Activity, Cry, Consolability Scale (*FLACC*) is used to assess postoperative pain in children between the ages of 2 months–7 years, or in individuals who are unable to communicate their pain. The scale has 5 categories (face, legs, activity, cry, consolability), each scored 0, 1, or 2, which result in a total score between 0 and 10, with 0 representing no pain. FLACC has good levels of inter-rater reliability measured with kappa values (from 0.52 to 0.66) and showed adequate validity in assessing children's postoperative pain [39]. Von Baeyer and Spagrud (2007) reported that FLACC is recommended as the first choice for the measurement of postoperative pain in hospital with patients up to 18 years of age [51]. We used this instrument for the total sample because we hypothesized that some participant would be non-verbal at the time of evaluation and thus unable to verbally communicate their pain after waking up from anesthesia.

Intervention and measurement times, instruments, and procedures were the same for all patients.

Statistical analysis

Descriptive statistics were used to describe demographic and clinical characteristics of the sample.

Agreement between the two observers was verified through Cohen's κ calculation for every category of m-YPAS and FLACC.

Analysis of variance (ANOVA) was used to study differences between the CG and the EG in levels of preoperative anxiety and postoperative pain. Parametric (Fisher test) and non-parametric (Kruskal-Wallis) tests were used when necessary.

Multivariate analysis was conducted to control any confounding or interacting of some covariate variables, such as previous surgery, age (< 10 or ≥ 10 years), gender, type of surgery, and length of surgery (15–35 min or 40–70 min, retrieved from charts filled out by nurses).

Relations between age, preoperative anxiety, and postoperative pain were assessed for the CG using Pearson's correlation coefficient (r).

All the analyses were conducted with STATA software version 11 (StataCorp LP, College Station, TX, USA). $p < 0.05$ was considered statistically significant.

Results

The main demographic and clinical characteristics of the sample are shown in Table 1. There were no statistically significant differences between the two study groups in this data.

Cohen's κ, measuring agreement between the two observers, showed a high level of agreement for every category of m-YPAS and FLACC, with values between .88 and .92.

Main findings emerged from the analyses on m-YPAS and FLACC that showed how the relaxation-guided imagery significantly reduced preoperative anxiety and postoperative pain. In particular, the level of preoperative anxiety, during the induction of anesthesia, was significantly lower for children in the EG compared with those in the CG ($p < .001$); similarly, the level of postoperative pain was significantly lower in the EG than in the CG ($p < .001$) (Figs. 1 and 2; Table 2). Multiple linear regression confirmed that these results continued to be valid independently of any possible measured intervenient variable (e.g., previous surgery, age, gender, length of surgery) (Table 3).

Table 4 shows the results of the multivariate linear regression that tested the interaction between any previous experience of surgery and the administration of relaxation-guided imagery (EG). Two models were developed, one with m-YPAS and other FLACC as dependent variables and only included previous experience of surgery and EG administration as covariates. The results showed that the EG intervention, relating to the control of preoperative anxiety, worked best (p for interaction = 0.07) in patients who had previous experience of surgery. The data did not show any interaction between the EG and previous surgery in the control of pain (p for interaction = 0.88).

The relation between preoperative anxiety and postoperative pain for the CG is non-statistically significant ($r = .22$; $p = .23$).

Discussion

Relieving preoperative anxiety and postoperative pain in children is necessary to reduce negative responses to medical care, as well as maladaptive postsurgery behavior and long-term effects [14, 30]. Relaxation-guided imagery is a technique that does not require any additional material, but it needs a specific training, an adequate setting, and a sufficient time to be effective. It can be used with school-age children who are cognitively mature to control distress, while younger children do not have sufficient cognitive development to benefit from this technique, needing physical comfort and different distraction techniques, such as bubble blowing, music, puppets, tablet and videogames [26, 27].

In line with literature, we found that relaxation-guided imagery reduced preoperative anxiety and postoperative pain in children undergoing general anesthesia for minor surgery, compared with a CG and independently from any possible intervenient variable [16, 17, 29, 45]. The novelty of this work is that the relaxation-guided imagery was performed by a trained psychologist, exclusively before surgery and not in the postsurgical period, to investigate its effect on both preoperative anxiety and postoperative pain. Our results strengthen the efficacy of this specific technique as useful in its own right.

