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Featured Article

Risk factors for the development of medical stress syndrome following surgical intervention

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ABSTRACT

Background: Pediatric surgical procedures involve traumatic stress that may cause psychological distress, leading to decreased adherence to continued surgical follow-up and delayed physical recovery. Risk factors for pediatric medical trauma, however, have not been studied enough. We aim to define the risk factors detectable during hospitalization in pediatric surgery and characterize children at risk of developing PTSD, in order to focus preventive interventions on these children.

Methods: The participants in this prospective study were parents of 235 children aged 1–13 years hospitalized in a pediatric surgical ward, who form a representative sample of patients of this age in the ward. They completed questionnaires measuring symptoms of psychological distress, 3–5 months after discharge.

Results: Higher parental stress, parental concerns regarding family social support, and parental concerns regarding sibling problems had a significant positive correlation with the children's emotional distress measured 3–5 months after hospitalization. Among children aged 1–5 years, emergency (as opposed to elective) operation and a higher number of invasive procedures were also positively correlated with the children's PTSS.

Conclusions: There is a need to develop measurements for identifying children at high risk for developing posttraumatic stress following surgical intervention; guidelines for developing such a screening instrument are outlined.

Type of study: Prognosis study (level of evidence – 1).

1. Introduction

Children in medical care who undergo surgical interventions may experience fear, uncertainty, helplessness, and sometimes even a sense of threat to life [1]. Studies in the field show that illnesses, hospitalization and medical interventions are significant stressors for children that may lead to the development of symptoms of posttraumatic stress disorder (PTSD), such as hyper-arousal, re-experiencing the event, and avoidance patterns. These symptoms can lead to significant changes, such as impairment in social and scholastic functioning, difficulties in self-regulation and in sleep, mood disturbances and developmental problems [2–6].

Most studies examining the development of posttraumatic symptoms following medical intervention among children focused on the population of cancer and diabetic patients [7, 8] and on children hospitalized in intensive care units [5, 9, 10]. Few studies concentrated on the development of posttraumatic symptoms in children who underwent surgical interventions. In a study of children aged 1–6 who were hospitalized for various surgical interventions, 28.6% of the parents reported that their children suffered from distress that impaired their functioning and caused them difficulties in adaptation, and 10.39% of the children were diagnosed with PTSD [2]. In another study of children aged 6–13 who were similarly hospitalized for various surgical interventions, 26.4% had partial PTSD and 10.2% had PTSD [11]. However, many of the children who developed posttraumatic stress symptoms (PTSS) after surgery have not been diagnosed and are inadequately treated due to lack of awareness among medical staff of the psychological implications of a medical event on children [9, 12].

Identifying risk factors is of great importance because it can enable the early identification of children at risk of developing medical trauma and allow their referral to preventive intervention. Indeed, early preventive interventions have been shown to be effective in children at risk of developing PTSD [13–17]. In the absence of early detection, developing PTSS will cause not only emotional distress and dysfunction but also decreased adherence to continued surgical follow-up and delayed physical recovery after surgery [18]. At the public level, moreover, the development of PTSD among children following a medical event leads to increased expenses for public health institutions. Early detection can enable the effective concentration of resources of the public health system, focusing on a smaller number of children who are at

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high risk of developing medical trauma and referring them to early preventive intervention.

Risk factors for the development of PTSD are well known, and include previous psychopathology, previous exposure to traumatic events, low socioeconomic status, low level of education, family dysfunction, and background psychiatric problems in the family [19–21]. Some studies have suggested additional risk factors which are specific to cases of medical trauma, such as parental stress response to the medical event, length of hospitalization, severity of hospitalization [9, 10, 22], exposure to high intensity of pain, exposure to frightening sights or sounds in the hospital, being alone without parents or caregivers, and lack of support by the peer group [20, 21]. A review of the literature shows that studies on this subject did not specifically examine risk factors for development of posttraumatic stress among children hospitalized in surgical wards. The current study aims to define the risk factors detectable during hospitalization in pediatric surgery and characterize children at risk of developing PTSD, in order to focus preventive interventions on these children.

2. Methods

2.1. Study procedure

The study was approved by the Institutional Review Board of the medical center. The interviewer approached the parents (or legal guardians) of all the children hospitalized at Hadassah-Hebrew University Medical Center Pediatric Surgery Department between 1 March 2016 and 1 June 2016 who fulfilled the inclusion criteria (Hebrew-speaking, 1–13 years old, no head injury). Those who agreed to participate signed an informed consent form and were asked to complete questionnaires. During the study tests were conducted on two occasions. During the first, parents completed questionnaires near the time of surgery and during the second, which was conducted about three to five months after discharge from the hospital, the same parents were contacted via telephone and completed psychometric measures. The list of questionnaires that were used in the study and the stages at which they were used are attached in Table 1. In order to improve reliability, the same clinician (A. B.), a doctoral candidate who is an experienced psychologist, conducted all the interviews.

