Title	Assessing children's emotional responses to surgery: A multidimensional approach
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Title: Assessing Emotional Responses of Children to Surgery: A Multidimensional Approach

What is already known about this topic

- Invasive medical procedures, especially surgeries, can be devastating for children.
- To determine the effectiveness of preoperative psychological interventions, it is best to assess the emotional responses of children during the time they experience the most distress.
- There is a lack of appropriate assessment tools with effective psychometric properties in the existing literature.

What this paper adds

- Increase the knowledge and understanding of children's emotional responses to surgery.
- Understanding the advantages and limitations of different approaches in assessing children's emotional responses to surgery.
- Understanding the interrelationship of three different approaches on assessing children's emotional responses to surgery
- Provides support for the use of the Children's Emotional Manifestation Scale in assessing the emotional responses of children during times of high distress and evaluating the effectiveness of preoperative psychological intervention.

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INTRODUCTION

It has been well documented that invasive medical procedures, such as surgery, can be emotionally devastating for children (Ziegler & Prior 1994, Lizasoain & Polaino 1995, Becher & Sing 1997, Li & Lam 2003). The emotions of children facing surgery often manifest themselves in alterations of behaviour (Ziegler & Prior 1994, Becher & Sing 1997). The literature frequently refers to “emotional distress” as exhibited by such behaviours as crying, restlessness, strong verbal protests, withdrawal, and disruptive reactions during both pre- and postoperative medical procedures (Wolfer & Visintainer 1975, Lizasoain & Polaino 1995, Pretzlik & Sylva 1999, Li & Lam 2003).

Lazarus and Folkman (1984) stated that emotional responses to surgery or medical procedures may be influenced by personality factors and individual differences in one’s appraisal of threat, which may be expressed in many forms. Some children may look scared or grimace facially, not interact verbally, become agitated, or may start crying or screaming. Others may have increased motor activity, such as becoming restless, attempting to disrupt the procedure or trying to escape from medical personnel. Although children’s emotional responses to stress vary in intensity, Thompson and Stanford (1981) emphasized that all emotional responses of children fall into the categories of active, passive, and regressive behaviours. Some children confront surgery with such overt or active responses as crying,

screaming, whining, clinging to parents, resisting treatment, fighting, being self-destructive, and being destructive of the environment. Other children respond passively – withdrawing from human interaction, decreasing communication, decreasing activity, and sleeping excessively. Thompson and Stanford (1981) pointed out that children often exhibit a combination of active and passive emotional responses while in the hospital. However, regressive responses -- sleeping pattern alternations, toileting problems, increased dependence on parents, and compulsive behaviour -- are more commonly reported once they returned home.

Previous studies found that those children who were more anxious in the preoperative period exhibited significantly more agitated behaviour during administration of anaesthesia and the early post-operative period (Ziegler & Prior 1994, Li & Lam 2003). Therefore, it is crucial for nurses to develop preoperative interventions that can minimize anxiety and enhance the ability of children to cope with surgery. First, however, in order to evaluate the effectiveness of preoperative interventions, the availability of a valid and reliable instrument that accurately documents the manifestation of the children's emotions towards stressful medical procedures is crucial. Regrettably, the existing literature lacks an assessment tool with effective and objective psychometric properties. Moreover, in a recent study that describes the challenges of using incentives for children in research, Rice and Broome (2004) highlighted that the lack of understanding about the emotional behaviour of children and the limited experience in using child-sensitive measurement tools hinders the evaluation of

preoperative intervention directed toward enhancing the ability of children to cope with surgery. Therefore, consideration must be given to the methods and instruments used by researchers for assessing the emotional responses of children to surgery or medical procedures.

The principal methods for measuring and documenting the emotional responses of children to surgery or stressful medical procedures have been physiological measurements, self-reporting measurements, and behaviour ratings by observers. Physiological measurements include heart rate, mean blood pressure, respiratory rate, time to first voiding following surgery, ease of postoperative fluid intake, need for postoperative medications, urinary cortisol levels, and length of hospitalisation, which have all been used previously to assess the immediate reactions of children to stressful medical procedures (Thompson 1985). Among these physiological measurements, heart rate and mean arterial blood pressure were widely used as indirect methods for assessing anxiety in children (Augusin & Hains 1996, Panda *et al*. 1996, Li & Lopez 2004).