In literature, there are many studies presenting the effectiveness of other non-pharmacologic techniques for preoperative anxiety and procedural distress and provided by nurses or anesthetists, such as preoperative preparation program [22, 37]; tablet computer interventions and virtual reality [33, 36, 47]; video clips and cartoons [24, 41, 44]; comic information [23]; storytelling, pictures and coloring [3]; clowns [50].

Relaxation-guided imagery gives the child and family a sense of control, improves cooperation, enhances recovery and improves long-term emotional and behavioral adjustment in patients and their parents [26, 42, 53]. It can be considered an hypnotic experience that, along with other hypnosis forms, such as direct and indirect hypnosis and self-hypnosis [31], shows efficacy in the management of procedural anxiety in children and adolescents [32] as well as in pediatric emergency situations [26, 53]. In the pediatric field, there is a paucity of research on the use of hypnosis forms for the reduction of preoperative anxiety [7, 15], unlike studies in the adult population, which have achieved encouraging results [4, 49] and stimulated research in the pediatric area, taking into consideration children's ability to use creative imagination, fantasy, and play [18, 25, 29]. To our knowledge, Lambert was the only one who used the specific technique of relaxation-guided imagery with children in a surgical context [29] underlining the decrease in perioperative anxiety and shortening the hospital stay.

Regarding postoperative pain, studies in literature report the efficacy of hypnosis forms, including guided-imagery, in the management of children's pain [1, 5, 29, 46], chronic [43, 54] and acutely painful conditions [38].

Table 1 Demographics of the study participants and their parents

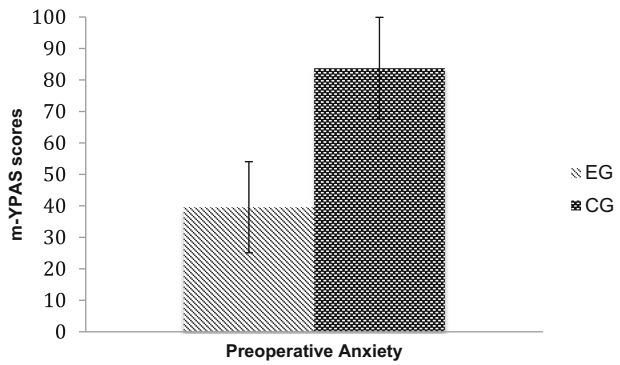
	Experimental group ($n = 30$)	Control group ($n = 30$)	Total sample ($n = 60$)
Age, mean ± standard deviation (SD)	8.5 ± 1.4	8.2 ± 1.3	8.3 ± 1.4
Sex, *n* (%)			
Male	15 (50)	17 (57)	32 (53)
Female	15 (50)	13 (43)	28 (47)
Type of surgery, *n* (%)			
Inguinal hernia	5 (17)	8 (27)	13 (22)
Phimosis	6 (20)	5 (17)	11 (18)
Endoscopies/biopsies[a]	19 (63)	17 (57)	36 (60)
Chosen parent, *n* (%)			
Father	4 (13)	3 (10)	7 (12)
Mother	26 (87)	27 (90)	53 (88)
Previous surgery, *n* (%)			
Yes	7 (23)	9 (30)	16 (27)
No	23 (77)	21 (70)	44 (73)
Length of surgery (min), mean ± SD	34.2 ± 10.7	39 ± 13	36.6 ± 12

[a] Gastroscopies and colonoscopies with biopsies

The latest studies on relaxation-guided imagery involve the use of videotapes and CDs with similar results [16–18, 45]. In the study by Huth and colleagues (2006), children when asked to record the reasons for using the imagery tape, most of them noted "*to help with the pain*," highlighting that the use of non-pharmacological techniques helps make pain more tolerable [17].

