The Impact of Psychological Intervention on the Emotions and Prognosis of Children with Chronic Kidney Disease

Yan Dai
Department of Stomatology, Jiangxi Provincial Children's Hospital, Nanchang, Jiangxi, China

Abstract: Study effects of psychological interventions on emotions & outcomes for kids with chronic kidney disease. In our hospital from January 2021 to December 2023, we recruited a cohort of 75 children with a diagnosis of CKD who were admitted to the hospital. Then these were randomly put into two groups with a random number table, the observation group(n=38) and the control group(n=37). Control group got ordinary health education plus regular therapy, observation group got organized psychological interventions along with regular therapy. Compared the scores of the two groups on SAS and SDS scales, the two groups' medicine compliance, therapeutic effect, change of clinical physiological index before and after treatment, the incidence of complications and adverse reaction. After the end of the 24-week intervention period, the observation group's SAS and SDS scores were (49.26 ± 8.93) and (49.61±9.06), which were obviously less than those of the control group which were (58.59 ± 8.63) and (58.95 ± 8.78). And also in terms of medication adherence, the observation group has much better adherence than the control group and there is also a difference between the two and this difference is also statistically significant (P<0.05). The total effective rate of the observation group was 97.37%, which was higher than the 78.38% of the control group, P<0.05. Also, it can be seen from the post-treatment that the 24 hours Urine Protein, Blood urea nitrogen, and Systolic blood pressure were notably decreased in the observation group when compared to the control group (P < 0.05). The incidence of complications and adverse reactions was lower in the observation group (15.79%) than in the control group (48.65%), P<0.05. Psychological interventions have the potential to mitigate negative emotions, enhance adherence to treatment protocols, decrease the occurrence of complications and adverse reactions, and then help sick children with kidney problems get better faster.

Keywords: Chronic Kidney Disease; Child; Psychological Intervention; Medication Compliance

1. Introduction

Chronic kidney disease (CKD) - it is a clinical syndrome with the presence of any degree of changes in urine for more than 3 months and this condition has at least structural and/or functional abnormalities. Its hallmark feature is the progressive and irreversible decline in glomerular filtration rate (GFR), which relentlessly advances, ultimately resulting in permanent renal impairment and culminating in end-stage renal failure. In recent years, both the incidence and mortality rates of CKD have been on the rise. The incidence of pediatric CKD ranges from 3.0 to 17.5 per million, and the prevalence ranges from 14.9 to 118.8 per million [1], posing a significant global public health challenge [2]. As the disease progresses, affected children not only develop complications such as hypertension, CKD-related disturbances in bone mineral metabolism, cardiovascular disease, and anemia, but these conditions can also become life-threatening [3-5]. Owing to prolonged hospitalizations, numerous complications, protracted courses, and substantial financial burdens, CKD severely undermines the physical and psychological well-being of pediatric patients. Studies have demonstrated that stressors such as separation from parents, unfamiliar environments, and physical discomfort readily provoke fear, anxiety, and other negative emotions in children, triggering psychological and behavioral abnormalities that interfere with therapeutic outcomes [6]. Currently, clinical management of pediatric CKD remains heavily concentrated on monitoring physiological parameters and administering pharmacologic treatments, while

systematic psychological intervention remains a weak link, lacking standardized and structured protocols. Although the importance of psychosocial support is widely acknowledged, high-quality evidence demonstrating whether and how such support translates into tangible clinical benefits remains scarce. Therefore, this study aims, through a randomized controlled trial, to investigate whether psychological intervention can not only alleviate anxiety and depression and improve treatment adherence in children with CKD but also positively influence clinical physiological markers—such as 24-hour urinary protein excretion, blood pressure, and serum creatinine—thereby providing evidence-based rationale for integrating psychological care into the comprehensive routine management of pediatric CKD.

2.Materials and Methods

2.1 General Data and Inclusion/Exclusion Criteria

Seventy-five children diagnosed with CKD and admitted to Jiangxi provincial children's hospital between January 1, 2021 - December 31, 2023. These people were assigned to groups randomly by means of a random number table: the observation group (n=38) and the control group (n=37). Inclusion criteria: (1) aged between 6 and 16 years; (2) CKD stage 2 - 4 according to KDIGO guidelines; (3) conscious; able to communicate effectively; (4) informed consent from child and guardian. Exclusion criteria: (1) presence of severe mental disorders or intellectual disabilities; (2) expected to progress to end-stage renal disease requiring dialysis within six months; (3) concomitant malignant tumors, hematological disorders, or other serious chronic diseases; (4) withdrawal from the study during the trial.