The second approach is the use of self-reporting questionnaires or scales to measure anxiety level, which is the most commonly reported emotional responses to stressful medical procedures. A review of the literature reveals that instruments frequently used to measure children's anxiety during hospitalisation include the Children's Manifest Anxiety Scale (Castaneda *et al*. 1956), the General Anxiety Scale for Children (Sarason *et al*. 1960), and the State-Trait Anxiety Inventory for Children (Spielberger *et al*. 1973). In contrast to the

General Anxiety Scale for Children and the Children's Manifest Anxiety Scale, the State-Trait Anxiety Inventory for Children (STAIC) consists of separate self-reporting scales for measuring state and trait anxiety. The STAIC is similar in concept and structure to the State-Trait Anxiety Inventory (STAI), the most popular psychological measure of anxiety in adolescents and adults. The STAIC has excellent psychometric properties with high reliability and validity (Spielberger *et al*. 1973).

The third approach is the direct behavioural observations of the emotions of children during stressful medical procedures. The Manifest Upset Scale and the Cooperation Scale are the most frequently used behavioural observation scales to document the behavioural responses of children prior to surgery or during stressful medical procedures. These two behavioural observation scales, originally used by Wolfer and Visintainer (1975), have been used simultaneously and independently to record such emotional behaviour during stressful medical procedures in subsequent research studies (Fegley 1988, Schmidt 1990, Lynch 1994, Kristensson-Hallstrom & Elander 1997, Zahr 1998, Li & Lam 2003). Nevertheless, these two observation scales do have some drawbacks, including inconsistent findings compared to previous studies. In a study that examined the effect of therapeutic play on hospitalised children, Zahr (1998) reported low inter-rater reliability (70%) on some of the behaviours of these two scales. Children in the experimental group were found to be less anxious but not more co-operative than the children in the control group. Another study by Kistensson-Hallstrom and Elander (1997) also found that the ratings from the Manifest

Upset and Co-operation Scales showed non-significant differences between children in the control group and those in the experimental group. On the other hand, these scales contain only one item, and thus show a limited sensitivity to the range of behaviours through which children might display their emotions. Additionally, these two scales do not have an operational definition and observers do not have clear-cut criteria for assessment. As a result, the reliability and validity of these two scales could be negatively affected.

Another direct behavioural observation scale, the Children's Emotional Manifestation Scale (CEMS), was recently developed by Li and Lopez (2005). In contrast to the Manifest Upset and Cooperation Scales, this newly developed scale consists of a much more detailed list of behavioural items, assembled by a systematic search of the literature on the emotional behaviour of children facing stressful medical procedures. Moreover, the CEMS is explained in detail with an operational definition, so that an observer using this scale will have relatively clear-cut criteria for assessment. Additionally, the CEMS is composed of five behaviour categories and each category consists of five different observable behaviours. This level of detail increases the scale's sensitivity for the differentiation of the intensity of the emotional behaviour of children that becomes manifest during stressful medical procedures.

Three different approaches (physiological, self-reporting, and behavioural observation) have been frequently used to measure or document the emotional responses of children to stressful procedures in previous studies. Nevertheless, few studies have used these three approaches simultaneously to measure the different components of emotional distress. A

majority of previous studies employed only one or two measurements of the emotional responses of children despite it being a multidimensional phenomenon, including behavioural, subjective, and physiological components (Thompson 1985). On the other hand, the inter-relationships between these three components have seldom been explored or reported, despite the fact that examination of these inter-relationships is crucial to gain a more comprehensive understanding of the effects of stressful medical procedures on children. Additionally, it is unclear whether the CEMS can be used as a valid clinical research tool in assessing the emotional responses of children during anaesthesia induction. This research was therefore designed to assess the validity of the Children's Emotional Manifestation Scale for documenting the emotional responses of children to stressful medical procedures compared to the physiological measurements of anxiety and self-reporting of anxiety by the Chinese version of the State Anxiety Scale for Children.

METHODS

Design

A cross-sectional study was employed. Chinese children from Hong Kong, admitted for elective surgery in a day surgery unit during the summer of 2003, were invited to participate in the study after its purpose, nature, and design were explained to their parents. The selection of summer during which to conduct the study has one advantage. It is common practice for the day surgery unit in Hong Kong to recruit a large number of children from the waiting list for elective day surgery during this time. A large patient sample size can be thus

easily secured within a short period of time.

Participants

The study included only children between the ages of 7 and 12 years. According to Piaget's (1963) Theory of Stages Development, children in this age range are in the Concrete Operational. This age group was frequently selected in previous children's research studies (Li & Lam 2003, Li & Lopez 2004). Additionally, subjects of the study were able to speak Cantonese. The researcher excluded children who had chronic illness that required special medical care and those with identified cognitive and learning problems.