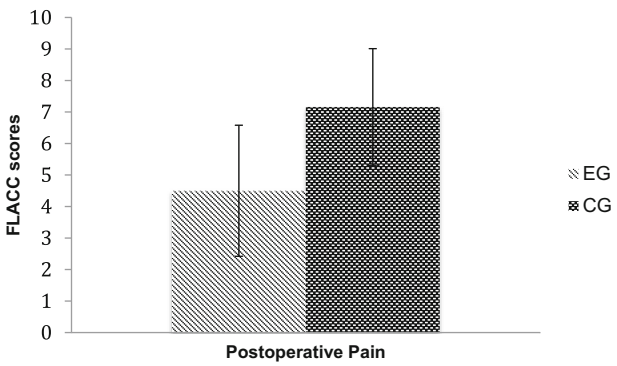
In line with precedent studies that demonstrated the importance of children's pain memory for future painful experiences [52], analyses on possible confounding variables showed that the effect of previous surgery on pain resulted statistically significant. Moreover, our results are in line with literature affirming that previous experience of surgery may contribute to higher levels of preoperative anxiety [19]. The multivariate linear regression performed to test if relaxation-guided imagery is efficient on high levels of basal anxiety related to previous surgery experience showed that the EG intervention was effective both for children who had had previous surgery and for those who had not and seemed to work best in patients with higher levels of basal anxiety. The same effect is not achieved for pain reduction. A possible explanation could be the substantial difference between these two variables: anxiety is a psychological state, which includes physiological manifestations that can be modified and controlled with psychological techniques, while pain is "an unpleasant sensory and emotional experience" (IASP, International Association for the Study of Pain, 1979); therefore, it is strictly related to objective physical stimuli, whose individual cognition/perception can be only partially modified with the help of psychological techniques.

Despite evidence reported in literature [9, 21], in our sample, the relation between preoperative anxiety and postoperative pain wasn't statistically significant. This could be related to the small sample size, one of the limitations of the present study along with the lack of measurement of analgesics needed for the surgery and rescue medications needed after pain assessment.



m-YPAS: Modified Yale Preoperative Anxiety Scale;

Fig. 1 m-YPAS: Modified Yale Preoperative Anxiety Scale



FLACC: Face, Legs, Activity, Cry, Consolability scale.

Fig. 2 FLACC: Face, Legs, Activity, Cry, Consolability Scale

Table 2 Means and standard deviation of outcome variables

	m-YPAS[a]	*p*	FLACC[b]	*p*
Intervention, mean ± standard deviation (SD)				
EG[c]	39.6 ± 4.5	< .001*	4.5 ± 2.1	< .001*
CG[d]	83.7 ± 16.2		7.7 ± 1.8	
Previous surgery, mean ± SD				
Yes	69.3 ± 29.9	.19	6.8 ± 2.3	.005
No	58.9 ± 25.6		5.5 ± 2.3	
Age, mean ± SD				
6–9 years	63.9 ± 26.7	.21	6.1 ± 2.4	.12
10–12 years	53.5 ± 27.2		4.9 ± 2.1	
Sex, mean ± SD				
Male	62.1 ± 28.1	.88	6.1 ± 2.2	.37
Female	61.1 ± 26.1		5.5 ± 2.6	
Type of surgery, mean ± SD				
Inguinal hernia	65.1 ± 27	.87	5.9 ± 2.4	.91
Phimosis	59.7 ± 27		5.5 ± 1.6	
Endoscopies/biopsies[e]	61 ± 27.9		5.9 ± 2.9	
Length of surgery, mean ± SD				
15–35 min	59 ± 28	.36	5.6 ± 2.4	.38
40–70 min	65.5 ± 25.3		6.2 ± 2.3	

[a] m-YPAS: Modified Yale Preoperative Anxiety Scale

[b] FLACC: Face, Legs, Activity, Cry, Consolability Scale

[c] EG: experimental group

[d] CG: control group; *$p < 0.05$

[e] Gastroscopies and colonoscopies with biopsies

The administration of rectal paracetamol for minor surgery in our hospital represents a standard choice that follows surgery protocols. In our sample, the levels of postoperative pain were relatively high in both groups. These results may be explained by the limitation related to the use of FLACC, instead of a verbal scale, which cannot perfectly distinguish between anxiety and fear-related behaviors that may present similar expressions. Another limitation related to pain measurement is the lack of additional pain assessment in different times after surgery.

Furthermore, we did not measure the parents' anxiety level nor planned any long-term follow-up for pain and behavioral problems assessment. Also, an evaluation of the impact of relaxation-guided imagery on routine care and its costs was not conducted.

