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Psychosocial Functioning and Quality of Life of Recipients in Pediatric Heart Transplant

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ABSTRACT: Background: Psychosocial functioning and quality of life (QoL) are strongly associated with outcomes in pediatric heart transplant recipients. The data in pediatric transplantation, however, is limited. This study aims to investigate the associations of perioperative anxiety and depression with postoperative complications, sociodemographic and clinical characteristics. **Methods:** This observational, analytical, longitudinal study included 42 pediatric participants aged 8 to 16 years old. Preoperative psychological assessments were completed by 36 children, the remaining 6 were unable to participate due to invasive ventilation, extracorporeal membrane oxygenation (ECMO), and physical debilitation. Postoperatively, all 42 subjects completed the psychosocial evaluations. Data on recipients characteristics, family characteristics and clinical parameters were collected. Anxiety and depression were assessed using the Screen for Child Anxiety Related Emotional Disorders (SCARED) and the Depression Self-Rating Scale for Children (DSRSC). The Short Form-36 Health Survey (SF-36) was applied to assess the health-related QoL. **Results:** Before transplantation, 91.7% (33/36) of the children exhibited symptoms of anxiety, and an identical proportion (91.7%, 33/36) showed signs of depression. After transplantation, the rates of anxiety and depression decreased to 35.7% (15/42) and 11.9% (5/42), respectively. Longer disease course ($p = 0.042$), preoperative hypoalbuminemia ($p = 0.032$), older age ($p = 0.024$), postoperative hypertension ($p = 0.011$), and postoperative CRRT ($p = 0.015$) result in depression symptoms. Preoperative hypoalbuminemia ($p = 0.032$) was also more common in the anxiety group. Additionally, children with psychosocial risks had significantly lower QoL scores in general health ($p = 0.008$) and mental health ($p = 0.015$). **Conclusions:** Perioperative anxiety and depression are highly prevalent among pediatric heart transplant recipients. Although significant improvements in psychosocial risks were observed at posttransplantation, approximately 40% children continued to experience psychosocial challenges.

KEYWORDS: anxiety; depression; quality of life; heart transplantation; children

1 Introduction

Heart transplantation in pediatric patients generally is considered as a treatment option of last resort, has now become the standard of care for end-stage heart disease in children all over the world [1]. Recent survival data indicate that the median overall survival for pediatric heart transplant recipients ranges from 16.7 to 21.9 years [2]. With improved long-term survival over the past several decades, there has been increasing emphasis on psychosocial functioning and quality of life (QoL).

Children undergoing heart transplantation often present with severely compromised preoperative clinical conditions. The treatment course typically involves prolonged bed rest, repeated hospitalization, and complex medication regimens preoperatively, followed by rigorous postoperative requirements including strict adherence to immunosuppressive therapy and lifelong monitoring through regular clinical evaluations. This protracted medical journey places significant psychological burden on both the children and their families. Studies indicate that approximately 30% of pediatric heart transplant recipients experience mental health issues [3,4]. Cousino et al. assessed fifty-six cases, and found that 40% of pediatric heart transplant recipients experienced varying degrees of psychosocial risk, and one-third exhibited clinically significant psychological problems [5]. Therefore, assessing emotional and behavioral functioning both before and after surgery is crucial, as psychosocial factors can significantly affect medication adherence and transplant outcomes [6,7].

Early studies were often limited by small sample sizes and primarily focused on the relationship between family functioning and psychosocial functioning in pediatric heart transplant recipients. To our knowledge, no study to date has comprehensively examined the combination of social, clinical and family factors contributing to transplant-related anxiety and depression in pediatric heart transplant populations. Furthermore, there remains a scarity of research exploring psychological changes before and after transplant. In our study, we aims to assess anxiety and depression in pediatric heart transplant recipients before and after heart transplant, investigate the associations between psychosocial functioning, demographic, surgery-related variables and follow-up related variables, and evaluate health-related QoL.

2 Methods

2.1 Participants and Procedures

This observational, retrospective study was conducted at the Pediatric Center of Fuwai Hospital in Beijing, China. A consecutive, non-probabilistic sampling method was used to enroll patients of both sexes, aged 8–16 years, who underwent their first heart transplant between January 2023 and August 2024. The review of clinical records was approved by the Institutional Review Board of Fuwai Hospital (Approval No: 2022-1869) and was conducted in accordance with the 1964 Helsinki declaration and its later amend-ments or comparable ethical standards. The requirement for informed patient consent was waived by the Board due to the retrospective nature of the research.