2.2. Participants

The study sample included 235 Hebrew-speaking parents of 235 children (63% boys, 37% girls) hospitalized in the Hadassah Medical Center pediatric surgery ward. All parents of children consecutively hospitalized in this ward during the study period who agreed to participate in the study were recruited. Head injury patients were excluded. The surgical procedures involved were in urology (26.7%), orthopedics (8.4%), ENT (11.3%), dermatology (11.3%), gastroenterology (8.4%), nephrology (8.4%), neurology (4.2%), cardiology (4.2%), combined (7%), and other (10.1%). Forty-six participants (19.6%) were hospitalized without surgery. The period of hospitalization ranged from 1 to 14 days, the average being 3.92 days (SD = 2.96). The hospitalization was elective for 64.8%. Among the children, 54.7% underwent complicated surgery (surgery requiring hospitalization for more than two days) and the rest underwent non-complicated surgery. The average age of children participating in the study was 5.2 years old (SD = 3.7). For 167 of the children (71.1%) it was the first surgical intervention in their lives. An assessment of the demographic data shows that our sample is representative of the whole population of Hebrew-speaking children hospitalized in this pediatric surgery ward over the course of a year: mean age 4.9 years old, gender ratio (56.2% boys, 43.8% girls), mean hospitalization length (3.82 days), and distribution of reasons for hospitalization (36% minor surgery, 4.5% major surgery).

Given the developmental differences between preschoolers and school-aged children, and considering that different instruments are used to measure distress at these ages, the sample was divided into two age groups: 1–5, 6–13.

The mean age of the parents was 36.5 years. Concerning the parents' level of education, 43.5% completed secondary education, 44.8% had a bachelor's degree, and 11.7% had a master's degree. Regarding their family and marital status, 87% were married, 19% had 1 child, 23% had 2 children, 31% had 3 children, and 27% had 4 children or more. The parents of 41 children refused to participate in the study. There were no significant differences between the demographic characteristics of this group and those of the study sample. Moreover, there were no differences in the distribution of different kinds of surgical procedures and in the circumstances of hospitalization (emergency or elective).

Table 1
Research questionnaires by time and function (outcome measures / predictive questionnaires)

Time 1 (Child hospitalized)	Time 2 (3-5 months after release)
Predictive questionnaires	Outcome measures
Demographic questionnaire	PCASS
CBCL (Time 1)	PTSDSSI
PAT	CBCL (Time 2)
IPS	UCLA-PTSD
PDS	

2.3. Measures

The instruments used in this study to assess the children's level of distress are based on parental report. Since there are no standardized tools that are specifically aimed at measuring psychological sequela of hospitalization, we used questionnaires that measure PTSS and other symptoms of psychological distress. To increase validity through triangulation, posttraumatic stress was assessed through several instruments.

2.3.1. Demographic questionnaire

This questionnaire focused on the following factors: age and gender of the child; cause of hospitalization; gender of the parent who answered the survey; and the parent's level of education. We took information pertaining to the characteristics of the hospitalization and of the medical intervention from the hospital's medical records (including data on the complexity of the surgery and on the child's preoperative preparation process).

2.3.2. Achenbach's Child Behavior Checklist (CBCL)

The CBCL is frequently used to measure emotional and behavioral problems in children aged 1.5–18 [23], and we used it to assess the child's overall distress level. The two parental versions of the questionnaire were used as per the child's age (the 1–5 version and the 6–18 version). The questionnaire was administered twice: at the beginning of the study, in order to assess the preoperative level of distress; and four months after hospitalization, in order to measure the child's postoperative distress level. The questionnaire is comprised of 112–138 items (according to the version) recorded on a 3-point Likert scale, addressing eight sub-scales (anxiety and depression, withdrawal, somatic complaints, attention problems, thought problems, social problems, rule-breaking behavior, and aggressive behavior) [24]. The questionnaire was translated into Hebrew and validated [25].

