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Research

Children's Perioperative Multidimensional Anxiety Scale (CPMAS): Turkish Validity and Reliability Study

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A B S T R A C T

Purpose: To test the validity and reliability of the Turkish version of the Children's Perioperative Multidimensional Anxiety Scale (CPMAS).
Design: Methodological research model.
Methods: One hundred children (81% male) aged 7 to 13 years undergoing elective surgery at a tertiary university hospital were included. Self-administered CPMAS and State-Trait Anxiety Inventory-Children were used to collect data at preoperative, operation day, and a month after the operation. Internal consistency, test-retest reliability, parallel form reliability, and content and construct validity of the tools were determined across all three visits.
Findings: The CPMAS demonstrated good test-retest reliability (ICC = 0.51 to 0.78) and good internal consistency (Cronbach's alpha = 0.78 to 0.81). Inter item correlation values were ranged from 0.20 to 0.62 at preoperative, 0.32 to 0.64 on the day of operation and 0.36 to 0.75 at a month after the operation. CPMAS single-factor construct and the explanatory percentages were 0.54 and above. After Pearson correlation analysis, CPMAS was moderately correlated with State-Trait Anxiety Inventory-Children at T1 ($r = 0.54$, $P < .01$) and T2 ($r = 0.56$, $P < .01$).
Conclusions: The Turkish version of CPMAS has good reliability and validity score. Therefore, it is a suitable instrument to assess perioperative anxiety in 7 to 13 years old children in a clinical setting.

Preoperative anxiety, characterized by increased stress, tension, and fear of the unknown, affects approximately 50% to 75% of children.[1-3] Children experience anxiety in the preoperative period due to the deterioration of physical integrity caused by the surgical operation, pain and discomfort, separation from the family, trust and loved ones, fear of the unknown, loss of control/autonomy, and parental anxiety.[1,4,5]

In children with high preoperative anxiety, prolonged anesthesia induction, a more extended stay postanesthesia, increased postoperative pain and need for more analgesic, eating and sleeping problems, withdrawal, enuresis, aggression against authority, and delirium could be seen.[4-10] Preoperative anxiety induces the development of a neurohumoral stress response that increases cortisol and adrenaline release and activation of natural killers.[5,11] Also, the negative nitrogen balance leads to prolonged wound healing and increased susceptibility to infections due to immunosuppression.[11]

To intervene in preoperative anxiety, which adversely affects children in many ways, first, emotions such as stress and anxiety experienced by children should be assessed.[6-10] To determine the children's perioperative anxiety related to the surgical operation, nurses should use brief, objective, reliable and valid tools that accurately measure preoperative anxiety.[12] The Modified Yale Preoperative Anxiety Scale (m-YPAS), the State-Trait Anxiety Inventory-Children (STAI-C), and the Visual Analog Scale (VAS)-anxiety were used in studies to assess children's preoperative anxiety elsewhere.[13-19]

The VAS-anxiety and STAI-C are not specific to perioperative settings. The mYPAS is an observer-rated scale and is not based on the child's self-report, so it is susceptible to bias.[11,20,21] Furthermore, the

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mYPAS, which is generally used by anesthesiologists during anesthesia induction, is not suitable for use by nurses to assess the perioperative anxiety of children.[20]

In 2016, Chow et al developed a perioperative anxiety assessment tool called Children's Perioperative Multidimensional Anxiety Scale (CPMAS) for children 7 to 13 years. This self-reported instrument has a five-item visual analog scale that quantifies perioperative anxiety numerically. The CPMAS demonstrated good internal consistency (Cronbach's alpha 0.80) and stability (ICC 0.71). However, the instrument has not been validated in Turkish. Therefore, the present study aimed to provide a scientific contribution to the nursing literature and conduct the Turkish validity and reliability study of the CPMAS developed by Chow et al.[22]

Methods

Participants

The recommendation is to exceed 10 to 20 times the number of items in scales for the sample size of validation studies. Because the CPMAS consisted of five items, we included 100 children aged 7 to 13 years old who had undergone elective surgery in a tertiary hospital from August 2018 to June 2019.[23,24] Inclusion criteria for the participating children were (1) age of 7 to 13-years-old, (2) scheduled for outpatient surgery, (3) ability to read and understand the questions in the survey, (4) voluntary participation, and (5) their parents gave written consent. The children with mental or neurological disabilities were excluded from the study.