A total of 42 pediatric recipients and 42 guardians (their parents: mother or father) were enrolled in the study. Among the pre-transplant cohort, 85.7% (36/42) of patients completed the psychosocial assessment. Reasons for non-completion included invasive ventilator (n = 3), ECMO support (n = 1) and weakness (n = 2). All 42 patients completed the post-transplant psychosocial assessment. All 42 guardians completed psychosocial evaluations both before and after transplantation. Patients were categorized into two groups based on the presence of anxiety: anxiety group and a no-anxiety group. Similarly, they were grouped according to the presence of depression: depression group and a no-depression group.

Recipients and their guardians completed psychosocial screening measures within 1 month before transplantation, and again during a follow-up clinic visit 3–6 months post-transplantation. Quality of life (QoL) was assessed in recipients at the 6-month follow-up. The Depression Self-Rating Scale for Children (DSRSC) and the Screen for Child Anxiety Related Emotional Disorders (SCARED) were utilized to evaluate symptoms of depression and anxiety in the pediatric population. The General Health Questionnaire-12 (GHQ-12) was administered to assess the psychosocial functioning in parents. The Short Form-36 Health Survey (SF-36) was used to evaluate health-related QoL. During the perioperative period, data were collected on social, demographic, and clinical characteristics, in addition to pre- and post-transplant anxiety and depression symptoms assessed through interviews.

2.2 Measurement

2.2.1 Depression Self-Rating Scale for Children (DSRSC)

DSRSC [8,9] is a self-report measure of an internal dimension of depression in children and adolescents between the ages of 8 and 16 years. This measure comprises 18 items that encompass a range of depressive symptoms, such as low mood, loss of interest, self-blame, sleep problems, changes in appetite, etc. The results are expressed as T-scores with a mean of 50 and a standard deviation of 10. A score exceeding 15 is indicative of a risk for depression.

2.2.2 Screen for Child Anxiety Related Emotional Disorders (SCARED)

SCARED [10,11] is a measure widely used for the self-assessment of anxiety disorders in children and adolescents aged 8–16 years, consisting of 38 items. SCARED is divided into 5 factors, namely somatization/panic, generalized anxiety, separation anxiety, social phobia, and school phobia. Higher scores on the scales indicate more anxiety. SCARED composite scores are reported as T-scores with a mean of 50 and standard deviation of 10, with scores above 23 indicating anxiety risk.

2.2.3 Short-Form-36 Health Survey (SF-36)

SF-36 [12,13] is used to measure health-related quality of life in children and adolescents. SF-50 assesses physical function, physical role, physical pain, general health status, vitality, social functioning, emotional role, and mental health from 36 items and 8 composites. Higher scores on the scales indicate better functioning on those domains.

2.2.4 General Health Questionnaire-12 (GHQ-12)

GHQ-12 [14] is a self-reporting questionnaire of mental health with 12-item general health questionnaire. It is uesd to measure anxiety/depression symptoms. The scores are summed to obtain a total score, with higher scores indicative of lower psychological well-being.

2.3 Data Analysis

Continuous variables are presented as the mean ± the standard deviation or if skewed as the median and range. Categorical variables are given as proportions and percentages. The chi-square test was used for comparison of categoric variables and the Mann–Whitney U-test was used for comparison of continuous variables. The correlation between variables was assessed by Sperman's correlation test. $p < 0.05$ was considered statistically significant. Data analysis was performed using SPSS version 22.

3 Results

3.1 Perioperative Psychosocial Functioning and Characterization in Pediatric Recepients

A total of 36 pediatric recipients aged 8–16 years old were enrolled before heart tranplant (Table 1). Among these children, 33 (91.7%) exhibited symptoms of depression, and 33 (91.7%) showed signs of anxiety issues. 30 patients (83.3%) experienced both anxiety and depression at the same time. In depression group, children present with longer course of disease (41.6 ± 55.9 vs. 17 ± 16.5, $p = 0.042$), and hypoalbuminemia preoperatively (63.6% vs. 0%, $p = 0.032$). Similarly, in anxiety group, children had hypoalbuminemia preoperatively (63.6% vs. 0%, $p = 0.032$) comparing with no-anxiety group.

Table 1: Preoperative characterization of the 36 patients submitted to pediatric heart transplantation.