2.3.3. Invasive Procedures Score (IPS)

The IPS is a checklist comprised of 74 medical invasive procedures divided into two categories: tissue-damaging procedures (e.g. chest tube and IV catheter insertion) and non-damaging procedures (e.g. airway suction). We used it to assess the number of medical invasive procedures the child had undergone. Interrater reliability for the

instrument has been established between two independent raters on twenty hospital charts at 95–100% agreement [6]. IPS scores were calculated by recording the number of times each procedure was performed on the child during a 24-hour period, carried out either by a parent or medical staff. Data were collected from the child's medical file. We used the original form in English in this study.

2.3.4. Posttraumatic Stress Disorder Semi-Structured Interview (PTSDSSI)

The 29 items of this parental-report questionnaire are recorded on a 3-point scale of agreement, addressing developmental changes and the child's reaction during and after an event. We used this instrument to assess the child's posttraumatic distress following the surgery in the 1–6 age group. Internal validity was established at 0.87 [26]. We used the Hebrew version in this study [27].

2.3.5. The Preschool Children's Assessment of Stress Scale (PCASS)

This parental-report instrument assesses a child's reaction to a traumatic stressor among children aged 1–6 years [28], and we used it to assess the children's reaction to the surgery. Originally developed in Hebrew and published in English, it includes 29 items rated on a Likert scale of 1–5 relating to symptoms such as anxiety, fears, sleep problems, loss of recently acquired developmental skills (e.g. toilet training), and mood liability. Internal reliability has been reported at $a = 0.89$ [28].

2.3.6. UCLA-PTSD Reaction Index: DSM-V Version, Parent Version (UCLA-PTSD-RI-P)

We used this self-report questionnaire to assess posttraumatic distress among children in the 6–13 age group following the surgery. The instrument's 31 items are recorded on a 5-point scale representing the frequency of appearance of symptoms. Since it is based on the new DSM-V version, information regarding its validity and reliability is still being accumulated [29]. Internal reliability in the current study was 0.98. The questionnaire was translated from English to Hebrew by the researcher, then back to English by two English-speaking reviewers, and back to Hebrew by two different reviewers [30]. Where inconsistencies arose, yet another reviewer who is a native English speaker with expertise in translation decided the phrasing.

2.3.7. Psychosocial Assessment Tool II (PAT 2.0)

The PAT 2.0 [31] is designed to assess psychosocial problems in children with life-threatening diseases. Higher PAT 2.0 scores are associated with higher levels of psychosocial risk for the child. The instrument includes 84 items and is comprised of 7 sub-scales: family structure and resources, family social support, family problems, parent stress reactions, family beliefs, child problems, and sibling problems. Each item in the sub-scales is dichotomously scored. In this study we used the Family Social Support and the Sibling Problems sub-scales. Internal consistency is strong at $a = 0.81$ [31].

2.3.8. Posttraumatic Stress Diagnostic Scale (PDS)

The PDS [32] is a self-report questionnaire that we used to assess parental posttraumatic distress. The tool includes 48 items rated on a Likert scale of 0–3. The PDS is widely used in clinical and research settings and has reported internal consistency of $a = 0.92$ [32]. We used the Hebrew translated and validated version [33]. In the current study, internal reliability yielded $a = 0.97$.

2.4. Data analysis

Data were entered and analyzed using SPSS version 25. First, descriptive statistics were produced for all measures, using frequencies for categorical variables and means with standard deviations for continuous variables. To predict emotional distress as measured by continuous indices (i.e. PCASS, CBCL, UCLA), we used hierarchical multivariate linear regression models. Mental distress outcomes were regressed with hospitalization-related variables at step 1 and parental variables at step 2. Regressions were conducted separately for the 1–5 age group, and for the 6–13 age group. To check for risk factors for the development of post-hospitalization PTSS, we used cut-off values for PCASS (for the 1–5 age group) [28], and UCLA (for the 6–13 age group) [29]. Then, we conducted logistic regressions that predicted Odds Ratio for PTSD due to operation. Level of significance was 5%.

3. Results

Table 2 shows the differences between the age groups in main factors influencing emotional distress among participants. As shown, the groups were similar in prevalence or levels of most factors. The only significant differences were at the rate of elective operations (80.6% of children younger than 5 had elective operations, compared to 64.8% of children aged 6–13) and in the family support subscale of the PAT. The fact that the two groups do not differ in most of the variables allows us to compare them.

