Prevalence and factors associated with anxiety during echocardiography procedure

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ABSTRACT

Purpose: Echocardiography is the main modality for definitive diagnosis and evaluation of children with congenital heart disease. Anxiety is the most common feeling experienced by children when they visit healthcare facilities. The first aim of this study was to give an overview of the prevalence of anxiety symptoms, and the second aim was to investigate the factors associated with anxiety during the echocardiography procedure.

Patients and methods: The cross-sectional study was conducted in the pediatrics cardiology outpatient clinic at Prof. Dr. I.G.N.G. Ngoerah General Hospital, Denpasar-Bali period February 2022 to August 2022. Children aged 18 months-6 years who underwent echocardiography evaluation were included. The visual analog scale of anxiety (VAS-A) was used to measure the severity of anxiety. The analysis is using chi-square test and logistic regression. The significance of risk factors is reported as a prevalence ratio with 95% confidence intervals and p<0.05.

Results: In a total of 156 subjects, the prevalence of anxiety during the procedure was 64.1% with a similar gender proportion. Multivariate analysis found that age <3 years old and did not attend school were associated with anxiety (PR 60.53; 95% CI 13.07-280; p<0.001 and PR 5.59; 95% CI 1.31-23.77; p<0.001).

Conclusion: Anxiety during the echocardiography procedure is common. Age <3 years old and did not attend school were associated with anxiety during echocardiography.

Keywords: anxiety, echocardiography, congenital heart disease.


INTRODUCTION

Congenital heart disease (CHD) is a newborn’s most common congenital disability worldwide. Echocardiography is the main modality for definitive diagnosis and evaluation of children with congenital heart disease. Patient cooperation is needed to obtain complete and accurate echocardiography results, but difficulties often occur in young children to comply during the procedure. Anxiety is the most common feeling experienced by children when they seek treatment at healthcare facilities. Another study regarding the anxiety of children aged 3-5 who went to the health center found that 86.7% experienced anxiety, while 67.6% of children aged 2-7 years who underwent preoperative procedures experienced anxiety.¹⁻⁵

There are many kinds of anxiety assessment tools for children, including: Spence Children’s Anxiety Scale (SCAS-Child), Pediatric anxiety rating scale (PARS), Modified Yale Preoperative Anxiety Scale (m-YPAS), and Visual Analogue Scale-anxiety (VAS-A). VAS-A was introduced in 1976 and used for the first time in patients planning to undergo dental procedures in 1988. VAS is used to assess anxiety and is simple, quick, and non-verbal. The validity and reliability tests have been studied by Berhams et al., which were carried out on pediatric patients aged 1.5 years-16 years who were about to undergo surgery. The instrument is a straight line with a length of 10 cm marked with two ends. There are 2 points, the left is not anxious, and the right is the most anxious. The ROC curve analysis (AUC=0.82, p<0.0001) shows that >3 cm is the cut-off point for distinguishing between anxious and not anxious, with a sensitivity level of 61.3% and a specificity of 95.4%.

There is no data regarding the prevalence and risk factors for anxiety in children undergoing echocardiography in Prof. Dr. I.G.N.G Ngoerah General Hospital, Denpasar. Thus, this research is conducted to investigate the prevalence and risk factors associated with anxiety in children during echocardiography.

MATERIAL AND METHODS

This cross-sectional study used primary data from the Pediatric Cardiology Polyclinic, Prof. Dr. I.G.N.G Ngoerah General Hospital, Denpasar-Bali, from February 2022 to August 2022. The inclusion criteria for this study were children aged 18 months - 6 years who underwent echocardiography evaluation. Subsequently, the ages were grouped into toddler age (1-3 years) and preschool age.
(4-6 years). If the child were 3 years 11 months, it would be rounded down and grouped as a toddler. Subjects who met the inclusion criteria would be included as research samples by consecutive sampling. Children with Down syndrome, attention-deficit/hyperactivity disorder, autism spectrum disorder, hearing impairment, and visual impairment were excluded.

The sample size was calculated using the formula of two unpaired proportions. The required number of samples was calculated from each variable with an effect size of 10%, and the desired absolute level of precision was 0.05. The sample size was obtained from the highest number of subjects by gender, namely 156 samples.

The VAS-A instrument is a straight line with a length of 10 cm marked with two ends. There are 2 points: the left was not anxious, and the right was the most anxious point with a value of >3 cm, which was the intersection point to distinguish between anxious and not anxious.7

Anxiety assessment in this study started from the beginning of the procedure until the end of the echocardiography, and the highest anxiety value was taken. Anxiety assessment was carried out by several people (Pediatric residents) who were trained, and the echocardiography operator was carried out by one person (Cardiology residents).