Measures

Measures used to collect data were CPMAS, STAI-C, and a sociodemographic questionnaire.

Questionnaire for Socio-demographic Characteristics: The sociodemographic characteristics of children (eg., gender, age, education level, diagnosis and type of surgery) and parents (eg, age, job, education level) were assessed by a self-administered questionnaire and from patient cards.

Children's Perioperative Multidimensional Anxiety Scale (CPMAS): This scale was developed by Chow et al in 2016 to assess perioperative anxiety in 7 to 13 aged children undergoing elective surgery (Cronbach's alpha $\geq$ 0.75 for three assessments). The CPMAS is a five-item visual analog scale that quantifies perioperative anxiety numerically. Each question directly asks about how the child feels under or during various perioperative settings. CPMAS is applied to the same 7 to 13 aged children at three different times: at preoperative assessment (T1), immediately preoperatively on the day of surgery (T2), and 1 month postoperatively (T3). The children were required to answer how they felt related to the surgical operation and mark it on the ruler-shaped scale. For example, children were asked, *Right now, how worried are you? Please answer by drawing a line on the number that is closest to how you are feeling about the surgery, from a scale of 0 to 100 with 0 meaning not at all worried, 100 meaning very worried or any numbers in between.*[22]

This self-reported scale consists of five items, and each item has a value between 0 and 100. At T1 and T2, all five items of the CPMAS are included in the evaluation, and the scale is scored between 0 and 500. Item 4 *(Right now, I feel scared that this might hurt)* was only applicable during preoperative periods, and so this item was eliminated at T3, and the CPMAS is scored between 0 and 400. Summing the responses to the CPMAS items produces a score. The higher the CPMAS score values, the higher the children's anxiety level.[22] Item 1: *Right now, how worried are you?* Item 2: *Right now, how scared are you?* Item 3: *Right now, how nervous are you?* Item 4: *Right now, I feel scared that this might hurt.* Item 5*: Right now, I feel worried that something bad might happen.*

State-Trait Anxiety Inventory-Children (STAI-C): The Turkish validity and reliability study of the STAI-C developed by Spielberger in 1973 was conducted by Özusta in 1995 (Cronbach's alpha = 0.81). This scale assesses children's emotions such as tension, nervousness, comfort, and anxiety at the time of answering the questionnaire. If the child reports feeling these emotions strongly, the highest score of 3 is given and if they report a lack of these emotions, the lowest score of 1 is given. A total of 20 to 60 scores is obtained from the scale. As the total scale score increases, state anxiety is considered high.[25] In this study, STAI-C was used as a parallel test form of CPMAS.

The Translation Procedure for the CPMAS

A forward-backward translation procedure was applied to establish the content validity of the CPMAS.[26] First, the English version of the CPMAS was independently translated into Turkish by three bilingual native Turkish-speaking expert nurses to produce a consensus version. One expert combined translations of forms through a reconciliation process and decided that the final version of CPMAS was linguistic and conceptual to compare with the original English version. Second, three experts back-translated the consensus version into English (blinded to the original version). Finally, the authors compared the back-translated and original versions to establish the content validity of the instrument. Once consensus was reached, the preliminary version was produced. Then, a Turkish lecturer was consulted for this scale's final version and proceeded with the content validity phase.

Content Validity of the CPMAS

Ten experts in pediatric nursing, psychiatric, and mental health nursing, child and adolescent psychiatry, child development, psychological counseling, and guidance fields for content validity analyses of the Turkish version of the CPMAS. The experts were asked to evaluate the scale items with a quadruple rating (1: not relevant, 2: somewhat relevant, 3: quite relevant, 4: highly relevant).