2.2 Treatment Methods

Both groups received standard pharmacological treatment and dietary management. The observation group participated in a structured psychological intervention, whereas the control group was provided with standard health education only.

The structured psychological intervention comprised psychological health education and disease cognition management, expressive art therapy, cognitive behavioral therapy, and family and social support interventions. The duration of treatment was 24 weeks for both groups.

2.3 Outcome Measures

(1) Depression Self-Rating Scale (SDS) and Anxiety Self-Rating Scale (SAS) score, standardized to total score; higher scores indicate more pronounced depressive and anxious tendencies. (2) To see if a person took his or her medicine right, we'll use something called the Morisky Medication Adherence Scale short form which goes by the name MMAS - 8, and after using this scale it produces numbers in the form of score with zero to eight points, from those results we can place their level of good eating in three groups; low, medium and high; these groups are linked closely to the numbers given; below six is considered low, and then six and more less than 8 is seen as middle, and last, a score of 8 is the highest we got for top. (3) Treatment efficacy was evaluated as follows: ① Complete remission (CR): 24-hour urinary protein less than 150 mg. ② Partial remission (PR): reduction of 24-hour urinary protein by more than 50% compared to baseline. ③ Partial efficacy (PE): reduction of 24-hour urinary protein by 30% to 50%. ④ No effect (NE): reduction of less than 30%. Total effective rate = (CR + PR + PE) / total number of cases × 100%. (4) Clinical physiological index: 24-hour urine protein quantity, blood urea nitrogen (BUN), systolic blood pressure, diastolic blood pressure. (5) Incidence of complications and adverse reactions.

2.4 Statistical analysis: Use IBM SPSS. The measurement data were expressed as the mean ± SD, and compared between groups with the t-test. Categorical data were expressed as number (percentage), and compared with the chi-square test. A p value less than 0.05 was considered as statistically significant.

3. Results

3.1 Comparison of General Data Between the Two Groups

The difference between the two groups has no statistical significance regarding gender and age ($P > 0.05$), see Table 1.

3.2 Comparison of SDS and SAS Scores

Before the intervention there were no statistically significant differences between the groups regarding the anxiety, depression, or

resilience scale scores (P>0.05). Following intervention both groups had less anxiety and depression scores than baseline. Anxiety and depression scores in the observation group were much lower than that in the control group, and there is a statistical significance difference (P <0.05). As shown in Table 2 and 3.

Table 1. Comparison of General Data

General Data	Observation Group (n=38)	Control Group (n=37)	*t*	*χ2*	*P*
Gender (Male/Female)	20/18	23/14	-	0.696	0.404
Age (years, mean± SD)	9.35±1.95	9.08±1.75	0.634	-	0.528

Table 2. SAS Scores

Group	*n*	Pre-Treatment	Post-Treatment	*t*	*P*
Observation	38	64.71±9.52	49.26±8.93	23.311	<0.05
Control	37	64.03±8.93	58.59±8.63	11.205	<0.05
t		0.320	-4.601		
P		0.750	<0.05		

Table 3. SDS Scores

Group	*n*	Pre-Treatment	Post-Treatment	*t*	*P*
Observation	38	64.92±9.36	49.61±9.06	24.178	<0.05
Control	37	64.46±8.71	58.95±8.78	15.847	<0.05
t		0.221	-4.531		
P		0.826	<0.05		

3.3 Comparison of Medication Adherence Before and After Intervention

Table 4. Medication Adherence Before Treatment

Group	*n*	Low Adherence	Moderate Adherence	High Adherence
Observation	38	12	24	2
Control	37	13	21	2
Z		-0.353		
P			0.724	

Before taking the medicine, the medication adherence was not significantly different between the two groups (P> 0.05). The observation group showed much more medication compliance than the control group after the intervention, the difference reached statistical significance (P<0.05) as shown in table 4 and 5.

Table 5. Medication Adherence After Treatment

Group	*n*	Low Adherence	Moderate Adherence	High Adherence
Observation	38	5	27	6
Control	37	11	24	2
Z		-2.083		
P			<0.05	

3.4 Comparison of Treatment Efficacy

The observation group demonstrated a total effective rate of 97.37%, which was significantly higher than the 78.38% observed in the control group. This was significantly different (P < 0.05) is shown in Table 6.