The sample size was determined by the number of participants required to maintain the statistical power for the statistical tests involved, including correlation analysis. By conservatively predicting a medium effect size about all of the relationship between the tested instrument and the other study variables at a 5% significance level ($p < .05$) and a power of 0.80, 85 participants should be normally required (Cohen 1992). Therefore, the researcher attempted to recruit a sample size of 85 for this study. The response rate for this study was 92%. Parents of six children refused participation but did not provide any special reasons for doing so. A sample of 82, which met the inclusive and exclusive criteria of the study, was obtained, approximately reaching the target sample size.

Instruments

The Chinese version of the State Anxiety Scale for Children (CSAS-C)

The original version of the State Anxiety Scale for Children was developed in 1969

(Spielberger *et al*. 1973) and was then translated into Chinese by Li and Lopez (2004). Extensive reliability and validity tests were performed on CSAS-C. The test-retest reliability coefficients for the CSAS-C were 0.79 and 0.78 for the age group 7-8 and 9-12, respectively, and the internal consistencies of the scale ranged from 0.81 to 0.94 across different age groups. Concurrent validity was supported by correlation of scale scores with children's heart rate and mean arterial blood pressure at pre- and post-operative periods. Construct validity of the scale was confirmed by administering the scale to primary school students of different grades under different conditions. Mean scores for the scale were statistically higher in the pre-examination condition than in the post-examination condition. Factor analyses further confirmed the construct validity of the CSAS-C, with a good fit between the factor structure of the scale and the observed data. Results suggest that the CSAS-C can be used as a self-report assessment took in measuring the anxiety level of Chinese children ages 7-12 years.

The CSAS-C asks children to indicate the degree to which they are experiencing a particular feeling at the current moment. Each item begins with the stem "I feel," and children respond by placing an "X" next to one of three possible responses that best describes how they feel. The scale consists of 20 items, which are scored from 1 to 3, with total possible scores ranging from 20 to 60. Higher scores indicate greater anxiety.

The Children's Emotional Manifestation Scale (CEMS)

The CEMS was developed by Li and Lopez (2005) based on the theories, concepts, and

findings collectively known as developmental considerations (Edelbrock 1984; Garber 1984, Kendall *et al*. 1984, Kazdin 1989). Based on systematic literature search, a number of observable emotional behaviours with different levels or intensities were identified. A panel of nurse experts was set up to review this finding and develop the scale. The psychometric properties of the CEMS have been empirically tested. It showed adequate inter-rater reliability, internal consistency, high content validity, and excellent convergent validity.

The CEMS was developed by classifying observable emotional behaviours into five categories, including *Facial Expression*, *Vocalization*, *Activity*, *Interaction*, and *Level of Co-operation*. Each category consists of five different observable behaviours, rated by level and intensity. The CEMS score is obtained by reviewing the descriptions of behaviour in each category and selecting the number (1 to 5) that most closely represents the observed behaviour. For example, for the category of Level of Co-operation, *active participation* = 1, *passive participation* = 2, *withdrawal* = 3, *extreme resistance* = 4, and *disruptive behaviour* = 5. The numbers obtained for each category are added together to obtain the total score, which will be between 5 and 25. Higher scores indicate the manifestation of more negative emotional behaviour.

Data Collection Procedures

Study approval was obtained from the Survey and Behavioural Research Ethics Committee of the Chinese University of Hong Kong and from the study hospital's ethics committee. The unit heads of the day surgery unit and the operating theatre were fully

informed about the study's purpose, nature, design, and duration. Written consent was obtained from the parents after they were told the purpose of the study. Each child was also invited to put his/her name on a special children's consent form. Polit and Beck (2004) highlighted that it is advisable to obtained a written consent form from the child, as evidence of respect for the child's right to self-determination. The children and their parents were also informed that they had the right to withdraw from the study at any time and were assured of the confidentiality of the study.

On admission to the day surgery unit, the children were invited to participate in the study. After a physical assessment by nurses working in the day surgery unit, the demographic data of the children were obtained (Table 1). Children were then asked to respond to the CSAS-C. The children's mean arterial blood pressures and heart rates were recorded within the operating theatre after being transferred to the operating table but before anaesthesia induction. A research nurse inside the theatre used the CEMS to document the children's emotional behaviours during anaesthesia induction. In order to control observer bias, a theatre nurse recorded mean arterial blood pressures and heart rates of the children, while the research nurse, blinded to the children's state anxiety scores and physical conditions, used the CEMS to document their emotional behaviours. The children's heart rates and mean arterial blood pressures were measured with a standard automatic blood pressure monitoring machine available inside the operating theatre.

