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Classification of postoperative behavior disturbances in preschool children: A qualitative study

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ABSTRACT

Background/Aim: Negative postoperative changes in children are frequent and have been described for decades. However, there is currently no theoretical framework, nor any consensual operational criteria for identifying them. This study aims at characterizing the many dimensions involved in postoperative behavioral disturbances in early childhood, using a qualitative analysis applied for the first time to these symptoms.

Method: Fifty-seven parents of preschool children (1-5 years old; 38 boys), who underwent general anesthesia, were interviewed 10 days after surgery. Semi-structured interviews investigated behavioral disturbances classically described in preschool children. Qualitative analysis of the transcripts allied both deductive and inductive reasoning, and inductive coding was carried out using constant comparison method with dedicated qualitative software

Results: Parents reported both positive and negative postoperative changes. Negative changes were classified in four main categories: (a) Externalizing and (b) Internalizing problems behaviors, (c) Feeding sleeping disruption and (d) Somatic problems, each comprising different sub-categories. Importantly within these categories, the symptoms distribution changed in 5 years old children, compared to younger children. Finally, our method allowed defining whether these (negative or

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positive) changes were significant or not, that is, the importance of postoperative behavioral changes.

Conclusion: The results of this study highlight the heterogeneity of postoperative disturbances in preschool children. These results are of primary importance for the definition and measurement of postoperative behavioral disturbances

1.INTRODUCTION

In the past two decades, there has been increasing awareness about the lasting negative psychological impact of hospitalization, anesthesia and surgery in children.[1,2] Indeed, even in the presence of a minor surgery, negative postoperatiave changes, such as sleep disturbances and anxiety have been reported in various studies,[1,5] with an incidence ranging between 15% and 40% at 2 weeks post-operatively.[3,4,6] In spite of such concerns, there is currently no theoretical framework defining negative postoperative changes, nor any consensual operational criteria that have been established for identifying them, which clearly limits the comparability of the studies. To our knowledge, only one tool has been reported in the medical literature for the measurement of these modifications: the Posthospitalization Behavior Questionnaire (PHBQ7). This parentrated questionnaire is designed to measure behavior changes after discharge from hospital in children from 1 month to 16 years old. Despite its extensive use in the literature,[7,8] this tool has several limitations[9]: (a) the absence of reliable data demonstrating its construct and content validity, and its reliability for different age groups; (b) the lack of a developmental perspective for the elaboration of the questionnaire, that is, the same dimensions and items are used regardless of age; (c) the absence of a consensual cut-off score for the identification of clinically significant negative postoperative behavior changes; (d) the lack of information concerning the severity of the postoperative symptoms and their impact on children's life.

Nowadays, it is therefore hardly possible to determine the nature of postoperative changes and to identify the age-dependent most affected behavioural components. Another difficulty raises from the lack to determine the specificity of these behavioral changes, and whether they express temporary maladjustment or a more severe problem that may persist over time and require specific care by a professional. In addition, positive changes are rarely investigated as studies usually focus on negative modifications.

In this context, the literature on behavioral/emotional difficulties in nonclinical populations provides a solid framework for determining the most pertinent dimensions to be investigated in a postoperative context. In preschool children, emotional and behavioral disorders are recognized as having a differentiated nature. There is a general agreement on the existence of two classes of problem behaviors, internalizing problems behaviors (IPB) and externalizing problems behaviors (EPB). IPB are conceptualized as a core disturbance in intropunitive emotions and moods, and manifest themselves as depression, withdrawal, and anxiety. On the other hand, EPB are characterized by behaviors that are harmful and disruptive to others, and encompass problems with

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attention, self-regulation, aggression, anger, and non- compliance.[10] Interestingly, IPB and EPB both include distinct dimensions, acknowledging the diversity of behavioral/emotional difficulties in children.[11] This multidimensional approach is combined with the awareness that detecting behavioral and emotional problems can be challenging, due to major developmental changes occurring at different age periods.[12] Indeed, children develop rapidly in various critical domains (eg language acquisition), leading to multiple implications for assessment. In this context, developmental scientists have emphasized the need for investigating IPB and EPB with a developmental perspective.[13] Various questionnaires measuring emotional and behavioral difficulties in children have been developed according to these recommendations, such as the Child Behavior Checklist (CBCL[11]) or the Infant-Toddler Social and Emotional Assessment (ITSEA[14]). However, despite their psychometric quality, they are not designed to explore specific settings, such as the postoperative context.

What is already known

- The results of this study highlight the heterogeneity of postoperative disturbances in preschool children.

What this article adds

- We developed a typology to describe the main postoperative modifications observed in preschool children.