Table 3 shows the results of the hierarchical multivariate linear regression assessing relationships with emotional distress. Among children aged 1–5, hospitalization-related variables—i.e. complicated operation, duration of hospitalization, kind of operation and preparation to operation—were not associated with the level of psychological distress 3–5 months after the hospitalization as measured by PCASS. However, parental variables explained 26% of total variance ($F(4,74) = 23.70$, $p < .001$). Specifically, the distress level of the parent (measured by PDS) and the number of invasive procedures (measured by IPS) were positively related to the child's emotional distress as measured by PCASS. In addition, the level of family social support positively predicted high distress in children. Almost all the participants who have reported posttraumatic distress (96.2%) considered their child's hospitalization as the main traumatic event and had no other previous traumatic events.

Emergency operation was related to higher distress as measured by the CBCL in children 1–5 years old. Parental variables explained additional 32% of total variance ($F(4,63) = 20.38$, $p < .001$). Specifically, the distress level of the parent (measured by PDS), the level of family social support and parental concerns regarding sibling problems were positively related to the child's emotional distress as measured by the CBCL. Finally, the number of invasive procedures (measured by IPS) was positively related to the child's emotional distress.

Among children aged 6–13, hospitalization-related variables were not associated with the child's emotional distress as measured by the UCLA index. However, after controlling for these variables, parental variables explained 45% of total variance ($F(4,55) = 15.84$, $p < .001$). Specifically, the parent's distress level (measured by PDS) was positively related to the child's emotional distress as measured by the UCLA index. Moreover, family social support (measured by the PAT) and parental concerns regarding sibling problems (measured by the PAT) positively predicted high distress in children. Hospitalization-related variables, furthermore, were not associated with the child's emotional distress as measured by the CBCL. However, after controlling for these variables, parental variables explained additional 51% of total variance ($F(4,56) = 25.09$, $p < .001$). Specifically, the parent's distress level (measured by PDS) was positively related to the child's emotional distress as measured by the UCLA index. In addition, family social support and parental concerns regarding sibling problems (both measured by PAT) positively predicted high child's distress.

To check for risk factors for PTSS following hospitalization, we used cut-off values for PCASS (for the 1–5 age group) and the UCLA index (for the 6–13 age group). Then, we conducted logistic regressions that produced Odds Ratio for PTSD following hospitalization using the same variables we used in the regressions shown in Table 3.

As shown in Table 4, among children aged 1–5 years, higher parental distress (measured by PDS) predicted higher probability for the child's PTSS. In addition, parental stress regarding family social support (measured by PAT) was associated with higher probability for the child's PTSS (OR = 21.42, 95% CI [2.70,167.19]).

Table 2
Comparison between age groups in main variables associated with emotional distress among children following hospitalization in pediatric surgery

	1–5 y/o	6–13 y/o	p	Whole Sample
	Mean (SD) / %	Mean (SD) / %		Mean (SD) / %
First vs. repeated surgery	33.1%	31.8%	0.886	32.6%
Complicated operation (vs. non-complicated)	54.2%	59.1%	0.497	56.1%
Duration of hospitalization	4.80 (8.80)	3.92 (2.95)	0.367	4.46 (7.16)
Kind of operation (elective vs. emergency)	80.6%	64.8%	0.012	74.4%
Preparation to operation	59.8%	71.8%	0.100	64.4%
The distress level of the parent (PDS)	9.02 (11.61)	6.62 (10.92)	0.126	8.07 (11.39)
Invasive Procedures Score (IPS)	4.14 (3.26)	4.91 (7.54)	0.301	4.42 (5.27)
Parental concerns regarding sibling problems (PAT)	18.48 (4.54)	19.43 (4.93)	0.139	18.84 (4.70)
Family Social Support (PAT)	0.35 (0.48)	0.23 (.42)	0.045	0.30 (0.46)

Among children aged 6–13 years, parental distress level (measured by PDS) was also positively associated with probability for the child's PTSS (OR = 1.89, 95% CI [1.04,3.43]). Parental concerns regarding sibling problems (measured by PAT) also positively predicted probability for the child's PTSS (OR = 1.52, 95% CI [1.12,2.06]).

4. Discussion

To the best of our knowledge, this is the first study that analyzes prospectively the risk factors for the development of PTSS among a representative sample of children hospitalized in a pediatric surgery ward. Characterizing these risk factors is important in order to understand the specific determinants of PTSS resulting from hospitalization, to enable early identification of children who are at high risk of developing psychological difficulties, and to apply timely interventions. Our findings show that higher parental stress, parental concerns regarding family social support, and parental concerns regarding sibling problems had a significant positive correlation with the children's emotional distress measured 3–5 months after hospitalization. In addition, among children aged 1–5 years, emergency (as opposed to elective) operation and a higher number of invasive procedures were also positively correlated with the children's PTSS.