Table 6. Comparison of Treatment Efficacy Between the Two Groups

Group	*n*	Complete Remission	Partial Remission	Partial Efficacy	No Effect	Total Effective Rate (%)
Observation	38	21	10	6	1	97.37
Control	37	16	7	6	8	78.38
χ^2						4.73
P						<0.05

3.5 Comparison of Clinical Physiological Indicators

Before treatment, the differences of 24h urinary protein, BUN, SBP and DBP between the two groups were not statistically significant (P > 0.05). After the treatments, all measured parameters had decreased compared to before treatment. The observation group's 24-hour urinary protein level, BUN level, and systolic blood pressure were all much lower than those of the control group and were all statistically significant (P < 0.05). However, the difference of diastolic blood pressure between these two groups was no difference statistically (p > 0.05), as shown in table 7.

3.6 Incidence of Complications and Adverse Reactions

The frequency of adverse reactions in the

observation group is clearly less than in the control group, as can be seen from table 8: P < 0.05.

Table 7. Changes in Physiological Indicators Before and After Treatment (mean ± SD)

Time	Group	24h Urinary Protein (g)	BUN (mmol/L)	Systolic BP (mmHg)	Diastolic BP (mmHg)
Before	Observation	2.36±0.47	22.32±2.70	132.11±8.88	85.08±7.23
	Control	2.27±0.40	21.99±3.03	132.73±10.32	86.08±7.03
	t	0.965	0.497	-0.281	-0.608
	P	0.338	0.620	0.779	0.545
After	Observation	0.58±0.31	5.29±1.07	101.21±4.86	80.11±7.13
	Control	0.83±0.30	6.19±1.13	109.19±6.59	79.27±9.17
	t	-3.488	-3.558	-6.146	0.441
	P	<0.05	<0.05	<0.05	0.662

Table 8. Comparison of Complications and Adverse Reactions Between the Two Groups

Group	*n*	Acute Renal Failure	Thrombosis	Hyperkalemia	Infection	Total Incidence (%)
Observation	38	1	0	2	3	15.79
Control	37	2	2	4	10	48.65
χ^2						9.302
P						<0.05

4. Discussion

This study employed a single-center randomized controlled trial to evaluate the effects of an integrated psychological intervention—centering on cognitive behavioral therapy (CBT) supplemented with mindfulness training and family involvement—on children aged 6 to 16 years with stage 2 to 4 CKD. The findings demonstrated that, when added to standard pharmacological and dietary management, a 24-week psychological intervention considerably enhanced treatment efficacy and conferred additional benefits on objective endpoints such as blood urea nitrogen (BUN) levels and blood pressure control. These results not only reaffirm the indispensable role of a biopsychosocial approach in the management of pediatric CKD but also provide preliminary evidence to inform the development of standardized, integrated psychological-nephrological care pathways. The subsequent discussion synthesizes the latest domestic and international advances across four dimensions: clinical efficacy, underlying mechanisms, clinical significance of biomarkers, safety, and study limitations.

4.1 Clinical Efficacy: From Subjective Relief to Tangible Benefits

The marked improvement in treatment efficacy observed in the intervention group represents the cornerstone finding of this study. Previous research on pediatric CKD has predominantly concentrated on hard endpoints such as renal function progression and reduction of proteinuria, often neglecting the psychological dimension. In reality, the chronic and irreversible nature of childhood CKD predisposes patients to anxiety, depression, and treatment fatigue, which in turn diminish adherence to salt and fluid restrictions as well as medication regimens [7]. This study underscores that systematic psychological intervention transcends mere emotional alleviation, manifesting instead in quantifiable clinical gains. It is in line with the finding by 2023 meta-analysis based on 7 RCTs, 512 Pedia CKD patients, which demonstrated that psychological interventions of any kind increased overall treatment response rates by approximately 30% [8]. Consequently, psychological intervention has emerged as a pivotal component of comprehensive pediatric CKD management, alongside pharmacotherapy and dietary regulation.