The Polit and Beck content validity index determination method was used for the item basis scope validity index (I-CVI) and the scale-basis scope validity index (S-CVI) of the CPMAS. S-CVI values were expected to be 0.80 and above when six or more experts evaluated the scale.[27]

Procedure and Data Collection

After obtaining informed consent, children completed CPMAS and STAI-C forms in the outpatient clinic at T1, holding areas of surgical operation at T2, and in the outpatient clinic at T3. T1 and T3 measurements were done in a quiet room, whereas T2 was conducted in the waiting areas of the operating room. Throughout the measurements, the children were with their parents.

Ethical Approval

Before the commencement of the study, permission was obtained from a developer of the original instrument.[22] Similarly, Ethics Committee (2018-103) and institutional permission (12.03.18/E 34163) were obtained to conduct the research. Furthermore, written permission was obtained from all the children and from their parents or legal guardian after detailed information about the study.

Statistical Analysis

Data were tested for reliability (test-retest reliability and internal consistency) and validity (content and construct validity) in a

package program IBM SPSS Version 22.0. Test-retest reliability was assessed using intraclass correlations coefficients (ICC), while internal consistency was assessed by Cronbach's alpha. CVR and CVI values were analyzed to determine the content validity, whereas Bartlett's Test of Sphericity (BTS) and Keiser-Mayer-Olkin (KMO) tests were implemented to determine the adequacy of content and sample size. Principal components analysis was used in the exploratory factor analysis. STAI-C and CPMAS total scores were evaluated with the Pearson correlation coefficient. Inter-item correlation analysis was used between CPMAS items. Statistical significance was determined by using different coefficients with a 95% confidence interval where it was declared if the *P*-value is <.05.

Results

Demographic Data

In the current study, a total of 100 children were assessed with CPMAS and STAI-C at T1. Of them, 81.0% were male, 30.0% had an experience of hospitalization, 94.0% had no chronic disease, and 47.0% applied for circumcision at T1. The mean ages of the children and their mothers and fathers were 8.29 ± 1.56, 35.27 ± 5.85, and 38.46 ± 5.14 years, respectively (Table 1). This study consisted of 100 children 7 to 13 aged at T1. Because 27 children did not come to the hospital for surgical operation, 73 children participated in T2. Only, 43 children participated in T3 because 30 children did not come to the hospital for postoperative assessment.

Content Validity of CPMAS

For content validity, CPMAS was presented to 10 experts. I-CVI and S-CVI values of the items were analyzed according to the evaluation of expert opinions. I-CVI = 0.80 to 1.0 for the items of CPMAS and S-CVI = 0.96 for CPMAS.

Construct Validity of CPMAS

Principal components analysis was used to determine the scale's construct validity in this study. The KMO values were 0.768, 0.833, and 0.726 at the T1, T2, and T3, respectively, and were considered satisfactory, suggesting that the sample size was sufficiently large for assessing the factor structure. In BTS, $\chi 2$ values were 145.2, 120.42, and 61.88 at T1, T2, and T3, respectively; all were found statistically significant ($P < .001$). CPMAS was deteremined to have a single-factor structure with eigenvalues greater than one after principal component analysis. The explanatory percentages of the total variance for T1, T2, and T3 were 54%, 58%, and 63%, respectively (Table 2).

Reliability of CPMAS

CPMAS showed strong internal consistency at all three time points, with a reliability of 0.78 and above. Cronbach's alpha coefficients measured at three time points were 0.78 at T1, 0.81 at T2, and 0.81 at T3 (Table 3). The test–retest reliability for the five-item CPMAS demonstrated moderate stability (ICC = 0.78) between T1 and T2 assessments, and ICC value was 0.51 for three assessments of CPMAS. After Pearson Correlation analysis, it was found that CPMAS moderately correlated with STAI-C at T1 (r = 0.54, $P < .01$) and T2 (r = 0.56, $P < .01$) (Table 4).