Our findings help improve the understanding of this under-researched field, as they indicate that the above-mentioned parental variables explained 26%–51% of total variance of the emotional distress. These results are in line with previous findings in other areas. A study of 272 children hospitalized in intensive care found that 33% of parents reported symptoms meeting ASD criteria during hospitalization, showing that significant parental distress develops because of the hospitalization of their children [22]. The duration and extent of the parents' initial response during hospitalization in the intensive care unit and their subjective perception of the extent of the danger to the child's life were found to be predictors of development of PTSD in their children [22]. Similarly, a study of children with cancer found that distress experienced by one of the parents predicted the development of PTSS in the child at 6- to 8-month follow-up [35]. Another study found that the level of family support among children with cancer was inversely associated with the emergence of posttraumatic symptoms [36].

Table 3
Standardized coefficients of variables associated with emotional distress among children following hospitalization in pediatric surgery

Step	Variable	Age group 3–5 years		Age group 6–13 years	
		PCASS	CBCL 1–5	UCLA	CBCL 6–18
1	Repeated surgery (vs. first)	.01	.02	.01	.01
	Complicated operation (vs. non-complicated)	.042	-.019	.006	.054
	Duration of hospitalization	.090	.100	.101	.008
	Kind of operation (elective vs. emergency)	.070	.279**	.002	.128
	Preparation for operation	-.118	-.130	.022	-.092
2	The distress level of the parent (PDS)	.386**	.257*	.496**	.277**
	Invasive Procedures Score (IPS)	.216*	.155*	-.106	-.022
	Parental concerns regarding sibling problems (PAT)	.080	.416**	.205*	.503**
	Family Social Support (PAT)	.195**	.150*	.221*	.200*
	R^2 change in step 2 (% of total variance explained)	.26**	.32**	.45**	.51**

* $p < .05$,
** $p < .01$

The family social support sub-scale of the PAT questionnaire used in our study examines the degree of support that the parents feel they can receive. This support includes psychological help, financial support, daily help, access to reliable and accurate information, and help with child care. Since it was found to be significally associated with the development of PTSS in children, it is suggested that this support constitutes a significant resource for the parents and the child, enabling them to cope with the stress of hospitalization. In this context, the correlation found between parental concerns about sibling problems and the development of emotional distress in children suggests a common explanation: the more parents are concerned about other problems, such as external support or emotional difficulties of one sibling, they have fewer resources to cope with the stress of hospitalization, and are less available to help and become a reliable source of support for the child.

Pain during hospitalization is known to be associated with subsequent chronic stress. For example, it has been found that administering morphine to children aged 1–4 years after burn experience reduces the level of posttraumatic symptoms at 3- and 6-month follow-up [37]. Therefore, the level of pain experienced by the child during the hospitalization is one of the risk factors for PTSS that should be taken into account. Since it is very difficult to measure the subjective experience of pain, we used the number of invasive procedures as a proxy. Among children aged 1–5 there was a correlation between the number of invasive procedures and the child's level of distress, as found by studies on children in intensive care units [9]. Among children aged 1–5 years there was also a correlation between the type of surgery (elective vs. emergency) and the child's level of distress. This is possibly related to the fact that in emergency settings, the preoperative level of stress is higher, and also that it is much more difficult to implement a proper process of psychological preparation of the child and his or her family. Our finding that older children (6–13 years old) are less affected by these factors (despite the fact that the rate of emergency operations was significantly much higher in this age group) could be explained by their more developed cognitive capabilities, which allow them to attain a better understanding of what is happening, experience less uncertainty, and thus cope better. An alternative explanation is that the parents and the medical staff offer more explanations to older children. The misconception that "very young children do not understand and thus it is worthless to give them explanations" is unfortunately very common among adults. As a result, young children do not receive proper psychoeducation and are left in a state of uncertainty that promotes distress.