In the absence of a theoretical model defining postoperative changes, and of an adapted tool for their assessment, the goal of this study was therefore to better characterize their nature and their age-dependent behavioral manifestations, using a qualitative approach. Indeed, qualitative methods are well-suited for a comprehensive detection of all pertinent behavioral dimensions that can be affected postoperatively. We focused on the experiences of preschoolers having undergone elective surgery under general anesthesia, as this population is at high risk of developing negative changes.[3,4] A qualitative analysis was thus applied on the parents' output of a semi-structured interview, using both a "top-down" approach that incorporates the developmental literature, and a "bottom-up" approach, based on the Grounded Theory, which allows extracting abstract concepts grounded in the data.[15]

2. MATERIALSANDMETHODS

2.1. Participants

Following approval from the Institutional Ethics committee, the study was proposed to all parents whose children aged 1-6 years required general anesthesia for a diagnostic or an elective surgical procedure at the University Hospitals of Geneva. The recruitment was ensured by the anesthesiologist during the preanesthesia visit before hospitalization. Only parents who provided a

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written informed consent and who were fluent in French were included in the study. Children admitted for an emergency procedure, having a history of mental or psychomotor delay and those with oncology/hematology disease were excluded. The recruitment lasted between February and December 2010 and ended once the interviewer noticed redundant information during data collection.

2.2. Procedure

Participants provided socio-demographic information on a form they were asked to postmail back. They were contacted by phone 10 days after the operation to undergo the interview by two trained psychologists. The interviews lasted between 5 and 30 minutes and were all recorded.

2.3. Data collection

In order to detect behavioral changes as exhaustively and as precisely as possible, we collected our data through individual semi-structured interviews (see Data S1 for details).

2.4. Data analysis

Our approach was based on both inductive (Grounded Theory[15]) and deductive reasoning (see Data S1 for details).

3. RESULTS

3.1. Sample characteristics

Table 1 summarizes the demographic data of the 57 children included in this study. The interviews were collected from 46 mothers and 11 fathers. Out of 57, 33 (58%) parents returned the socio-demograophic form. All socio-demographic categories were represented across parents, who in the vast majority, lived together (29 over 33 available). Children had general anesthesia for dental procedures, ear-nose and throat (ENT), genito-urinary, plastic, abdominal, ophthalmological, or orthopedic surgical procedures. Five children underwent a magnetic resonance imaging. The mean duration of the anesthesia procedure was 123 minutes (SD = 70). Thirteen out of the 33 parents (39%) who returned the socio-demographic form reported a prior hospitalization to their current procedure and 10 out of 33 (30%) reported a history of general anesthesia. At the time of the interview, most of the children had reintegrated their routine care (45/57 corresponding to 79%).

3.2. Typology of postoperative changes

We developed a typology to describe the main postoperative modifications observed in preschool children (see Figure 1 and Table 1). Two major types of postoperative changes emerged from our data, namely*: (a) Negative* and *(b) Positive Postoperative Changes.*

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3.2.1. Negative postoperative changes

CLASSIFICATION OF NEGATIVE CHANGES

The coding of negative changes from the whole corpus of data led to the identification of four main types of modifications, which were labeled as IPB, EPB, feeding sleeping disruption (FSD), and somatic problems (SP). Each of these main categories was composed of various subcategories identified inductively. Categories and subcategories are defined below (see Data S1 for exhaustive definitions and examples).

INTERNALIZING PROBLEMS BEHAVIORS

This category reflects a set of negative behavioral and emotional manifestations directed against the child himself, reflecting an "internal conflict", such as sadness, withdrawal, fear, anxiety, shyness, avoidance behaviors linked to anxiety, emotivity, emotional lability, regression, and somatic complaints without a known medical cause. There are nine subcategories:

- Separation anxiety: We divided separation anxiety into two types:
    - Separation anxiety during daytime
    - Separation anxiety at bedtime
- Generalized anxiety
- Specific fear
- Emotionality
- Regression
- Physical and social withdrawal/sadness
- Somatic complaints without a known medical cause

TABLE 1 *Demographic and clinical data of the children*

	N (%)
Children's gender	
Girls	38 (67%)
Boys	19 (33%)
Children's age	
1-2 years	16 (28%)

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3 years	17 (30%)
4 years	12 (21%)
5 years	12 (21%)
ASA physical status	
I	38 (67%)
II	19 (33%)
Typology of postoperative changes	
At least one negative change	38 (67%)
At least one positive change	6 (11%)
Both negative and positive changes	4 (7%)
No change	13 (23%)

ASA, American Society of Anesthesiologists.