Data analysis was performed using a computer program. Descriptive data were expressed in the form of tables. Bivariate analysis was carried out using the chi-square test on dependent and independent variables and continued with multivariate analysis using logistic regression. Anxiety levels were expressed in prevalence ratios (PR) with 95% confidence intervals and a significant level of p <0.05. This research was conducted using questionnaires.

This research has been approved by the Research and Development Unit (of the Faculty of Medicine, Universitas Udayana/Prof. Dr. I.G.N.G Ngoerah Hospital with letter No: LB.02.01/XIV.2.2.1/7782/2022.

RESULTS

This research was conducted between February 2022 and August 2022 with a total sample of 156 subjects who met the inclusion criteria. The prevalence of children with anxiety was 100 (64.1%), consisting of 49 males (59.8%) and 51 females (68.9%). Characteristic data is listed in Table 1.

For categorical variables, the chi-square test results showed that gender, age, number of echocardiography, hospitalization history, and education of the subject were significant factors in the incidence of child anxiety during echocardiography. Multivariate analysis was performed using logistic regression, independent variables with p <0.25 will be included in the multivariate model as candidate variables. The results of the multivariate analysis showed that the variables that had a significant effect on anxiety were children aged £3 years and not yet attending school (p=0.001 and p=0.02). Bivariate and multivariate analysis data are shown in Table 2.

DISCUSSION

Pediatric patients visit primary health care 31 times on average from birth to 21 years of age. In 2012, approximately 5.9 million US children were hospitalized, increasing the average number of medical interactions. Population data reports that up to 20% experience “white coat syndrome” when they come into contact with a doctor. Limited cognitive development causes children to use behavior to convey their emotions.8

Several international and local studies reported that the prevalence of children experiencing preoperative anxiety was approximately 50% - 80%, and the 2010 National Health Survey stated that as many as 60% of children experienced anxiety during hospitalization. In Indonesia, as many as 30.82% of preschool-age children experience anxiety while undergoing treatment at the hospital. Research at the Sundari Hospital Medan in children aged 1-3 years revealed that 55% experienced anxiety during hospitalization.8-12

The food consumed by toddlers will affect their nutritional status. Differences...
in the nutritional status of toddlers have different effects on each child's development; if the nutrition is not fulfilled adequately, it will hinder their development, including cognitive, motor, language, and personal-social. The effect of adequate and inadequate nutrition during the first thousand days of life on children's development can be assessed at 3–4 years old. This study found that 54.5% of subjects were well nourished.²

Several studies stated that the most common gender that experiences anxiety is female. Theoretically, female is easier to experience anxiety than males since females are more sensitive and receive stressors more intensively than explorative males.⁶ In this study, there was no significant association between gender. Research conducted by Madyastuti et al., 2018 found no association between the gender of the child and the level of anxiety, p=0.948.

Normal anxiety occurs from the age of 8-9 months and peaks around the age of 10-18 months in the form of anxiety towards strangers, separation from parents, and certain threats, such as the sound of thunder, medical procedure, and so on. For most children, anxiety will disappear by 2-3 years.¹⁴ Children's reactions to anxiety vary depending on age level. School-age children and adolescents can express their anxiety verbally more than pre-school-aged children and toddlers. Toddlers tend to show more aggressive anxiety responses than preschoolers since their thought processes are still egocentric, making it difficult to understand the purpose of each action taken. In contrast, preschoolers show more passive behavior when compared to toddlers.

In this study, there was a relationship between age and anxiety. Multivariate analysis showed significant results in children aged ≤3 years on children's anxiety. In several previous studies, the age groups used for comparison were toddlers and preschool. In general, it was found that anxiety rates were higher in toddlers than in preschoolers. This is similar to the research conducted by Novayelinda et al. using the Spance Children Anxiety Scale measuring tool, which obtained significant results regarding toddler-age children's anxiety in anger, tension, and restlessness. Behavioral problems shown by children, such as being irritable, tense and anxious, are the most common responses experienced by toddlers. At toddler age, children have difficulty expressing their feelings. This is due to limitations in physical development and a limited vocabulary, so toddlers try to show their feelings through changes in behavior and feelings compared to preschool-age children.