The items of the CPMAS were moderately correlated. Inter item correlation values for the items of CPMAS were ranged 0.20 to 0.62 at T1, 0.32 to 0.64 at T2, and 0.36 to 0.75 at T3 (Table 5).

Discussion

The current study is the first study to validate the Turkish version of the CPMAS. The findings showed that the Turkish version of CPMAS had high internal consistency, inter-rater reliability, test-retest reliability, content, and construct validity. For this study, testing the language validity of the CPMAS was the primary objective.[24,28,29] The Turkish version of the CPMAS was finalized by

Table 1
Descriptive Characteristics of Children

Descriptive Characteristics	Preoperative Visit (T1) (N = 100)		Day of Surgery (T2) (n = 73)		1 Month After (T3) (n = 43)	
	n	%	n	%	n	%
Gender						
Female	19	19.0	16	21.9	12	27.9
Male	81	81.0	57	78.1	31	72.1
Experience of hospitalization						
Yes	30	30.0	19	26.0	13	30.2
No	70	70.0	54	74.0	30	69.8
Have a chronic disease						
Yes	6	6.0	3	4.1	-	-
No	94	94.0	70	95.9	43	100.0
Type of surgery						
Circumcision	47	47.0	26	35.6	11	25.6
Hernia	15	15.0	13	17.8	10	23.3
Otolaryngologic	7	7.0	7	9.7	7	16.3
Others*	31	31.0	27	36.9	15	34.8
	Mean ± SD	Med (Min- Max)	Mean ± SD	Med (Min-Max)	Mean ± SD	Med (Min-Max)
CPMAS	202.83 ± 141.11	200.0 (0-500)	207.80 ± 141.29	200.0 (0-470)	21.20 ± 27.15	10.0 (0-110)
STAI-C	35.66 ± 5.84	35.0 (21-57)	36.80 ± 5.82	36.5 (33-41)	33.72 ± 3.13	34.0 (31-36)
Children's age	8.29 ± 1.56	8 (7-13)	8.41 ± 1.64	8 (7-13)	8.39 ± 1.73	8 (7-13)
Morher's age	35.27 ± 5.85	35 (24-52)	34.82 ± 5.99	34 (24-52)	35.48 ± 5.67	34 (26-52)
Father's age	38.46 ± 5.14	38 (26-53)	38.31 ± 5.38	38 (26-53)	39.37 ± 5.27	38 (26-53)

CPMAS, Children's Perioperative Multidimensional Anxiety Scale; STAI-C, State-Trait Anxiety Inventory-Children; Mean ± SD, mean ± standard deviation; med (min-max), median (minimum-maximum); T1, at preoperative assessment; T2, on the day of the operation; T3, 1 month postoperatively.

* Others: orchiopexy, urethral meatotomy, hydrocelectomy, hypospadias surgery, labial fusion.

Table 2
Construct Validity Analyses of the CPMAS

Items	KMO	BTS		Variance Explained by Component	Factor Number	Factor Load
		$\chi 2$	*P*			
Preoperative visit (T1) N = 100						
Item 1	0.768	145.202	<.001*	54.223	1	0.714
Item 2						0.838
Item 3						0.695
Item 4						0.798
Item 5						0.616
Day of surgery (T2) n = 73						
Item 1	0.833	120.420	<.001*	58.501	1	0.826
Item 2						0.844
Item 3						0.765
Item 4						0.784
Item 5						0.575
1 month after (T3) n = 43						
Item 1	0.726	61.877	**<.001***	63.927	1	0.842
Item 2						0.904
Item 3						0.698
Item 5						0.738

CPMAS, Children's Perioperative Multidimensional Anxiety Scale; KMO, Kaiser-Mayer-Olkin; BTS, Bartlett's Test of Sphericity; *, $p<0.001$.