EXTERNALIZING PROBLEMS BEHAVIORS

This category reflects a set of negative behavioral manifestations directed toward the "outside", inherent to a conflict with the external environment, such as agitation/hyperactivity, impulsivity, aggression, disobedience, oppositional behavior, defiance, or attentional difficulties. There are four subcategories:

- Anger/frustration/impatience
- Noncompliance/oppositional behavior
- Directed aggressive behavior
- Agitation/hyperactivity

FEEDING SLEEPING DISRUPTION

This category comprises two subcategories:

- Sleeping problems: this subcategory was divided into three subclasses:
    - Difficulty falling asleep
    - Nocturnal agitation
    - Decrease in sleep duration
- Eating problems

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SOMATIC PROBLEMS

This category is composed of three subcategories:

- Physical Pain
- Unpleasant physical sensations
- Fatigue

OCCURRENCE AND CO-OCCURRENCE OF NEGATIVE CHANGES

Thirty-eight children (67%) presented at least one negative change, with several presenting at least one IPB, one EPB, one FSD, or one SP (respectively 24, 20, 18 and 20). Most children (N = 31, 54%) presented with several symptoms simultaneously, with a maximum of 10 symptoms. These symptoms could co-occur within the same category (homotypic co-morbidity) or across the four main categories (heterotypic co-morbidity). More precisely, more than half of the children (N = 29) showed symptoms from at least two different categories, with every possible combination being represented (note that 3 children presented symptoms from the four categories simultaneously). Table 2 shows the occurrence of each symptom by decreasing order. Except for "Somatic complaints without a known medical cause", all negative changes were reported to be still present by at least one parent at the time of the interview, that is, at 10 days postoperatively. Note that the number of children who had already been hospitalized or who already underwent general anesthesia previously was too low to compare their results with those of children undergoing hospitalization for the first time. Besides, five children presented with an illness within the 10 days after surgery (eg, a gastro-enteritis). However, the results do not show major changes when these children are withdrawn from the sample.

FIGURE 1 *Typology of postoperative behavioral changes. Note that when the behavior's description was not specific enough to enable precise labeling, this was coded as "nonspecifiable" at each level of the typology*

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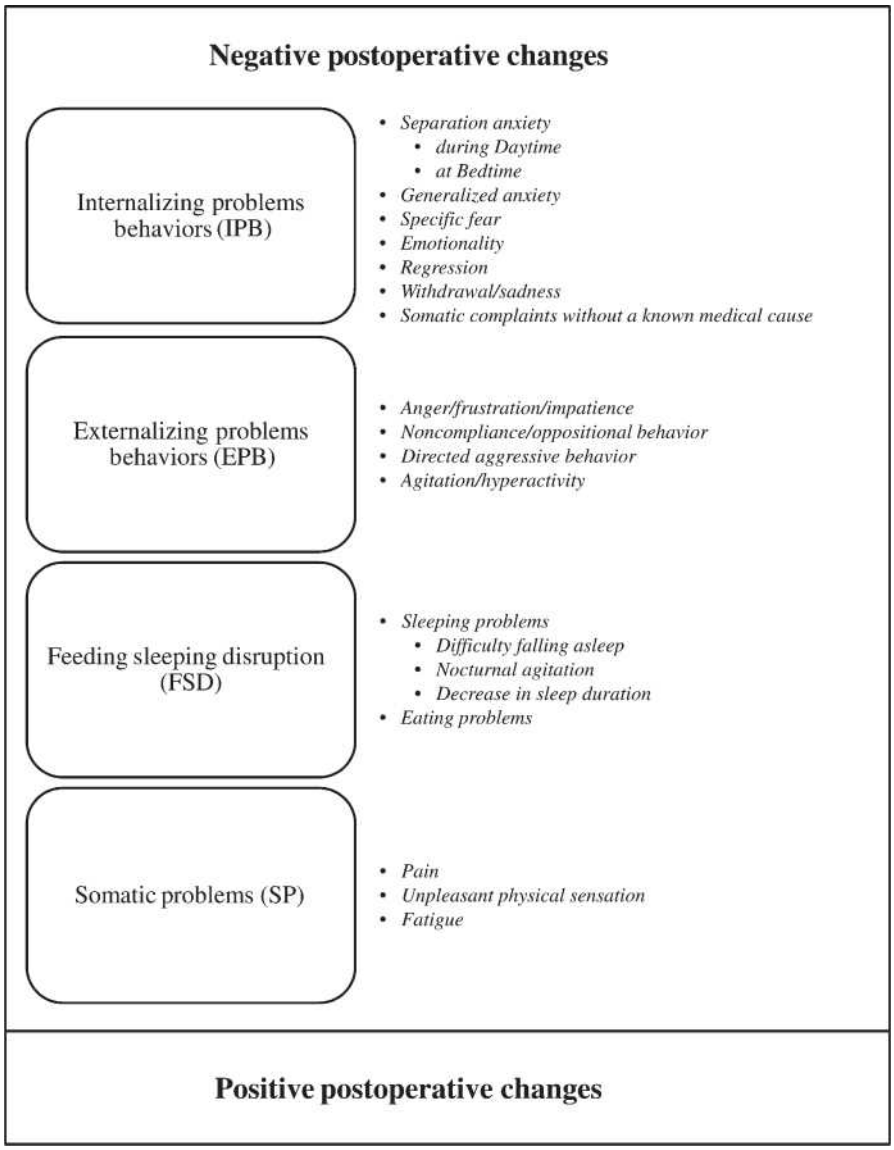
We divided the group into four age groups (Table 1): the 1-2 years old (N = 16), the 3 years old (N = 17), the 4 years old (N = 12) and the 5 years old (N = 12). In all age groups, children presented at least one negative change (11/16; 11/17; 10/12, and 8/12 respectively) and symptoms from each of the four main categories (Figure 2). However, it is interesting to note that in the three youngest age groups, Generalized anxiety and Somatic complaints were systematically absent, whereas they were present in the oldest age group. On the contrary, in this oldest group, symptoms of Eating problems, Difficulty falling asleep, Reduction in sleep duration, Anger/frustration/impatience, Separation anxiety at bedtime and Unpleasant physical sensations were systematically absent, whereas they were systematically present in the other three groups.