Variable	Anxiety (n = 33)	No-Anxiety (n = 3)	p	Depression (n = 33)	No-Depression (n = 3)	p
General charateristics						
Male (n, %)	20 (60.6)	1 (33.3)	0.359	20 (60.6)	1 (33.3)	0.359
Age (years)	11.0 (8.0,12.5)	12.0 (8.0,13.0)	0.835	11.0 (8.0,13.0)	8.0 (8.0, 9.0)	0.066
Primary school (n, %)	17 (51.5)	1 (33.3)	0.546	16 (48.5)	1 (33.3)	0.615
Junior high school (n, %)	16 (48.5)	2 (66.7)	0.546	17 (51.5)	2 (66.7)	0.615
Parental seperation (n, %)	3 (9.1)	0	0.585	3 (9.1)	0	0.585
Rural household registration (n, %)	10 (30.3)	2 (66.7)	0.201	10 (30.3)	2 (66.7)	0.201
Clinical symptoms						
Nausea (n, %)	19 (57.6)	1 (33.3)	0.418	19 (57.6)	1 (33.3)	0.418
Vomiting (n, %)	10 (30.3)	0	0.512	10 (30.3)	0	0.512
Abdominal pain (n, %)	14 (42.4)	2 (66.7)	0.418	14 (42.4)	2 (66.7)	0.418
Chest distress (n, %)	19 (57.6)	2 (66.7)	0.760	19 (57.6)	2 (66.7)	0.760
Dyspnea (n, %)	11 (33.3)	0	0.230	11 (33.3)	0	0.230
Syncope (n, %)	11 (33.3)	0	0.230	11 (33.3)	0	0.230
Frailty (n, %)	14 (42.4)	1 (33.3)	0.760	14 (42.4)	1 (33.3)	0.760
Edema (n, %)	12 (36.4)	1 (33.3)	0.917	12 (36.4)	1 (33.3)	0.917
Clinical features						
Preoperative admission time (days)	13.2 ± 18.7	15 ± 13.2	0.257	13.8 ± 18.9	5.6 ± 3.1	0.794
Course of disease (months)	42.7 ± 55.5	29.7 ± 7.4	0.359	41.6 ± 55.9	17 ± 16.5	0.042
HTx waiting time (months)	5.9 ± 8.2	5.0 ± 8.2	0.375	5.9 ± 8.2	5.3 ± 7.9	0.719
Complications						
Hyperbilirubinemia (n, %)	16 (48.5)	2 (66.7)	0.546	17 (51.5)	1 (33.3)	0.152
Hyperuricemia (n, %)	15 (45.5)	3 (100)	0.070	16 (48.5)	2 (66.7)	0.546
Hypoalbuminemia (n, %)	21 (63.3)	0	0.032	21 (63.3)	0	0.032
Malignant arrhythmias (n, %)	10 (30.3)	0	0.262	10 (30.3)	0	0.262
Cerebral infarction (n, %)	2 (6.1)	0	0.661	2 (6.1)	0	0.661
Infection (n, %)	2 (6.1)	0	0.661	0	0	-
Interventions						
ECMO (n, %)	3 (9.1)	0	0.585	3 (9.1)	0	0.585
CRRT (n, %)	4 (12.1)	0	0.522	4 (12.1)	0	0.522
Ventilator use (n, %)	10 (3.3)	0	0.262	10 (3.3)	0	0.262
Surgery (n, %)	7 (21.2)	0	0.374	7 (21.2)	0	0.374
Pacemaker (n, %)	1 (3)	0	0.769	1 (3)	0	0.769

HTx: Heart transplantation, ECMO: Extracorporeal Membrane Oxygenation, CRRT: Continuous Renal Replacement Therapy.

A total of 42 pediatric recipients aged 8–16 years old were enrolled after heart transplant (Table 2). 15 (35.7%) and 5 (11.9%) of children still experienced anxiety and depression respectively. 3 patients (7.1%) experienced both anxiety and depression at the same time. In depression group, the patients were older (14.0 (14.0, 15.0) vs. 11.0 (8.0, 12.0), p = 0.000), experienced CRRT (60.0% vs. 8.1%, p = 0.015), had postoperative hypertension (80.0% vs. 24.3%, p = 0.011). 36 pediatric participants have actually completed both preoperative and postoperative evaluations and 13 (36.1%) of them had anxiety, 4 (11.1%) had depression.