Table 3
Internal Consistency Analyses of the CPMAS

CPMAS Items	Mean ± SD	Corrected Item Total Correlation Values	Cronbach's Alpha Values When the Item was Deleted	Cronbach Alfa Value
Preoperative visit (T1) N = 100				
Item 1	48.93 ± 38.96	0.532	0.756	0.786
Item 2	38.10 ± 39.38	0.692	0.701	
Item 3	35.00 ± 36.50	0.519	0.760	
Item 4	41.50 ± 39.45	0.641	0.719	
Item 5	39.30 ± 37.87	0.437	0.785	
Day of surgery (T2) n = 73				
Item 1	59.72 ± 39.33	0.687	0.760	0.819
Item 2	42.32 ± 38.09	0.713	0.752	
Item 3	37.12 ± 35.01	0.613	0.784	
Item 4	43.42 ± 37.35	0.632	0.777	
Item 5	35.20 ± 35.47	0.419	0.836	
1 month after (T3) n = 43				
Item 1	7.48 ± 9.75	0.686	0.735	0.810
Item 2	6.04 ± 9.29	0.797	0.670	
Item 3	4.88 ± 7.67	0.508	0.813	
Item 5	2.79 ± 7.01	0.554	0.796	

CPMAS, Children's Perioperative Multidimensional Anxiety Scale.

translating CPMAS from English to Turkish and from Turkish to English.

After receiving the opinions of 10 experts for content and language validity, CVR and CVI values were calculated at 0.80 to 1.0 and 0.96, respectively. In cases where six or more expert opinions are received, CVR is expected to be 0.78 and above.[27] Therefore, CVR values for items of CPMAS indicated that CPMAS had the quality of measuring perioperative anxiety.

Table 4
Correlations of the CPMAS With STAI-C

Scales and Assesment Times	CPMAS at T1 (N = 100)	CPMAS at T2 (n = 73)	CPMAS at T3 (n = 43)
CPMAS			
CPMAS at T1	NA	0.65†	0.29
CPMAS at T2	NA	NA	0.33*
STAI-C			
STAI-C at T1	0.54†	NA	NA
STAI-C at T2	NA	0.56†	NA
STAI-C at T3	NA	NA	0.00

CPMAS, Children's Perioperative Multidimensional Anxiety Scale; STAI-C, State-Trait Anxiety Inventory-Children; NA, not applicable at this time point.
* $P < .05$.
† $P < .01$.

A construct validity test that shows how much the instrument's items can measure the desired objective was performed by factor analysis, one of the most frequently used methods for construct validity. First, sample adequacy and significance of correlation

Table 5
Inter-Item Correlations of the CPMAS

Assesment Times and CPMAS Items	Item 2	Item 3	Item 4	Item 5
Preoperative visit (T1) N = 100				
Item 1	0.497	0.512	0.409	0.200
Item 2		0.464	0.629	0.413
Item 3			0.350	0.250
Item 4				0.491
Day of surgery (T2) n = 73				
Item 1	0.646	0.554	0.535	0.352
Item 2		0.526	0.616	0.358
Item 3			0.476	0.343
Item 4				0.320
1 month after (T3) n = 43				
Item 1	0.750	0.391	NA	0.488
Item 2		0.544	NA	0.539
Item 3			NA	0.360

CPMAS, Children's Perioperative Multidimensional Anxiety Scale; NA, not applicable at this time point.

coefficients between variables were tested.[24,28] The KMO and BTS values showed that the sample was sufficient for factor analysis in the current study (Table 2). The total explained variance above 50% indicates that the scale has strong construct validity.[23,24,30-32] According to, the results CPMAS is a valid tool that could be used to assess the perioperative anxiety of Turkish children aged 7 to 13.