IMPORTANCE OF NEGATIVE CHANGES

Parents' reports contained valuable information beyond the phenomenology of the symptoms. They described the symptoms' intensity (more or less intense), their duration (at the time of the



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interview, some symptoms resorbed, others persisted to a lesser extent, while others were still present) and their belief about the appearance of the postoperative symptoms (with a more or less causal role attributed to the operation). Some also reported consequences on their own psychological suffering, on everyday situations at home (eg, modification in daily routine), or on the external environment (eg, changes reported at school). We used this information as a basis to determine whether the reported changes were significant or not, as well as the extent to which the parent insisted on the difficulties (eg, repetition of these aspects in the corpus of data), and whether or not they mentioned the changes spontaneously. In case of doubt, the interviews were examined again in order to take prosodic speech elements into consideration (such as intonation or speed of speech).

TABLE 2 - *Occurrence (N and %) of the symptoms according to the main categories*

	IPB	EPB	FSD	SP
Fatigue				12 *(21%)*
Nocturnal sleeping problems			10 *(18%)*	
Eating problems			9 *(16%)*	
Anger/frustration/ impatience		9 *(16%)*		
Separation anxiety at bedtime	8 *(14%)*			
Pain				8 *(14%)*
Difficulty falling asleep			7 *(12%)*	
Agitation/hyperactivity		7 *(12%)*		
Noncompliance/ oppositional behavior		6 *(11%)*		
Separation anxiety during day time	6 *(11%)*			
Emotionality	6 *(11%)*			
Decrease in sleep duration			6 *(11%)*	
Withdrawal/sadness	5 *(9%)*			
Unpleasant physical sensations				5 *(9%)*
Directed agressive behavior		4 *(9%)*		
Regression	4 *(7%)*			
Specific fear	3 *(5%)*			
Somatic complaints without a known medical cause	2 *(4%)*			
Generalized anxiety	1 *(2%)*			

EPB, externalizing problems behaviors; FSD, feeding sleeping disruption; IPB, internalizing problems behaviors; SP, Somatic Problems.

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Nine out of the 57 children (16%) were categorized as presenting significant negative changes. All of them belonged to the three youngest age groups. In comparison with children without significant negative changes, we did not observe notable differences in terms of socio-demographic or medical condition. Furthermore, none of these nine children had any sickness, or significant event during the postoperative days, which could have explained these changes. Interestingly however, the single child with reported problems following a previous anesthesia procedure, was part of these nine children with significant changes. Finally, none of them presented with Positive Postoperative Changes.

Concerning the nature of the negative changes, these nine children expressed all the symptom subcategories identified by the qualitative analysis, except Generalized anxiety or Somatic complaints (these two subcategories were expressed only by children above 5 years of age). Moreover, they presented with 2-10 symptoms that co-occurred within and across categories (homotypic and heterotypic comorbidity). The most frequently reported symptom was

Anger/frustration/impatience (4/9 children). Importantly, no symptom was exclusively observed in this sub-group compared to children without significant negative changes.

In many cases, symptoms were described as very intense (36/45 or 80% of symptoms), with some symptoms being exclusively described as "very intense" by all parents (Directed aggressive behavior, Anger/frustration/impatience, Noncompliance/ oppositional, Emotivity, Withdrawal/sadness and Regression). Their duration was variable, but importantly, Pain and Nocturnal agitation always disappeared. On the contrary, Decrease in sleep duration, Directed aggressivity, and Emotivity always persisted. In the majority (7/9 children, corresponding to 77%), parents provided at least one explanation implicating the operation, more or less strongly. Surgery was even considered the only explaining factor in three parents.