The incidence of anxiety and depression among pediatric recipients and parents was notably high before transplant. However, the incidence of anxiety and depression decreased significantly after transplant. After transplantation, there was a reduction in mean scores on child questionnaires, and the proportion of children scoring above the threshold for depression declined by approximately 65% over time. Pediatric recipients had lower scores after transplant in somatization panic, generalized anxiety, dissociative anxiety, socialization terror, school phobia, and depression (p < 0.001) (Table 3).

Table 2: Postoperative characterization of the 42 patients submitted to pediatric heart transplantation.

Variable	Anxiety (n = 15)	No-Anxiety (n = 27)	p	Depression (n = 5)	No-Depression (n = 37)	p
General charateristics						
Male (n, %)	7 (46.7)	20 (74.1)	0.958	2 (40.0)	24 (64.9)	0.352
Age (years)	11.5 (8.8, 13.0)	11.0 (8.0, 12.0)	0.706	14.0 (14.0, 15.0)	11.0 (8.0, 12.0)	0.000
Primary school (n, %)	7 (46.7)	19 (61.3)	0.891	1 (20.0)	23 (62.2)	0.074
Junior high school (n, %)	8 (53.3)	12 (38.7)	0.052	4 (90.0)	14 (37.8)	0.074
Parental seperation (n, %)	1 (6.7)	3 (9.7)	0.723	0	3 (8.1)	0.677
Rural household registration (n, %)	3 (20.0)	12 (38.7)	0.496	1 (20.0)	24 (64.9)	0.331
Dropout for over 6 months (n, %)	4 (26.7)	13 (41.9)	0.746	2 (40.0)	14 (37.8)	0.926
Clinical symptoms						
Pain (n, %)	4 (26.7)	13 (41.9)	0.746	2 (40.0)	13 (35.1)	0.831
Insomnia (n, %)	3 (20.0)	13 (41.9)	0.390	3 (60.0)	24 (64.9)	0.831
Irritable bowel syndrome (n, %)	9 (60.0)	20 (64.5)	0.286	2 (40.0)	13 (35.1)	0.831
Headache (n, %)	3 (20.0)	4 (12.9)	0.272	2 (40.0)	4 (10.8)	0.080
Clinical features						
Postoperative admission time (days)	32 ± 11.3	33.4 ± 14.8	0.699	30.8 ± 12.2	33.7 ± 14.5	0.923
ICU time (months)	17.3 ± 10.3	17.3 ± 11.8	0.518	15.6 ± 11.9	18.1 ± 11.6	0.640
Complications						
Poor wound healing (n, %)	2 (13.3)	8 (25.8)	0.610	1 (20.0)	9 (24.3)	0.659
Pulmonary hypertension (n, %)	1 (6.7)	6 (19.4)	0.433	1 (20.0)	6 (16.2)	0.831
Obesity (n, %)	3 (20.0)	6 (19.4)	0.582	1 (20.0)	8 (21.6)	0.934
Infection (n, %)	2 (13.3)	5 (16.1)	0.875	1 (20.0)	6 (16.2)	0.831
Tumour (n, %)	1 (6.7)	1 (3.2)	0.460	0	2 (5.4)	0.774
Hypertension (n, %)	5 (33.3)	8 (25.8)	0.226	4 (80.0)	9 (24.3)	0.011
Interventions						
OTT for more than 48 hours (n, %)	2 (13.3)	7 (22.6)	0.760	1 (20.0)	8 (21.6)	0.934
CRRT (n, %)	3 (20.0)	3 (9.7)	0.152	3 (60.0)	3 (8.1)	0.015
Pericardiocentesis (n, %)	2 (13.3)	1 (3.2)	0.163	1 (20.0)	2 (5.4)	0.323

ICU: Intensive center unit, OTT: Oral trachea cannula, CRRT: Continuous Renal Replacement Therapy.

Table 3: Depression Self-Rating Scale for Children and Screen for Child Anxiety Related Emotional Disorders of pediatric heart recipients at pretransplant and posttransplant.

