

Review Article

Summary and Considerations in the Nursing Care of Patients with Progressive Familial Intrahepatic Cholestasis

Ni Zhang¹, Yuanzong Song², Meixue Chen¹, Lingli Cai¹, Manli Liu¹, Weiwei Wang¹, Qingran Lin^{3,*}

¹College of Nursing, Jinan University, Guangzhou, China

²Department of Neonatal, The First Affiliated Hospital of Jinan University, Guangzhou, China

³Department of Nursing, The First Affiliated Hospital of Jinan University, Guangzhou, China

Email address:

zhangniemail@126.com (Ni Zhang), qingranlin@126.com (Qingran Lin)

*Corresponding author

To cite this article:

Ni Zhang, Yuanzong Song, Meixue Chen, Lingli Cai, Manli Liu, Weiwei Wang, Qingran Lin. Summary and Considerations in the Nursing Care of Patients with Progressive Familial Intrahepatic Cholestasis. *American Journal of Nursing Science*. Vol. 9, No. 5, 2020, pp. 310-315.

doi: 10.11648/j.ajns.20200905.11

Received: August 3, 2020; **Accepted:** August 13, 2020; **Published:** August 19, 2020

Abstract: Background: Progressive familial intrahepatic cholestasis (PFIC) is a group of rare cholestatic liver diseases whose main features are itching, jaundice and even liver failure. Many studies have been reported in clinical reports, but the care of PFIC is rarely described. Purpose: To provide a summary and recommendations for the setup of strategies for PFIC patient care. Material and methods: A non-systematic review of PFIC nursing research until July 12, 2020. Use online search engines (PubMed, Medline, Embase, Web of Science, and CINAHL) to find PFIC nursing-related content, sort and summarize nursing-related content. Results: As a rare disease, there is limited research in PFIC nursing. The main care measures of PFIC including nursing interventions and evaluation tools. Nursing intervention is divided into general symptom care and nursing care of postoperative complications. Evaluation tools mainly focus on quality of life assessment and evaluation of itching. Conclusions: Nurses should pay attention to the use of scales when caring for PFIC patients, and observe whether specific nursing measures can help improve patients' quality of life. PFIC nursing interventions and evaluation tools should be tailored according to PFIC clinical manifestation. A multidisciplinary collaborative approach is encouraged for proper management and tailoring therapy according to clinical manifestation.

Keywords: Progressive Familial Intrahepatic Cholestasis (PFIC), Nursing, Evaluation, Itching, Quality of Life, Intervention

1. Introduction

Progressive familial intrahepatic cholestasis (PFIC) is an autosomal recessive genetic disease with an incidence of about 1/50,000 to 1/100 000 [1]. As a type of cholestasis, PFIC is divided into 6 types according to different mutation genes encoding biliary transport-related proteins, and they are designated as PFIC types 1 to 6. Patients with PFIC with different subtypes have similarities, usually starting in infancy or childhood, mainly manifested as jaundice, hepatosplenomegaly, itching, stunting, and vitamin deficiency [2]. The main treatments include drug treatment, surgical treatment [3]. The poor physical condition and unstable condition of PFIC patients lead to an increased incidence of

complications [4]. In recent years, studies have shown that the care of patients with cholestasis can effectively increase the life span of patients [5]. However, there are few reports on the care of patients with PFIC, and no effective integration has been formed. Therefore, this article summarizes the nursing experience of PFIC patients to provide reference in the future for the nursing staff of PFIC patients.

2. Material and Methods

On July 12, 2020 we performed a non-systematic review of the available literature through online search engines (PubMed, Medline, Embase, Web of Science, and CINAHL). After analyzing the content of selected peer-reviewed papers,

we summarized some recommendations to improve the nursing management of PFIC.

3. Nursing Management

3.1. General Symptom Care

The general symptom care focuses on itching care, improving medication compliance, and changing diet structure and lifestyle to help PFIC patients and their families detect the risks as early as possible and improve their ability to cope with the disease.

In terms of itching care, itching seriously affects the daily life of patients with PFIC [6], prompting the patient to scratch the skin and causing skin damage. Because the patient's sympathetic nerves are excited at night, the itching is increased, most the patient has insufficient sleep, auxin cannot be secreted normally, therefore most patients are short [7]. Nurse should closely observe the child's skin for skin damage and deal with it as soon as it occurs [8]; at the same time, attention should be paid to detect the patient's growth and development status, and calculate according to the "Standardization Curve of Height for Children and Adolescents 0-18 Years" height and weight Z value to assess the growth and development of PFIC patients [9]. Therefore, for the care of itch-related symptoms in PFIC patients, including changes in the severity of itching, skin condition, appetite, length, weight, and upper arm circumference should be dynamically observed.

Cholestyramine Powder, Ursodeoxycholic acid and other drugs are special effect drug for PFIC and can promote bile excretion and relieve the damage of cholestasis to liver cells [10]. Nurses should inform PFIC patients to insist on taking drugs Acid is important in relieving the deterioration of liver function in patients. Additionally, patients with PFIC often suffer from fat-soluble vitamins A, D, E, and K deficiency; therefore, it is necessary to inform patients and their families about the importance of supplementing fat-soluble vitamins, medium-chain fatty acids, and trace elements according to individual needs [11].

PFIC patients need to change the diet structure. Deficiency of bile salts in the intestines of patients leads to malabsorption of long-chain fatty acids. The richness of long-chain fatty acids in breast milk can cause steatorrhea in patients with PFIC, while medium-chain fatty acids are not dependent on bile absorption [12]. Therefore, nurses should inform the parents of children with PFIC to special formula milk powder with enhanced medium-chain fatty acids on the basis of breastfeeding [8]. When supplementary food is added to the diets of children with PFIC, it is important to follow the principle of high carbohydrate, high protein and normal lipids, and supplement with the addition of medium chain fatty acid to meet the nutrients needed for growth and development [8].