Finally, 2/9 children (22%) presented with postoperative distress[16] which was characterized by

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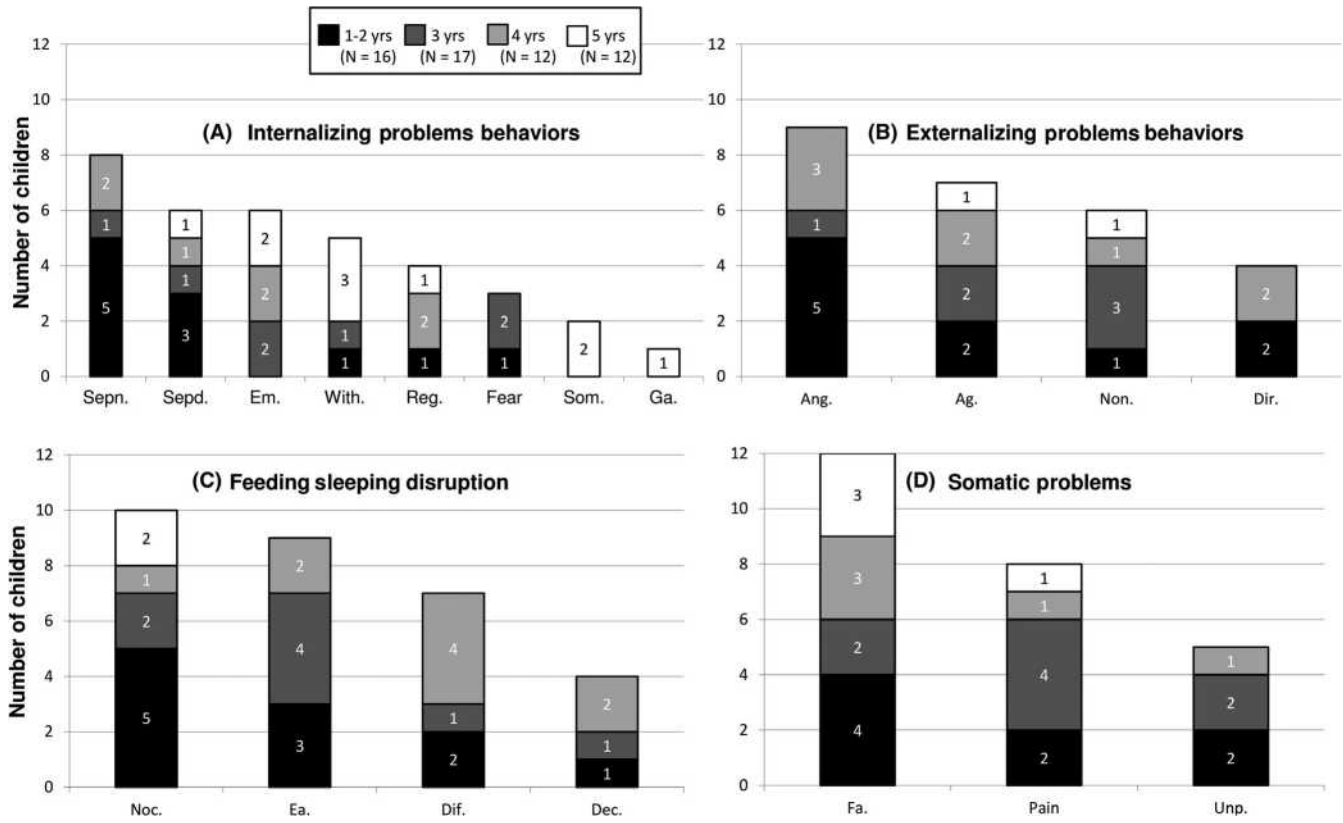

FIGURE 2 *Occurrence of symptoms according to the four main categories sorted by age groups (1-2, 3, 4, and 5 years old children). A) Internalizing Problems Behaviors: Sepn = Separation anxiety at bedtime, Sepd = Separation anxiety during daytime, Em = Emotionality, With = Withdrawal/Sadness; Reg = Regression, Fear = Specific Fear, Som = Somatic complaints without a known medical cause, Ga = Generalized Anxiety. B) Externalizing Problems Behaviors: Ang = Anger/Frustration/Impatience, Ag = Agitation/Hyperactivity, Non = Noncompliance/oppositional behavior, Dir = Directed aggressive behavior. C) Feeding Sleeping Disruption: Noc = Nocturnal sleeping*

restlessness, combativeness, crying, and disorientation in the very early postoperative period. This has left parents with significant suffering, which was still present at the time of the interview (feelings of anger, worry). One of these two children also had difficulties during the induction phase of the anesthesia (the induction had to be forcefully carried out because the child was crying so much and was extremely agitated). It should be noted that these two cases of « anesthesia-related complications » were the only two cases in the whole sample, that is, the remaining 55 children (96%) did not experience complications of this type.

3.2.2 Positive postoperative changes

CLASSIFICATION AND OCCURRENCE OF POSITIVE CHANGES

Six children presented with at least one positive change (11%), with a maximum of four positive changes in the same child. Four of the six children were over the age of 5 years old, one was over the age of 3, and the youngest was 2 years old. All children had undergone an ENT or dental procedure (due to hearing problems or fillings), apart from the youngest who required an urological operation due to recurring urinary infections. Reported changes often involved an improvement in feeding

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patterns (eg, improved appetite) or sleeping patterns, or an improvement in attentional, sensory (hearing), behavioral (eg, the child became more open), or psycho-motor skills (improved motor skills). In most cases, positive changes were, to a greater or lesser extent, attributed to the operation. Thus, the nature of the observed change depended on the type of operation that was carried out. In all the children, the reported changes were still present at the time of the interview, and their intensity was qualified as variable.