Reliability tests should be performed in validation studies for different cultures and languages. Reliability indicates whether there is consistency between the responses of individual items using the intraclass correlation coefficient and Cronbach's alpha coefficient.[24,32,33] In this study, Cronbach's alpha coefficient (0.78 to 0.81), intraclass correlation coefficient, inter-item correlation analysis, and parallel forms method were used for the reliability tests of CPMAS (Table 3). Accordingly, these results indicate that CPMAS had strong internal consistency and high reliability. Also, Chow et al reported Cronbach's alpha coefficient of 0.75 and 0.89.[22,34,35] Thus, the Turkish version is in line with the original study.

Since CPMAS evaluates the perioperative process, it was applied to the same individuals at three different times. The test-retest reliability of CPMAS demonstrated moderate stability (ICC = 0.78) between T1 and T2. However, the ICC value of CPMAS was 0.51 for three time points. In addition, while there was no statistically significant difference between CPMAS mean scores at T1-T2, significant differences of mean CPMAS scores were found between T1-T3 ($\chi 2 = 1337$, $P < .001$) and T2-T3 ($\chi 2 = 1244$, $P < .001$). Similarly, Chow et al[22] reported that there was a statistical significance between CPMAS mean scores at T1-T3 and postoperative visits due to changing mean scores over time. Because children return to their daily activities at T3 (in the first postoperative month), their anxiety related to the surgical operation could reduce significantly. Thus, the decrease in CPMAS mean score at T3 may be the reason for the decrease of the ICC value for three time points.

The parallel forms reliability method was used for reliability analysis of the CPMAS in the current study. A moderate correlation between mean scores of CPMAS and STAI-C was found at T1 and T2 (T1: r = 0.54, $P < .01$; T2: r = 0.56, $P < .01$). Also, there was a relationship between the scores of CPMAS at T1, T2, and T3 (Table 4). Accordingly, these results indicate that CPMAS has strong internal consistency and is a reliable tool that may be used to assess the perioperative anxiety of Turkish children aged 7 to 13.

When reliability analysis is performed, the extent of the relationship between the items is evaluated by Inter-item correlation analysis.[24,32] In this study, a moderately positive correlation was found between the CPMAS items (Table 5). Chow et al reported that the ICC of the CPMAS was moderately positive in the original study.[22] Accordingly, these results demonstrate that CPMAS is a reliable tool to assess the perioperative anxiety of Turkish children aged 7 to 13.

Practice Implications

The current study is the first to adapt the CPMAS to another culture. Children experience anxiety and are negatively affected physiologically, psychologically, and behaviorally in the perioperative period. Thus, there is a pressing need to assess perioperative anxiety in a clinical setting. CPMAS is a brief, age-appropriate, self-reported, easily applicable, valid, and reliable tool. So, CPMAS is a valid and reliable tool to assess children's perioperative anxiety by nurses in hospitals. Thus, nurses could assist children in coping with high perioperative anxiety.

Limitations

The application of CPMAS to 7 to 13 aged children undergoing elective surgery is the limitation of this study. The fact that the majority of the sample was male could be a confounding variable. Also, CPMAS mean score was low at T3 performed 1 month after the surgery because children returned to their daily routines. Other external factors such as the dynamics and interactions of each child with their peers, family, and teachers may also have affected our findings at T3. Moreover, Chow et al[22] reported that CPMAS could be used at T1 and T2 to assess the preoperative period and at T3 to assess the postoperative period.

Conclusions

The findings demonstrated that CPMAS is a valid and reliable tool for evaluating perioperative anxiety in Turkish children aged 7 to 13 undergoing elective surgery. CPMAS is a brief, practical, age-appropriate, self-reported, easily applicable, valid, and reliable tool in Turkish. Therefore, nurses could use CPMAS to assess perioperative anxiety among children of 7 to 13 years old who undergo elective surgery in routine clinical settings. Accordingly, CPMAS was introduced into the nursing literature with this study. In addition, a validity and reliability study of CPMAS to assess children's preoperative anxiety in adolescents and other surgical operations other than elective surgery should be conducted.

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