The preschool period is a golden age in which stimulation of all aspects of development plays an important role in further developmental tasks, where 80% of children's cognitive development has been achieved at preschool age. Activities in Early Childhood Education and Kindergarten begin at preschool age, which provides stimulation according to the stage of child development. All activities are carried out through a play-and-learn approach. Children who previously received school education often can communicate better. This is because children are used to playing, studying, and eating with friends of the same age. The results of this study found that children who are already at school have a lower level of anxiety.¹⁵ Research conducted by Liang Y et al., 2021 regarding preoperative anxiety found that preoperative anxiety decreased significantly in children who attended school compared to those who

### Table 2. Bivariate and multivariate analysis of children with anxiety during echocardiography procedure

<table>
<thead>
<tr>
<th>Variables</th>
<th>Anxiety</th>
<th>Bivariate analysis</th>
<th>Multivariate analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td>p-value    PR (95% CI)</td>
</tr>
<tr>
<td>Gender, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>51 (68.9)</td>
<td>23 (31.1)</td>
<td>0.23</td>
</tr>
<tr>
<td>Male</td>
<td>49 (59.8)</td>
<td>33 (40.2)</td>
<td>(0.77-2.89)</td>
</tr>
<tr>
<td>Age, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 3 year</td>
<td>98 (83.8)</td>
<td>19 (16.2)</td>
<td>0.001</td>
</tr>
<tr>
<td>&gt; 3 year</td>
<td>2 (5.1)</td>
<td>37 (94.9)</td>
<td>(21.17-429)</td>
</tr>
<tr>
<td>CHD, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cyanosis</td>
<td>17 (68)</td>
<td>8 (32)</td>
<td>0.65</td>
</tr>
<tr>
<td>Acyanosis</td>
<td>83 (63.4)</td>
<td>48 (36.6)</td>
<td>(0.49-3.06)</td>
</tr>
<tr>
<td>Echocardiography, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeated echocardiography</td>
<td>79 (61.7)</td>
<td>7 (25)</td>
<td>0.18</td>
</tr>
<tr>
<td>First echocardiography</td>
<td>21 (75)</td>
<td>49 (38.3)</td>
<td>(0.73-4.7)</td>
</tr>
<tr>
<td>Hospitalization history, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have been</td>
<td>75 (61.5)</td>
<td>9 (26.5)</td>
<td>0.19</td>
</tr>
<tr>
<td>Never</td>
<td>25 (73.5)</td>
<td>47 (38.5)</td>
<td>(0.74-4.05)</td>
</tr>
<tr>
<td>Education status, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did not attend school</td>
<td>96 (75)</td>
<td>32 (25)</td>
<td>0.001</td>
</tr>
<tr>
<td>Attend school</td>
<td>4 (14.3)</td>
<td>24 (85.7)</td>
<td>(5.8-55.81)</td>
</tr>
<tr>
<td>Nutrition status, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malnutrition</td>
<td>50 (71.4)</td>
<td>20 (28.6)</td>
<td>0.085</td>
</tr>
<tr>
<td>Well-nourished</td>
<td>50 (58.1)</td>
<td>36 (41.9)</td>
<td>(0.91-3.52)</td>
</tr>
<tr>
<td>Parenting, n (%)</td>
<td>100 (64.1)</td>
<td>56 (35.9)</td>
<td></td>
</tr>
</tbody>
</table>

Published by Intisari Sains Medis | Intisari Sains Medis 2023; 14(1): 529-532 | doi: 10.15562/ism.v14i1.1674

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did not (p=0.010). In this study, most anxiety was found in children who did not attend school (75%).

Children who undergo treatment in hospitals face challenges, such as dealing with separation, adjusting to unfamiliar environments, adjusting to many foreign people who take care of them, having to relate and socialize with other sick children, and undergoing painful treatments. The experience of hospitalization in children will affect the anxiety experienced by them. As explained in previous research, children who have experienced being hospitalized have lower anxiety than children who have not experienced hospitalization. Other research explains that anxiety is more common in children with a history of hospitalization. This may be related to the medical procedures that have been done before, which may cause trauma and create unpleasant experiences, causing children to feel anxious. In this study, a history of hospitalization did not affect the child’s anxiety level. This study has a limitation: the anxiety assessments were carried out by several people who did not do assessment suitability. Parental anxiety was not specifically evaluated in this study.

CONCLUSION
This study demonstrates that the prevalence of children with anxiety is 64.1%, and children aged 2-7 years old and not yet attending school are at risk factors for children’s anxiety during echocardiography procedures. For future research, the operator’s suitability for assessing anxiety is recommended.

CONFLICT OF INTEREST
The author reports no conflicts of interest in this work.

AUTHOR CONTRIBUTION
KM contributed in design, definition of intellectual research, literature search, clinical study, data acquisition, data analysis, statistical analysis, manuscript preparation and editing. EG, NPKY, IGATW, IGANSA, and NLSPM contributed in design, definition of intellectual content, literature search, data analysis, manuscript preparation and editing.

FUNDINGS
There is no funding provided for this study.

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