IMPORTANCE OF POSITIVE CHANGES

Half of the children (three out of six) presented with changes mostly described as very intense with positive repercussions on social, cognitive and psychological fronts (eg, better interaction with others). We qualified these changes as significant (using the same criteria as those for "significant negative changes").

4. DISCUSSION

This qualitative study explored the typology and phenomenology of postoperative behavioral changes in preschool children. The findings suggest two main types of postoperative changes in preschool children: Negative and Positive. Positive changes were present in very few children with no possible identification of the dimensions and were more dependent on the surgical procedure. Conversely, four categories could be identified for Negative changes: EPB, IPB, FSD, and SP Finally, there was an age-dependent behavioral manifestation, with Generalized anxiety and Somatic complaints present beyond 5 years of age, whereas Eating problems, Difficulty falling asleep, Reduction in sleep duration, Anger/frustration/impatience, Separation anxiety at bedtime, and Unpleasant physical sensations were only present in the three youngest age-groups.

The current available investigations in the literature have approached behavioral changes on a global level, providing limited information such as the incidence of children presenting with at least one negative change. On the contrary, the results of this study highlight the heterogeneous and possibly multidimensional nature of postoperative difficulties. These findings are in agreement with previous work conducted in the field of child and developmental psychopathology.[10,17,18] Indeed, we observed EPB and IPB, two dimensions described in the literature and measured with various tools in other contexts, including CBCL and ITSEA.[11,14]

The first observed dimension, the EPB, and the identification of the nature of the four symptoms are in total agreement with previous multidimensional models of disruptive behavior in the preschool child.[13,17] Moreover, the second observed dimension, the IPB, and the identification of the eight symptom sub-categories also concur with previous data highlighting the typical heterogeneity underlying IPB.[10,18] Accordingly, recent studies demonstrate that models differentiating anxiety from depression symptoms are more appropriate than one-dimensional models.[18,19] Furthermore, anxiety can be broken down into several dimensions from 2 years old onwards,[19,21,22] consistently with the results of this study. There was also evidence for additional sub-categories within IPB, including Emotionality and Somatic complaints without a known medical reason, which are also

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found in the CBCL.[11] Finally, "Regression" is rarely evaluated in questionnaires measuring emotional and behavioral difficulties in children.

Another negative dimension, "Feeding and sleeping disruptions (FSD)", was characterized. Two sub-categories were identified: (a) Sleeping problems with three main symptom types, and (b) Eating problems that were not sub-classified, but manifested in different ways (refusal to eat, poor appetite). These results are also compatible with previous data highlighting the multidimensional nature and phenomenological diversity of the Feeding and Sleeping disruptions in this population.[23,24]

An additional category of negative change was represented by the "Somatic Problems (SP)", with three symptom sub-categories. It should be noted that these aspects were never previously considered, neither in the PHBQ,[7] nor in more general questionnaires measuring behavioral and emotional difficulties in children.[11,14] We can therefore conjecture that SP is a specific category related to the hospital and post-operative context.

Some commonalities were observed between the present dimensions, and those approached in the PHBQ, namely, Generalized anxiety, Separation anxiety, Sleep disturbances, Eating disturbances, and Aggression toward authorities.[7] However, Apathy, a dimension addressed in the PHBQ could not be distinguished from the current qualitative analysis. On the contrary, the PHBQ does not measure SP while in this category, symptoms such as Fatigue were among the most cited side-effects in the present sample of children. Finally, the EPB dimension is underrepresented in the PHBQ, with only two items measuring it.

A high number of children presented at least one negative change, which supports the current literature reporting a fairly elevated incidence of these side-effects.[1,3,6] Symptoms were generally expressed in conjunction with others, suggesting that both heterotypic and homotypic symptomatic comorbidities are the rule rather than the exception, also in the domain of postoperative behavioral changes.[25] Moreover, the observed age-dependent difference in behavioral manifestations is consistent with the developmental literature.[16] Indeed, two dimensions which requires more elaborated language capacities to be expressed, that is Generalized anxiety and Somatic complaints, manifested only in children above 5 years of age. Futhermore, it is important to highlight that the way a dimension such as EPB is expressed, will be constrained by the child's emotional, cognitive and social abilities.[13,16] Thus, the assessment of behavior changes should be adapted to the child's age, measuring relevant behavior based on his/her developmental stage. From this perspective, this study offers a precise classification of postoperative behavioral changes in preschool children, providing a requisite foundation for the elaboration of a questionnaire tailored to meet these requirements in future works.