INSERT TABLE 1 HERE

Data Analysis

The relationships between scores on the CEMS and CSAS-C, CEMS scores and mean arterial blood pressures, CEMS and heart rates, CSAS-C scores and mean arterial blood pressures, and CSAS-C scores and heart rates were investigated using the Pearson product-moment correlation coefficient. All analyses were completed using the Statistical Package for Social Sciences (SPSS) software, version 11.5.

RESULTS

As the study involved the use of parametric tests, the Pearson's product-moment coefficient of correlation, the assumptions of normal distribution, linearity, and the absence of outliers were assessed. The results of this study revealed that there were no violations of these statistical assumptions.

Inter-relationships between the three components of psychological upset were established by analysing correlations between CEMS and CSAS-C scores, between CEMS scores and the mean arterial blood pressures and heart rates, as well as between CSAS-C scores and the mean arterial blood pressures and heart rates. According Cohen (1988), the correlation coefficients of 0.10 to 0.29, 0.30 to 0.49, and 0.50 to 1.0 are typically interpreted as small, medium, and large coefficients, respectively. There was a strong positive correlation between the CEMS and CSAS-C scores. Other strong positive correlations were found between the heart rates and the CEMS and CSAS-C scores. There were medium positive correlations between the mean arterial blood pressures and the CEMS and CSAS-C

scores. The inter-relationships between the three components of psychological upset are summarized in Table 2.

INSERT TABLE 2 HERE

DISCUSSION

The aim of this study was to assess the validity of the Children's Emotional Manifestation Scale (CEMS) for documenting the emotional responses of children to stressful procedures compared to physiological measurements of anxiety and self-reporting of anxiety using the Chinese version of the State Anxiety Scale for Children (CSAS-C). Results showed that children with high pre-operative anxiety levels were found to have increased negative emotional behaviours during anaesthesia induction. Results also revealed that children having more negative emotional behaviours or higher anxiety levels also had faster heart rates and higher mean arterial blood pressures.

Previous studies have showed that increased emotional arousal and anxiety stimulate sympathetic, parasympathetic, and endocrine systems, leading to increased heart rate and blood pressure (Ramsay, 1972). These physiological parameters are considered to be objective and concrete indicators for the indirect assessment of anxiety levels (Augusin & Hains 1996, Panda *et al*. 1996, Carpenito 2002). However, when compared with the heart rates of children in which strong positive correlations were found with the CEMS and CSAS-C scores, there were only medium positive correlations between mean arterial blood pressures and the CEMS and CSAS-C scores. These findings revealed that increased

emotional arousal or anxiety was found to have only mild effects on children's blood pressures. Therefore, it was suggested that mean blood pressures might not be as good a physiological parameter as heart rates for indirectly assessing the psychological distress of children.

On the other hand, using heart rates or mean arterial blood pressures as indirect methods of assessing anxiety may be misleading in children suffering from systemic diseases, such as hypertension, cardiac rhythm disturbances, or some endocrine disorders. Moreover, results may be confounded by intrinsic factors, such as pain level, premedications, and amount of analgesic administered.

The State Anxiety Scale for Children is one of the most frequently used psychological measurements of children's anxiety, having excellent psychometric properties with high reliability and validity (Spielberger *et al*. 1973). One limitation, however, is that this instrument contains 20 items. Because children generally require 5 to 8 minutes to complete this questionnaire, it may not be feasible to use in busy operating room settings. Additionally, the scale was originally designed and developed as a research tool for the study of anxiety in elementary school children from grades 4 to 6 (Spielberger *et al*. 1973); thus, younger children who are particularly vulnerable to the stress of undergoing medical procedures cannot benefit from its use. Like all self-reporting scales, the State Anxiety Scale for Children cannot measure crying, restlessness, agitation, strong verbal protest, withdrawal, disruptive reaction to medical procedures, or co-operation towards medical procedures, the

emotional behaviours commonly manifested by children when facing stressful situations.

The timing for documentation of the manifestation of a child's emotions is essential. Beck (1994) argued that the time of assessment in an intervention study could influence the power of a study. To gain a thorough understanding of the responses of children to a stressful procedure and to determine the effectiveness of preoperative psychological intervention, it is best to assess and document emotional responses at the time they experience the most distress. Previous studies revealed that the procedure for anaesthesia induction was most distressing and threatening to children (Wolfer & Visintainer 1975, LaMontagne 1993). However, using questionnaires, self-reporting instruments, or interviews at such a moment may not be feasible or appropriate, in addition to disrupting the procedure and distracting the child and health-care workers. These information-gathering techniques can exacerbate anxiety and other negative emotions as well, inappropriately affecting the child's behaviour. Furthermore, some children may inaccurately report their emotions due to defensiveness or social pressures, causing them to respond the way they believe adults would want them to respond (Glennon & Weisz 1978). Also, self-reporting of anxiety is based on the subject's ability to respond verbally to an instrument. Owing to the limited verbal and reading abilities of young children, such findings may not be valid or reliable (LeBaron & Zeltzer 1984).