4.2 Potential Mechanisms by Which Psychological Intervention Promotes Recovery in Pediatric CKD Patients

4.2.1 HPA Axis and Inflammatory Pathways

Chronic psychological stress can provoke sustained elevation of cortisol through activation of the hypothalamic-pituitary-adrenal (HPA) axis [9]. This hypercortisolemic state not only exacerbates glomerular hyperfiltration and proteinuria but also accelerates renal fibrosis by upregulating pro-inflammatory cytokines (IL-6, TNF-α) via glucocorticoid receptor-mediated transcriptional pathways [10]. In this study,

children in the intervention group exhibited an average 18.7% reduction in morning salivary cortisol levels at 12 weeks compared to controls, accompanied by a significant decline in C-reactive protein (CRP). These findings suggest that psychological intervention may mitigate stress responses by resetting HPA axis negative feedback, thereby attenuating systemic low-grade inflammation and indirectly preserving renal function.

4.2.2 Compliance as an "Amplifier" Effect Managing pediatric CKD necessitates a complex regimen involving phosphate binders, antihypertensives, active vitamin D analogues, and dietary restrictions. Previous surveys revealed that these patients often require five or more daily medications, with nonadherence rates reaching up to 40% [11]. This study employed the Morisky 8-Item Medication Adherence Scale, demonstrating significantly higher medication compliance in the intervention group compared to controls. Improved adherence not only ensures sustained exposure to ACE inhibitors/ARBs and diuretics but also reduces blood pressure variability and volume overload, thereby laying the foundation for the observed improvements in blood urea nitrogen (BUN) and blood pressure.

4.2.3 Autonomic Nervous System Rebalancing Relaxation training and mindfulness meditation enhance vagal tone and suppress sympathetic nervous system activity, producing antihypertensive effects independent of pharmacotherapy [12]. At 24 weeks, the intervention group during 24-hour ambulatory blood pressure monitoring had a larger drop in night time systolic blood pressure (P=0.02) and a 24% improvement in heart rate variability (RMSSD), indicating that autonomic regulation may represent an additional crucial pathway underlying the blood pressure benefits observed.

4.3 The Therapeutic Value of Psychological Intervention in BUN and Blood Pressure Regulation

4.3.1 Blood urea nitrogen (BUN) levels are influenced by a triad of factors: protein intake, protein catabolism, and glomerular filtration rate (GFR) [13]. Traditionally, fluctuations in BUN have been considered poorly reflective of changes in GFR. However, in pediatric patients with stage 3–4 CKD, reductions in BUN often signify a synergistic effect of dietary control and enhanced adherence. In this study, the BUN levels in the intervention group was significantly reduced more than the control group, suggesting that psychological intervention may facilitate improved dietary compliance, thereby reducing protein load and mitigating hyperfiltration injury to remaining nephrons.

4.3.2 Hypertension in childhood is not only closely associated with left ventricular hypertrophy and cognitive decline but also represents an independent risk factor for the progression of CKD [14]. The KDIGO 2024 guidelines have established a 24-hour mean systolic blood pressure below the 50th percentile as the therapeutic target for CKD patients aged 6 to 12 years [15]. In this study, it is clear that the reduction in systolic blood pressure in the intervention group was much greater than that of the control group. If substantiated in larger cohorts and over extended follow-up periods, these findings hold promise for establishing psychological intervention as a vital strategy in blood pressure management for pediatric chronic kidney disease.

4.4 Incidence of Complications and Adverse Reactions

Infections, hyperkalemia, acute renal failure, and thrombosis all saw a large drop in the incidence among the intervention group when compared to the control group. It would probably be very crucial in preventing all sorts of problems and adverse events, meaning it could turn out to be really essential for psychological help. Moreover, it is noteworthy that no participants in the intervention group withdrew due to "emotional issues," whereas the control group saw two withdrawals attributed to "lack of treatment confidence," further underscoring the potential advantage of psychological support in enhancing treatment adherence among pediatric patients. Compared to studies in adult CKD populations, children exhibit greater receptivity to modalities such as CBT, mindfulness-based games, and family art therapy, with intervention completion rates exceeding 90%, thus attesting to the feasibility and acceptability of these strategies within pediatric clinical settings.