Another aspect of this study is related to the identification of a subgroup of children with significant adverse changes in terms of symptoms' severity and subsequent impact. These findings provide some guidelines that can be applied to elaborate a cut-off score for distinguishing between behaviors that denote a temporary adjustment, from the behaviors linked to a more long-lasting problem. Moreover, and in agreement with the literature, potential risk factors associated with significant adverse changes (previous hospitalization and general anesthesia, and difficulties during

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the induction phase) were only reported in this subgroup of children with significant negative modifications.[5]

Some limitations of this study should be mentioned. Firstly, caution is warranted regarding the generalizability of our findings to the whole population or other contexts. Indeed, our sample was limited to healthy children admitted for elective surgery. Children with oncology/hematology disease or having a history of mental or psychomotor delay were also excluded, in order to rule out a possible interaction between changes due to these chronic conditions and changes due to elective surgery. Furthermore, the study was performed in one single institution with a homogeneous population and therefore, caution should be taken when extrapolating the results to other cultures. Future research is therefore needed to determine if similar results can be observed in other settings (ie, in different centers and countries, including emergency procedures, ...).

Secondly, the theoretical saturation was not empirically demonstrated in the present study. Despite this weakness, we do not believe that the validity of the present findings was affected. Indeed, our sample size exceeded that reported in the qualitative literature with person's report, which was limited to 50 participants.[26] The recruitment was stopped once the interviewer noticed redundancy in the information collected. Such redundancy was also observed in the end of the coding process, suggesting that theoretical saturation has been reached. Furthermore, we followed in this study the recommended guidelines for successful application of qualitative methods, such as detailed and transparent description of the methodology, which makes its duplication possible.[15,27] As a result, the analysis performed in this study led to the definition of dimensions that matched with well-established factors reported in the developmental literature, which strengthen their validity.

A third limitation of this study stems from the informant. The evaluation of the child's symptoms was provided by the parents only, mostly mothers. Additional research is therefore required to ensure that these results could be replicated with fathers as well. Also, it would have been interesting to collect data from other informants than the parents (nanny, ...) in order to detect if postoperative modifications are reported by other caregivers to the same extent. Furthermore, participating in this study may have encouraged parents to enhance their attention on their child's behavior, and to report the slightest change. To reduce this bias, parental recruitment could have been done at the time of data collection (in our case, 10 days after the surgery). However, such a design could introduce another bias related to the children's severity of negative change (ie, parents whose children have significant negative changes would be more likely to participate than parents whose children have less severe modifications).

Another consideration may be related to the SP category reported in the present study. Accordingly, a crossover between SP and other behavior categories cannot be totally excluded, particularly in young children, since they do not have the capacity to express their feelings verbally. For instance, behaviors viewed by parents as fatigue could correspond to apathy. Further qualitative studies are therefore mandatory to better specify these points.

Finally, even if different criteria were proposed to identify significant negative changes, our study does not allow to determine if some of the affected children needed specific care by a professional. Indeed the observed changes could express temporary maladjustment or a more severe problem

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that may persist over time. In particular, a longitudinal study would allow to better understand the duration and the potential repercussions of these changes, and to determine pertinent criteria for referral.

Despite these limitations, this study represents a first step toward the comprehension of postoperative behavior in preschool children. Yet, future studies are warranted to develop a specific questionnaire for detecting behavioral changes that may occur in the postoperative period. This development implies several steps. Firstly, the results obtained in this study should be reproduced under similar conditions. Next, postoperative children modifications should be investigated in various settings (ie, other countries) in order to assess the generalisability of the present results. Then, several studies would be necessary to establish and validate the questionnaire. The development of such a tool is of paramount importance for various reasons. First, it would constitute a useful mean for practitioners to detect children in need for special care and follow-up. Moreover, it could be used at an institutional level (eg, for quality control) and in future research (for example, to identify putative risk factors associated with the appearance of significant negative changes).

In summary, this study provides, for the first time, a classification of the postoperative behavioral modifications in preschool children based on a qualitative approach. It reveals the heterogeneous nature of postoperative disturbances in preschool children and the age-dependent manifestation within this high risk group. Future studies are needed in order to develop a questionnaire tailored to detect these modifications. Such a specific questionnaire is of paramount importance for both clinical and research issues.

REFERENCES

1. *Caldas J, Pais-Ribeiro JL, Carneiro SR. General anesthesia, surgery and hospitalization in children and their effects upon cognitive, academic, emotional and sociobehavioral development-a review. Pediatr Anesth. 2004;14(11):910-915.*

2. *Kain ZN, Caldwell-Andrews AA, Maranets I, et al. Preoperative anxiety and emergence delirium and postoperative maladaptive behaviors. Anesth Analg. 2004;99(6):1648-1654.*

3. *Kotiniemi L, Ryhanen P, Moilanen I. Behavioural changes in children following day-case surgery: a 4-week follow-up of 551 children. Anaesthesia. 1997;52(10):970-976.*

4. *Stargatt R, Davidson AJ, Huang GH et al. A cohort study of the incidence and risk factors for negative behavior changes in children after general anesthesia. Pediatr Anesth. 2006;16(8):846-859.*