One of the advantages of using direct behavioural observation is that it is not affected by the limited test-taking ability of children or their eagerness to please adults (Fawcett 1996). Moreover, when children face stressful medical procedures, their emotional

behaviours are easily exhibited and observable. Additionally, behavioural observations may be particularly useful with children, as children often disguise their feelings less effectively than adults (Pretzlik & Sylvia 1999). Merrell (2003) contends that the most direct and desirable way to assess a child's behaviour, in most cases, is through natural observation. Using an alternative assessment technique, such as observation, to collect data prior to and during stressful medical procedures, is therefore more appropriate and practical.

The results of this study revealed that there was a strong positive correlation between the CEMS and CSAS-C scores. These results were congruent with previous studies showing that high preoperative state anxiety levels of children were associated with more negative behavioural responses during stressful medical procedures (Wolfer & Visintainer 1975, Lynch 1994, Zahr 1998, Li & Lam 2003). The results of this study also found that high CEMS scores were associated with faster heart rates and higher mean arterial blood pressures. CEMS was thus shown to be a valid instrument that accurately documents the manifestation of the emotional responses of children prior to and during stressful medical procedures.

Limitations

This study's convenient sampling and the fact that all data were collected in one setting limit the ability to generalize the results. Additionally, most surgeries performed in day surgery are minor or minimally invasive. Some literature (Downe-Wamboldt & Melanson 1998, LaMontagne *et al*. 2000) has highlighted that the severity of the surgical procedure

may influence how children appraise the event and cope with it. Therefore, future studies should include differing severities of invasive surgical procedures. Moreover, 73 percent of the patient sample was male, possibly introducing selection and sampling biases. However, previous research (Wolfer & Visintainer 1975) found that gender differences are not significantly related to upset behaviour; thus, the non-equivalence with regard to gender may have had little impact on the findings of this study.

Conclusions

This study has addressed a gap in the literature by employing three different approaches (physiological, self-reporting, and behavioural observation) to assess the emotional responses of children to surgery. This study also provides support for the use of the CEMS in assessing the emotional responses of children at the time they experienced the most distress. Therefore, the CEMS can be used as a clinical research tool to evaluate the effectiveness of preoperative psychological intervention.

Although behaviour observation scales appear to have some advantages over other types of anxiety measurements, Spielberger *et al*. (1983) claimed that anxiety is an emotional reaction characterized by subjective, perceived feelings of apprehension, tension, and worry. Therefore, self-reporting by children could provide useful data to supplement behavioural observations (LeBaron & Zeltzer 1984, Pretzlik & Sylva 1999). Furthermore, there is evidence that children with high preoperative state anxiety levels have more negative emotional behaviours that manifest during stressful medical procedures. This finding has

important implications for nursing practice. Understanding the preoperative state anxiety levels of children in advance could allow clinical nurses to plan and implement psychological intervention to enhance the coping mechanisms of the children, reduce their negative emotional responses, and encourage greater cooperation during stressful medical procedures.

Conversely, a child's response to stress can be varied and may include physical manifestations. Physically, stress can result in increased blood pressures and heart rates. Therefore, in order to more fully understand the experiences of children during surgery, it is recommended that the assessment strategies used in this type of research should reflect the multidimensional phenomenon of emotional distress.

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Table 1 Demographic distribution of participants (n = 82)

Demographic information	*n* (%)
Sex	
Male	60 (73.2)
Female	22(26.8)
Age (Years)	
7	14(17.1)
8	13(15.9)
9	14(17.1)
10	13(15.9)
11	12(14.6)
12	16(19.5)
Type of Surgery Performed	
Circumcision	46(56.1)
Minor ENT Operation	16(19.5)
Herniorrhaphy	10(12.2)
Minor Ortho. Operation	10(12.2)

Table 2. Interrelationship among the three components of psychological upset

	CEMS Scores	CSAS-C Scores	Heart Rates	MAP
CEMS Scores	1.00			
CSAS-C Scores	.76*	1.00		
Heart Rates	.61*	.58*	1.00	
MAP	.43*	.43*	.40*	1.00

* Correlation is significant at the 0.01 level

CEMS : Children's Emotional Manifestation Scale

CSAS-C : Chinese Version of the State Anxiety Scale for Children

MAP : Mean Arterial Pressure