Table 4
Odds ratio and 95% confidence intervals of candidate risk factors for PTSS following hospitalization in pediatric surgery

Step	Variable	Age group 1–5 years	Age group 6–18 years
		PCASS	UCLA
1	Repeated surgery (vs. first)	1.34 [0.11,15.76]	0.92 [0.16,5.21]
	Complicated operation (vs. non-complicated)	0.088 [0.01,3.16]	0.720 [0.60,8.00]
	Hospitalization duration	1.24 [0.90,1.70]	1.171 [0.69,1.98]
	Elective operation	1.76 [0.09,33.12]	4.301 [0.70,257.1]
	Preparation for operation	1.05 [0.06,19.50]	0.348 [0.01,24.17]
2	The distress level of the parent (PDS)	1.42** [1.14,1.76]	1.892* [1.04,3.43]
	Invasive Procedures Score (IPS)	1.05 [0.67,1.65]	0.812 [0.63,1.04]
	Sibling Problems (PAT)	0.74 [0.53,1.03]	1.525** [1.12,2.06]
	Family Social Support (PAT)	21.24** [2.70,167.19]	0.413 [0.01,13.29]

* $p < .05$,
** $p < .01$

The difference between the preschool-age children and school-age children is in line with most studies that report that school-age children are generally more influenced by environment reactions [38]. This may explain the fact that this group had a parental variables effect, but no effect was found to be associated with hospitalization-related factors.

The most significant risk factors found in the current study were related to parental distress variables, which explain 26%–51% of the variance in the children's distress level. This is in line with previous findings in other medical settings [39–42], but this is the first study to document this effect in pediatric surgery.

The finding that parental factors (e.g. parental anxiety and perceptions of the child's condition) are so significant is encouraging because, unlike hospital-dependent factors, which are very difficult to change, parental factors are more likely to be affected by targeted psychological interventions.

PTSS in children have significant long-term consequences regarding non-compliance to medical follow-up and treatment [1]. This is especially crucial within the pediatric population coping with surgical conditions that require a long process in which the child has to comply with repeated procedures. Orthopedic interventions, for example, require long-term compliance with physiotherapy. Another example is the removal of large nevus, which often requires tissue-expander maintenance and a prolonged series of surgical procedures.

Drawing out the profile of risk factors for psychological distress among children is of primary importance, since this profile will allow the early identification of the children at risk and the implementation of preventive interventions with the children and their parents.

The current study had several limitations. The sample included two different age groups, reducing group size and requiring the use of different age-specific measures. It was important to us that the study sample will be representative of the population hospitalized in this pediatric surgery ward, and consequently we included a very wide age range (1 — 13). Another limitation is the fact that all the measurements were based on parental reports. Since many of the children in the study sample were too young to be interviewed, it was not possible to assess directly their own knowledge of their condition or their symptoms of distress. Parental assessment of their child's posttraumatic symptoms has been highly correlated with the children's self-reports [8]. Nevertheless, to increase validity, multiple instruments for measuring distress were used in each age group, which indeed reinforced results among the entire study population. In the literature on traumatic stress in the general population it is well known that previous psychopathology and previous exposure to traumatic events are risk factors for the development of PTSD [9, 10, 19–22]. The fact that in the present study, these factors were not found by the multivariate linear regression to be risk factors for PTSD is due to the young age of the children in our sample (mean age was 4.9)The chances of children at such a young age to be have been exposed to previous traumatic events or to suffer from previous psychopathology are almost null.

5. Conclusions

Currently, due to lack of awareness, interventions that could reduce the prevalence of PTSS are not implemented. In order to improve this situation, especially in pediatric surgery wards in public hospitals, a selected group of high-risk children should be identified for a focused use of limited public psychological resources. The present study identified the main risk factors for PTSS, and we are conducting at present a study to validate a screening instrument based on them. The introduction of such a screening tool to the routine intake procedure of pediatric surgery wards could increase awareness of the risk of PTSS and enhance the implementation of preventive actions (e.g. better psychoeducation for both the parents and the child before the surgical intervention). These may improve not only the psychological well-being of the children, but also the results of the surgical intervention and the long-term compliance of the children with the surgical follow-up.