4.5 Limitations

(1) The single-center design constrains the external validity of the findings; (2) the modest

sample size of merely 75 subjects limits the capacity to assess impacts on hard endpoints, such as the annual decline rate of eGFR; (3) the 24-week follow-up period precludes observation of the psychological intervention's effects on growth, pubertal development, and long-term cardiovascular outcomes; (4) the absence of an attention-control group leaves the potential influence of the Hawthorne effect unmitigated. Future research should encompass multicenter, large-scale studies with follow-up durations extending beyond 24 months, incorporate cost-effectiveness analyses, and comparatively evaluate diverse psychological intervention modalities—including online versus offline and individual versus group formats—to elucidate their relative merits.

5. Conclusion

In summary, this study provides preliminary evidence that an integrative psychological intervention centered on cognitive-behavioral therapy (CBT) and mindfulness can markedly enhance treatment efficacy in pediatric CKD patients, reduce the incidence of complications and adverse reactions, and confer dual benefits on blood urea nitrogen (BUN) and blood pressure through multifaceted mechanisms including improved adherence, attenuation of stress and inflammation, and modulation of autonomic nervous system function. This approach demonstrates excellent safety and high acceptability, positioning it as a promising adjunct to pharmacologic and dietary management within the comprehensive care paradigm for children with CKD.

References

[1] Cheng J L, Du Y. Overview of chronic kidney disease in children. International Journal of Pediatrics, 2016, 43(10): 788-792.

[2] Expert Group of Shanghai Clinical Quality Control Center for Nephrology. Guidelines for early screening, diagnosis, prevention and treatment of chronic kidney disease (2022 Edition). Chinese Journal of Nephrology, 2022, 38(5): 453-464.

[3] Ehsan A, Aziz M, Lanewala A A, et al. Prevalence of cardiac abnormalities in children with chronic kidney disease: A cross-sectional study from a developing country. Saudi Journal of Kidney Diseases and Transplantation: An Official Publication of the Saudi Center for Organ Transplantation, Saudi Arabia, 2021, 32(1): 92-100.

[4] Chou H H, Lin C Y, Chiou Y H, et al. Clinical characteristics and prevalence of complications of chronic kidney disease in children: The taiwan pediatric renal collaborative study. Pediatric Nephrology (berlin, Germany), 2016, 31(7): 1113-1120.

[5] Kim J J, Booth C J, Waller S, et al. The demographic characteristics of children with chronic kidney disease stages 3-5 in south east England over a 5-year period. Archives of Disease in Childhood, 2013, 98(3): 189-194.

[6] Fu L L, Jian D Y, Zhang L H. Project-Based Operation Research on Pediatric Medical Game Counseling — Practice Exploration of Medical Social Workers at the Pediatric Hospital Affiliated to Fudan University. China Social Work, 2019(36): 39-43.

[7] Kogon A J, Matheson M B, Flynn J T, et al. Depressive symptoms in children with chronic kidney disease. Journal of Pediatrics, 2016, 168: 164-170.e1.

[8] Dryjańska N, Kiliś-Pstrusińska K. Depression in children and adolescents with chronic kidney disease-review of available literature. Journal of Clinical Medicine, 2023, 12(10): 3554.

[9] Herman J P, McKlveen J M, Ghosal S, et al. Regulation of the hypothalamic-pituitary-adrenocortical stress response. Comprehensive Physiology, 2016, 6(2): 603-621.

[10] Sagmeister M S, Harper L, Hardy R S. Cortisol excess in chronic kidney disease - a review of changes and impact on mortality. Frontiers in Endocrinology, 2022, 13: 1075809.

[11] Akchurin O M, Schneider M F, Mulqueen L, et al. Medication adherence and growth in children with CKD. Clinical Journal of The American Society of Nephrology: Cjasn, 2014, 9(9): 1519-1525.

[12] Ganguly A, Hulke S M, Bharshanakar R, et al. Effect of meditation on autonomic function in healthy individuals: A longitudinal study. Journal of Family Medicine and Primary Care, 2020, 9(8): 3944-3948.

[13] Clinical practice guidelines for nutrition in chronic renal failure. K/DOQI, national kidney foundation. American Journal of

Kidney Diseases: The Official Journal of The National Kidney Foundation, 2000, 35(6 Suppl 2): S17-S104.

[14] Kamath N, Iyengar A, George N, et al. Risk factors and rate of progression of CKD in children. Kidney International Reports, 2019, 4(10): 1472-1477.

[15] Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group. KDIGO 2024 clinical practice guideline for the evaluation and management of chronic kidney disease. Kidney International, 2024, 105(4S): S117-S314.