5. *Cohen-Salmon D. Perioperative psychobehavioural changes in children. Ann Fr Anesth Reanim. 2010;29:289-300.*

6. *Kain ZN, Wang SM, Mayes LC, Caramico LA, Hofstadter MB. Distress during the induction of anesthesia and postoperative behavioral outcomes. Anesth Analg. 1999;88(5):1042-1047.*

7. *Vernon DT, Schulman JL, Foley JM. Changes in children's behavior after hospitalization: some dimensions of response and their correlates. Am J Dis Child. 1966;111(6):581-593.*

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Status : Postprint (Author's version)

8. *Thompson RH, Vernon DT. Research on children's behavior after hospitalization: a review and synthesis. J Dev Behav Pediatr. 1993;14(1):28-35.*

9. *Lopez U, Habre W. Evaluation of intraoperative memory and postoperative behavior in children: are we really measuring what we intend to measure? Pediatr Anesth. 2009;19(12):1147-1151.*

10. *Campbell SB. Behavior problems in preschool children: a review of recent research. Child Psychol Psychiatry. 1995;36(1):113-149.*

11. *Achenbach TM, Rescorla LA. Manual for the ASEBA Preschool Forms & Profiles: An Integrated System Of Multi-Informant Assessment; Child Behavior Checklist for Ages 1 1/2-5; Language Development Survey; Caregiver-Teacher Report Form. Burlington: University of Vermont; 2000.*

12. *Angold A, Egger HL. Preschool psychopathology: lessons for the lifespan. J Child Psychol Psychiatry. 2007;48(10):961-966.*

13. *Wakschlag LS, Tolan PH, Leventhal BL. Research review:Ain't misbehavin': towards a developmentally-specified nosology for preschool disruptive behavior. J Child Psychol Psychiatry. 2010;51(1):3-22.*

14. *Carter AS, Briggs-Gowan MJ, Jones SM, Little TD. The infant-toddler social and emotional assessment (ITSEA): factor structure, reliability, and validity. J Abnorm Child Psychol. 2003;31(5):495-514.*

15. *Forman J, Damschroder L. Qualitative Content Analysis. Empirical Research for Bioethics: A Primer. Oxford: Elsevier Publishing; 2008:36-92.*

16. *Carter AS, Godoy L, Wagmiller RL, et al. Internalizing trajectories in young boys and girls: the whole is not a simple sum of its parts. J Abnorm Child Psychol. 2010;38(1):19-31.*

17. *Wakschlag LS, Henry DB, Tolan PH, Carter AS, Burns JL, Briggs- Gowan MJ. Putting theory to the test: modeling a multidimensional, developmentally-based approach to preschool disruptive behavior. J Am Acad Child Adolesc Psychiatry. 2012;51(6):593-604.*

18. *Eley TC, Bolton D, O'Connor TG, Perrin S, Smith P, Plomin R. A twin study of anxiety-related behaviours in pre-school children. J Child Psychol Psychiatry. 2003;44(7):945-960.*

19. *Spence SH, Rapee R, McDonald C, Ingram M. The structure of anxiety symptoms among preschoolers. Behav Res Ther. 2001;39(11):1293-1316.*

20. *Sterba S, Egger HL, Angold A. Diagnostic specificity and nonspecificity in the dimensions of preschool psychopathology. J Child Psychol Psychiatry. 2007;48(10):1005-1013.*

21. *Edwards SL, Rapee RM, Kennedy SJ, Spence SH. The assessment of anxiety symptoms in preschool-aged children: the revised Preschool Anxiety Scale. J Clin Child Adolesc Psychol. 2010;39(3): 400-409.*

22. *Mian ND, Godoy L, Briggs-Gowan MJ, Carter AS. Patterns of anxiety symptoms in toddlers and preschool-age children: evidence of early differentiation. J Anxiety Disord. 2012;26(1): 102-110.*

23. *Crist W, Napier-Phillips A. Mealtime behaviors of young children: a comparison of normative and clinical data. J Dev Behav Pediatr. 2001;22(5):279-286.*

24. *Lewandowski AS, Toliver-Sokol M, Palermo TM. Evidence-based review of subjective pediatric sleep measures. J Pediatr Psychol. 2011;36(7):780-793.*

25. *Keenan K, Wakschlag LS. More than the terrible twos: the nature and severity of behavior problems in*

Published in : Paediatric Anaesthesia (2019), vol. 29, n°7, pp. 712-720
DOI: 10.1111/pan.13627
Status : Postprint (Author's version)

clinic-referred preschool children. J Abnorm Child Psychol. 2000;28(1):33-46.

26. *Mason M. Sample size and saturation in PhD studies using qualitative interviews. Forum Qualitative Sozialforschung/Forum: Qualitative Social Research. 2010;11(3):art.8.*

27. *Palinkas LA. Qualitative and mixed methods in mental health services and implementation research. J Clin Child Adolesc Psychol. 2014;43(6):851-861.*

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