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References

[1] Kazak AE, Kassam-Adams N, Schneider S, et al. An integrative model of pediatric medical traumatic stress. J Pediatr Psychol 2005;31(4):343–55. https://doi.org/10.1093/jpepsy/jsj054.
[2] Ari AB, Peri T, Margalit D, et al. Surgical procedures and pediatric medical traumatic stress (PMTS) syndrome: Assessment and future directions. J Pediatr Surg 2018;53(8):1526–31 https://doi.org/10.1016/j.jpedsurg.2017.10.043.
[3] Yule W, Smith P. Post-traumatic stress disorder. In: Thapar A, Pine DS, Leckman JF, Scott S, Snowling MJ, Taylor E, editors. Rutter's child and adolescent psychiatry. 6th ed. London: John Wiley & Sons; 2015. p. 806–21.
[4] Forgey M, Bursch B. Assessment and management of pediatric iatrogenic medical trauma. Curr Psychiatry Rep 2013;15(2):340 https://doi.org/10.1007/s11920-012-0340-5.
[5] Judge D, Nadel S, Vergnaud S, et al. Psychiatric adjustment following meningococcal disease treated on a PICU. Intensive Care Med 2002;28(5):648–50. https://doi.org/10.1007/s00134-002-1237-2.
[6] Rennick JE, Johnston CC, Dougherty G, et al. Children's psychological responses after critical illness and exposure to invasive technology. J Dev Behav Pediatr 2002;23(3):133–44.
[7] Landolt MA, Vollrath M, Ribi K, et al. Incidence and associations of parental and child posttraumatic stress symptoms in pediatric patients. J Child Psychol Psychiatry 2003;44(8):1199–207 https://doi.org/10.1111/1469-7610.00201.
[8] Phipps S, Long A, Hudson M, et al. Symptoms of post- traumatic stress in children with cancer and their parents: effects of informant and time from diagnosis. Pediatr Blood Cancer 2005;45(7):952–9 https://doi.org/10.1002/pbc.20373.
[9] Rennick JE, Rashotte J. Psychological outcomes in children following pediatric intensive care unit hospitalization: a systematic review of the research. J Child Health Care 2009;13(2):128–49. https://doi.org/10.1177/1367493509102472.
[10] Colville GA, Tighe H, Pierce C. Children's factual and delusional memories of paediatric intensive care. Crit Care Med 2006;34(12):20–3.
[11] Ari AB, Margalit D, Udassin R, et al. Traumatic stress among schoolaged pediatric surgery patients and their parents. Eur J Pediatr Surg 2018. https://doi.org/10.1055/s-0038-1660449.