	Pretransplant	Posttransplant	p
Somatization Panic	18.4 ± 6.6	5.7 ± 4.3	<0.001
Generalized Anxiety	13.5 ± 4.2	4.3 ± 3.8	<0.001
Dissociative Anxiety	11.6 ± 4.1	3.2 ± 3.1	<0.001
Socialization Terror	9.7 ± 3.7	2.8 ± 2.6	<0.001
School Phobia	5.7 ± 2.1	2.2 ± 2.1	<0.001
Depression	25.3 ± 7.1	8.3 ± 4.8	<0.001

3.2 Postoperative Pediatric Heart Recipients QoL

After surgery, in anxiety group, pediatric heart transplant recipients had similar QoL scores to those of no-anxiety group in physical functioning, role-physical, bodily pain, vitality, social functioning, role-emotional, and reported health transition. However, recipients with anxiety demonstrated significantly lower QoL scores compared to those without anxiety in general health (55.1 ± 16.6 vs. 68.2 ± 10.6, p = 0.008) and mental health (65.1 ± 21.8 vs. 80.4 ± 15.2, p = 0.015).

In depression group, pediatric heart transplant recipients had similar QoL scores to those of no-depression group in physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional, mental health, and reported health transition (Table 4).

Table 4: Postoperative SF-36 scores of the 42 patients submitted to pediatric heart transplantation.

Domain	All	Anxiety	No-Anxiety	*p*	Depression	No-Depression	*p*
Physical Functioning	80.7 ± 14.6	79.3 ± 15.1	81.5 ± 14.6	0.604	80.1 ± 15.4	85.1 ± 6.1	0.735
Role-Physical	58.9 ± 33.9	48.3 ± 30.6	64.8 ± 34.8	0.101	50 ± 35.3	60.1 ± 34.1	0.472
Bodily Pain	87.3 ± 11.2	85.1 ± 11.9	88.5 ± 10.8	0.393	94.3 ± 7.9	86.4 ± 11.4	0.167
General Health	64.5 ± 14.4	55.1 ± 16.6	68.2 ± 10.6	0.008	53 ± 21.4	64.9 ± 12.9	0.207
Vitality	51.4 ± 15.7	45.3 ± 17.9	54.8 ± 13.5	0.074	48 ± 20.8	51.9 ± 15.3	0.763
Social functioning	81.2 ± 17.9	79.3 ± 19.2	83.9 ± 16.9	0.495	77.8 ± 17.6	81.7 ± 18.2	0.910
Role-Emotional	78.6 ± 29.3	73.3 ± 28.7	81.5 ± 29.7	0.465	60 ± 27.9	81.2 ± 28.9	0.180
Mental Health	74.9 ± 19.1	65.1 ± 21.8	80.4 ± 15.2	0.015	68 ± 25.3	75.9 ± 18.3	0.571
Reported Health Transition	12.5 ± 26.6	18.3 ± 33.4	9.26 ± 22.1	0.562	0	14.2 ± 27.9	0.342

3.3 Perioperative Psychosocial Functioning in Pediatric Guardians

We uesd GHQ-12 to identify individuals who are at a high risk of having or developing a common mental health disorder. A score of ≥4 is the most commonly uesd threshold. Scores of 4 or more suggest psychosocial risk. Before heart tranplant, 83.3% (35/42) parents had psychosocial risk. After heart tranplant, 85.7% (36/42) parents had psychosocial risk. There is no siginificant difference between pre- and post-transplant ($p = 0.124$). There was no significant correlation between parents and children in psychosocial risk ($p > 0.05$).

4 Discussion

Pediatric heart transplant candidates and recipients are susceptible to high levels of psychological distress both before and after transplantation. Pre- and post-transplant psychological functioning has been shown to significantly affect QoL, adherence to treatment, and overall medical outcomes. Thus, assessing and enhancing psychosocial functioning is essential for improving outcomes among pediatric heart transplant recipients. In our study, we found that 91.7% (33/36) of children presented with clinically significant overall psychosocial risk before transplantation. After transplantation, anxiety and depression rates decreased notably to 35.7% and 11.9%, respectively. Previous studies also indicated that approximately 40% of heart transplant children endorsed psychosocial problems, and could had improvement after surgery [3,4,15]. Our results were consistent with previous psychosocial research.

Peroperative adverse psychosocial risk factors may lead to poorer transplant-related outcomes. To explore potential causes, we evaluated associations between psychosocial risk, demographic variables, social variables, and surgery-related factors. Our analysis showed that sex, age at surgery, education degree, clinical symptoms, clinical intervention and social factors were not significantly associated with preoperative psychosocial distress. These results are generally consistent with the existing literature [5,16]. A key finding was that pediatric patients with prolonged disease duration prior to transplantation showed significantly higher levels of anxiety and depressive symptoms compared to those with recent-onset disease and rapid progression. This difference may stem from cumulative burdens such as repeated hospitalizations, limited physical mobility, and uncertainty of future treatment plans. These results highlight the need for timely and targeted early psychological intervention for children with long-standing disease before surgery.