Table 4 Evaluation of interaction between relaxation-guided imagery and previous surgery

EG[c]/previous surgery	m-YPAS[a]		FLACC[b]	
	Mean (95% CI)[d]	*p*	Mean (95% CI)[d]	*p*
No/yes	14.2 (2.3; 26)	.02*	1.0 (− 0.5; 2.6)	.19
Yes/no	− 39.4 (− 48.4; − 30.4)	< .001*	− 2.6 (− 3.8; − 1.5)	< .001*
Yes/yes	− 41.5 (− 54.5; − 28.5)	< .001*	− 1.4 (− 3.1; 0.3)	.10

[a] m-YPAS: Modified Yale Preoperative Anxiety Scale

[b] FLACC: Face, Legs, Activity, Cry, Consolability Scale

[c] EG: experimental group

[d] 95% CI: 95% confidence interval; *$p < 0.05$

Table 3 Multiple linear regression - independent effect of each variable on outcome

	m-YPAS[a]		FLACC[b]	
	Mean (95% CI)[c]	*p*	Mean (95% CI)[c]	*p*
Type of intervention EG[d] vs. CG[e]	− 44.2 (− 52.4; − 36)	< .001*	− 2.6 (− 3.7; − 1.6)	< .001*
Previous surgery Yes vs. no	6.0 (− 3.2; 15.2)	.19	1.2 (− 0.0; 2.3)	.05
Age (years) 6–9 vs. 10–12	− 1.0 (− 3.9; 1.9)	.49	0.0 (− 0.3; 0.4)	.90
Gender M vs. F	1.1 (− 7.2; 9.4)	.79	− 0.6 (− 1.6; 0.4)	.26
Length of surgery (min) 15–35 vs. 40–70	− 0.1 (− 0.5; 0.2)	.48	0.0 (− 0.1; 0.0)	.47

[a] m-YPAS: Modified Yale Preoperative Anxiety Scale

[b] FLACC: Face, Legs, Activity, Cry, Consolability Scale

[c] 95% CI: 95% confidence interval

[d] EG: experimental group

[e] CG: control group; *$p < 0.05$

In conclusion, present results show that the relaxation-guided imagery may be considered a working tool to support children, reducing preoperative anxiety due to previous surgery experiences and postoperative pain. It can be used as a single tool to reduce both preoperative anxiety and postoperative pain without requiring any other non-pharmacological intervention that would entail additional time and costs. Therefore, it is important to investigate the feasibility of this non-pharmacological intervention in a surgical context, with the aim of developing specific protocols, adequate for multidisciplinary routines in order to achieve an increasingly patient-tailored care.

It is not necessary for the psychologist to be dedicated to the surgery department and fully available to perform this technique to all the patients undergoing minor surgery, but having in the surgery staff a trained professional in the use of non-pharmacological techniques may be an opportunity to teach them only to those patients most in need (e.g., high levels of anxiety, previous experience of surgery, in line with our results). In our experience, the psychologist should be considered the most suitable professional to perform relaxation-guided imagery with patients, in particular because of the emotional aspects that may emerge and need to be managed. Those considerations allow to hypothesize that different contexts may benefit of this approach, in a sustainable way for times and costs.

Future research should involve a higher sample size (study the potential reduction of drug administration for postoperative pain, the length of hospitalization and any eventual pediatric/psychological consultations due to behavioral problems resulting from surgery experience, highlighting possible cost reduction). Furthermore, future studies should investigate the effect of relaxation-guided imagery in preventing pain chronicization and possible role of parental anxiety.

Authors' contributions Laura Vagnoli: conception and design; acquisition of data; drafting of the manuscript; final approval of submitted manuscript. Alessandra Bettini: analysis and interpretation of data; drafting of the manuscript; final approval of submitted manuscript. Elena Amore: analysis and interpretation of data; drafting of the manuscript; final approval of submitted manuscript. Salvatore De Masi: analysis and interpretation of data; drafting of the manuscript; final approval of submitted manuscript. Andrea Messeri: conception and design; interpretation of data; critical revision of the manuscript for important intellectual content; final approval of submitted manuscript.

Compliance with ethical standards

Conflicts of interest The authors declare that they have no conflicts of interest.

Informed consent Informed consent was obtained from all parents of individual participants included in the study; agreement was obtained by all children.

Financial disclosure The authors have no financial relationships relevant to the article to disclose.

Ethical approval All procedures performed in this study involving human participants were in accordance with the ethical standards of the Institutional and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Pediatric ethical committee approval number: 30/2017.

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