[12] Banh MK, Saxe G, Mangione T, et al. Physician-reported practice of managing childhood posttraumatic stress in pediatric primary care. Gen Hosp Psychiatry 2008;30(6):536–45. https://doi.org/10.1016/j.genhosppsych.2008.07.008.
[13] Makley AT, Falcone Jr RA. Posttraumatic stress disorder in the pediatric trauma patient. Semin Pediatr Surg 2010;19(4):292–9 https://doi.org/10.1053/j.sempedsurg.2010.06.006.
[14] Thapar A, Pine DS, Leckman JF, Scott S, Snowling MJ, Taylor E, editors. Rutter's child and adolescent psychiatry. 6th ed. London: John Wiley & Sons; 2015.
[15] Tezenas de Montcel S, Clot F, Vidailhet M, et al. Epsilon sarcoglycan mutations and phenotype in French patients with myoclonic syndromes. J Med Genet 2006;43(5):394–400. https://doi.org/10.1136/jmg.2005.036780.
[16] Kramer DN, Landolt MA. Characteristics and efficacy of early psychological interventions in children and adolescents after single trauma: A meta-analysis. Eur J Psychotraumatol 2011;2(1):7858. https://doi.org/10.3402/ejpt.v2i0.7858.
[17] Ziegler MF, Greenwald MH, DeGuzman MA, et al. Posttraumatic stress responses in children: Awareness and practice among a sample of pediatric emergency care providers. Pediatrics 2005;115(5):1261–7. https://doi.org/10.1542/peds.2004-1217.
[18] De Civita M, Dobkin PL. Pediatric adherence as a multidimensional and dynamic construct, involving a triadic partnership. J Pediatr Psychol 2004;29(3):157–69. https://doi.org/10.1093/jpepsy/jsh018.
[19] American Psychiatric Association. Diagnostic and statistical manual of mental disorders (DSM-5®). American Psychiatric Pub; 2013.
[20] Brosbe MS, Hoefling K, Faust J. Predicting posttraumatic stress following pediatric injury: a systematic review. J Pediatr Psychol 2011;36(6):718–29 https://doi.org/10.1093/jpepsy/jsq115.
[21] Daviss WB, Mooney D, Racusin R, et al. Predicting posttraumatic stress after hospitalization for pediatric injury. J Am Acad Child Adolesc Psychiatry 2000;39(5):576–83 https://doi.org/10.1097/00004583-200005000-00011.
[22] Balluffi A, Kassam-Adams N, Kazak A, et al. Traumatic stress in parents of children admitted to the pediatric intensive care unit. Pediatr Crit Care Med 2004;5(6):547–53. https://doi.org/10.1097/01.PCC.0000137354.19807.44.
[23] Achenbach T, Edelbrock G. Manual for Child Behavior Checklist and Revised Child Behavior Profile. Burlington, VT: University of Vermont; 1983.
[24] Achenbach TM, Ruffle TM. The Child Behavior Checklist and related forms for assessing behavioral/emotional problems and competencies. Pediatr Rev 2000;21:265–71. https://doi.org/10.1542/pir.21-8-265.
[25] Zilber N, Auerbach J, Lerner Y. Israeli norms for the Achenbach Child Behavior Checklist: comparison of clinically-referred and non-referred children. Isr J Psychiatr Rel 1994;31(1):5–12.
[26] Scheeringa MS, Zeanah CH. PTSD Semi-Structured Interview and Observational Record for Infants and Young Children. New Orleans: Department of Psychiatry and Neurology, Tulane University Health Sciences Center; 2005.
[27] Cohen E. Play and adaptation in traumatized young children and their caregivers in Israel. In: Barbanel L, Sternberg RJ, editors. Psychological interventions in times of crisis. New York: Springer; 2006. p. 151–80.
[28] Laor N, Wolmer L, Mayes LC, et al. Israeli preschoolers under Scud missile attacks: a developmental perspective on riskmodifying factors. Arch Gen Psychiatry 1996;53(5):416–23. https://doi.org/10.1001/archpsyc.1996.01830050052008.
[29] Leigh E, Yule W, Smith P. Measurement Issues: Measurement of posttraumatic stress disorder in children and young people—lessons from research and practice. Child Adolesc Ment Health 2016;21(2):124–35. https://doi.org/10.1111/camh.12124.
[30] Brislin RW. Research instruments. In: Lonner WJ, Berry JW, editors. Field methods in cross-cultural research. Beverly Hills, CA: SAGE Publications; 1986. p. 137–64.
[31] Pai AL, Patiño-Fernándes AM, McSherry M, et al. The Psychological Assessment Tool (PAT 2.0): psychometric properties of a screener for psychological distress in families of children newly diagnosed with cancer. J Pediatr Psychol 2008;33(1):50–62 https://doi.org/10.1093/jpepsy/jsm053.
[32] Foa EB. The Posttraumatic Diagnostic Scale (PDS) Manual. National Computer Systems: Minneapolis, MN; 1996.
[33] Tuchner M, Meiner Z, Parush S, et al. Health-related quality of life two years after injury due to terrorism. Isr J Psychiatry Relat Sci 2010;47(4):269–75.
[35] Best M, Streisand R, Catania L, et al. Parental distress during pediatric leukemia and posttraumatic stress symptoms (PTSS) after treatment ends. J Pediatr Psychol 2001;26(5):299–307 https://doi.org/10.1093/jpepsy/26.5.299.
[36] Young GS, Mintzer LL, Seacord D, et al. Symptoms of posttraumatic stress disorder in parents of transplant recipients: incidence, severity, and related factors. Pediatrics 2003;111(6):e725–31. https://doi.org/10.1542/peds.111.6.e725.
[37] Stoddard Jr FJ, Sorrentino EA, Ceranoglu TA, et al. Preliminary evidence for the effects of morphine on posttraumatic stress disorder symptoms in one- to four-year-olds with burns. J Burn Care Res 2009;30(5):836–43 https://doi.org/10.1097/BCR.0b013e3181b48102.
[38] Masnari O, Schiestl C, Rössler J, et al. (2013). Stigmatization predicts psychological adjustment and quality of life in children and adolescents with a facial difference. J Pediatr Psychol 2013;38(2):162–72 https://doi.org/10.1093/jpepsy/jss106.
[39] Tabrizi JS, Seyedhejazi M, Fakhari A, et al. Preoperative education and decreasing preoperative anxiety among children aged 8–10 years old and their mothers. Anesth Pain Med 2015;5(4):1–5. https://doi.org/10.5812/aapm.25036.
[40] Cagiran E, Sergin D, Deniz MN, Tanatti B, Emiroglu N, Alper I. Effects of sociodemographic factors and maternal anxiety on preoperative anxiety in children. J Int Med Res2014;42(2): 572–80. DOI: https://doi.org/10.1177/0300060513503758.
[41] Davidson AJ, Shrivastava PP, Jamsen K, et al. (2006). Risk factors for anxiety at induction of anesthesia in children: A prospective cohort study. Paediatr Anaesth 2006;16(9):919–27 https://doi.org/10.1111/j.1460-9592.2006.01904.x.
[42] Caldwell-Andrews AA, Kain ZN, Mayes LC, et al. Motivation and maternal presence during induction of anesthesia. Anesthesiology 2005;103:478–83.