Previous studies have consistently demonstrated a correlation between low serum albumin levels and symptoms of depression and anxiety [17–19]. In our study, we found that recipients with psychosocial distress had lower serum albumin levels, alongside heightened symptoms of depression and anxiety. One possible mechanism is that chronic dietary restrictions and peripheral tissue edema may exacerbate hypoalbuminemia in patients with heart failure. Another explanation involves the antioxidant propeties of serum albumin [20], as severe depressive disorders are associated with increaesd oxidative products [21]. These factors may collectively contribute to hypoalbuminemia in depressed individuals.

We also observed significant postoperative reductions in average scores on both the DSRSC and SCARED among pediatric recipients. This improvement may be due to better cardiac function, reduced hospital readmissions and increased participation in age-appropriate activities such as sports and school attendance [22]. Nonetheless, a small subset of the patients continued to experience psychological difficulties after transplantation. Invasive postoperative procedures such as continuous renal replacement therapy (CRRT) may aggravate postoperative stress responses. Additionally, the requirement for lifelong immunosuppressant therapy, along with frequent regular clinical appointments including laboratory tests, restrictions dietary and activity can contribute to emotional instability. Side effects of immunosuppressant therapy, including hypertension, haisutry, growth restriction and change of appearance could be another reason [23,24]. We further found that older children were more vulnerable to depression following transplantation, likely due to their greater cognitive awareness of the surgery seriousness and concerns regarding complications and survival. We evaluated the psychological risk in the parents of recipients and discovered that 80–85% experienced psychological challenges before surgery and with no significant change post-transplantation. Concerns over surgical outcomes, recovery, long-term health, insufficient social support, and financial strain contributed to sustained psychological risk.

Assessment of QoL showed that recipients with anxiety or depression had similar QoL scores in physical functioning, role-physical, bodily pain, vitality, social functioning, role-emotional, and reported health transition to those without anxiety and depression group. However, children with psychological issues demonstrated lower scores compared to their healthy counterparts in the areas of general health and mental health. Kira Endén et al. compared QoL between pediatric kidney transplantation recipients and healthy controls, showed that greater depressive symptoms were associated with decreased QoL [25]. Better psychosocial functioning is generally correlated with improved QoL among solid organ transplant recipients [26,27]. These findings highlight the importance of pediatric heart transplant recipients care in order to improve QoL outcomes. In our study, we demonstrated that pediatric transplant recipients exhibited improvements in physical functioning, social functioning, and engagement in age-appropriate activities post-transplant. There were no significant differences in psychosocial risk group and no psychosocial risk group. Mental health emerged as a crucial determinant in the evaluation of postoperative quality of life (QoL), with children experiencing anxiety receiving lower scores. Some studies have indicated that more complex medical factors, such as surgery-related complications, graft failure, and increased hospitalizations, as well as socio-demographic factors, including race, gender, and income, contribute to diminished QoL [28–30]. It is suggested that understanding children' needs and perceptions and finding out health-related factors is fundamental to the development of appropriate interventions that address their psychosocial problems.

5 Conclusions

Perioperative anxiety and depression are prevalent among pediatric heart transplant recipients. Despite notable improvements in the psychosocial risk of pediatric heart transplant recipients at posttransplant, approximately 40% children present with sustained psychosocial challenges. Our findings suggest that regular monitoring of psychosocial functioning and providing the varied interventions for both recipients and their families is essential to improve children's QoL and long-term surgical outcomes.

6 Limitation

There were a number of limitations that be noted in our study. First, it is a retrospective, single-center, small sample, and observational study. Transplant populations, assessment tools, and perioperative characteristics limited our conclusions about the data. Second, our study was based on children's self-reports

and parental questionnaires. These general nonspecific questionnaires might underestimate or exaggerate the overall prevalence of psychosocial functioning problems. Third, future research can be carried out with larger sample sizes, and the psychosocial assessment after transplant is slightly shorter, which could be extended in the future.

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Availability of Data and Materials: The authors confirm that the data supporting the findings of this study are available within the article.

Ethics Approval: The review of clinical records was approved by the Institutional Review Board of Fuwai Hospital (Approval No: 2022-1869) and was conducted in accordance with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The requirement for informed patient consent was waived by the Board due to the retrospective nature of the research.

Conflicts of Interest: The authors declare no conflicts of interest to report regarding the present study.

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