Hepatic fibrosis in PFIC patients leads to hepatosplenomegaly in daily activities. Nurses should guide patients to pay attention to protecting organs, avoid violent activities and collisions, and prevent hemorrhage caused by

rupture of the liver and spleen.

3.2. Nursing Care of Postoperative Complications

Partial internal biliary diversion or liver transplantation can effectively relieve the symptoms of pruritus in patients with PFIC, which are also prone to postoperative complications. Nurses should observe the patient after partial internal biliary diversion for complications such as anastomotic leakage, color change of stool, diarrhea, etc [13]. When the patient's stool color becomes light or even white clay, or there are no less than 3 loose or loose when the liquid is resolved, or when the number of stools is higher than normal, the patient should be informed of the condition in time [9]. 13%-43% of liver transplant patients have neurological symptoms manifesting as mild encephalopathy, coma, convulsions, severe headache, depression, mental disorders and stroke [14]. Therefore, patients with PFIC liver transplantation should be observed for neurological symptoms. Close care of postoperative complications of PFIC patients has a positive effect on improving the surgical effect and delaying the progression of the disease.

3.3. PFIC Nursing Assessment Tool

3.3.1. Health-related Quality of Life (HRQOL)

Health-related quality of life (HRQOL) is a scale designed by Mick *et al* [15] of the World Health Organization in 1998 for patients with chronic diseases. The purpose is to assess the subjective experience indicators of daily life. Applicable subjects are healthy and unhealthy people. HRQOL includes 100 entries with 26 subscales (physical status, mental health, independence, social adaptation, subjective beliefs, surrounding environment, etc.). Likert scoring is used, and each item has a score ranging from 4 to 20 points. Except for pain, negative psychology, and drug dependence, the higher the score, the better the quality of life. Mick *et al* [15] conducted a reliability and validity test on 250 people with illness or disabilities and 50 healthy people. The results showed that the comprehensive Cronbach's α coefficient was 0.65 to 0.93. Therefore, Yee *et al* [16] used HRQOL to conduct a cross-sectional study of 63 PFIC patients and 5 PFIC patients' nursing staff. The results showed that the quality of life of PFIC patients and the sleep, mood, and itching of patients were statistically significant, indicating that the tool has a good distinction between PFIC quality of life.

The advantages of this tool are: (1) The scale is comprehensive and suitable for all patients; (2) It is widely used and has been translated into various languages such as Chinese. Disadvantages are: (1) the tool has many entries and low feasibility.

3.3.2. 23-item Pediatric Quality of Life Inventory (PedsQL 4.0)

The 23-item Pediatric Quality of Life Inventory (PedsQL 4.0) was developed in 2013 by Gellman *et al* [17] based on the HRQOL, and aims to improve the sensitivity of children's health measurement. It is applicable to all healthy and chronic

children aged 2 to 18 years. The scale focuses on the four aspects of children's physiology, emotion, society and school performance. It consists of a children's measurement scale and a parents' measurement scale. It uses Likert scoring, a total of 23 items, with a total score of 0-100 points. The higher the value, the better the quality of life. A survey of 1677 children and parents aged 2-18 years was conducted to test the reliability and validity of the tool. The overall Cronbach's α coefficients of the child scale and parent scale were 0.88 and 0.90, respectively. Wassman *et al* [18] used PedsQL 4.0 to conduct a prospective study of PFIC patients with 32 exceptions for biliary shunt and liver transplantation to assess whether there is a difference in the quality of life of PFIC patients with the two surgical methods. The results showed that there was no significant difference in the quality of life between biliary shunt PFIC patients and liver transplantation PFIC patients, but there were marginal differences in physiology ($P = 0.07$).

The advantages of this tool: (1) It is an assessment tool for the health status of children; (2) assessment tools are divided into children's and parents' report scale, easy to use. (3) Good reliability and validity. The disadvantages are: (1) There are fewer translated versions.

3.3.3. Pediatric Quality of Life Inventory (PedsQL™)

The Pediatric Quality of Life Inventory (PedsQL™) was developed by Varni *et al* [19] in 1999 based on the HRQOL. It aims to simplify the scale and improve the assessment of the health status of children with chronic diseases. It is applicable to all cancers as well as children with chronic diseases. The scale focuses on the four aspects of children's physiology, emotion, society and school performance. It is divided into a patient scale and a caregiver scale. Likert score is used. There are 15 items in total, with a total score of 0 to 45 points. The higher score, the better the quality of life. A survey of 291 cancer patients and their parents was conducted to test the reliability and validity of the tool. The overall Cronbach's α coefficients of the child scale and parent scale were 0.83 and 0.86, respectively. Serrano *et al* [7] used PedsQL™ to conduct a randomized study and an observational non-intervention study of 62 children with cholestasis (including 19 children with PFIC) to verify the itch reported by the caregiver of the patient with cholestasis and the patient's life relevance of quality. The results of the study showed that the itching symptoms reported by the caregivers of patients with cholestasis were inversely related to the patients' quality of life.

The advantages of the tool: (1) The measurement can be completed within 5 minutes, and the feasibility is high; (2) The assessment tool is divided into a report scale for children and parents, which is easy to use. The disadvantages are: (1) Cronbach's α coefficient is low, and there may be bias in the evaluation results.

3.3.4. The Itch Reported Outcome (ItchRO)

The Itch Reported Outcome (ItchRO) was developed in Canada in 2018 by Kamath *et al* [20] based on the qualitative research results of itching symptoms in children with

cholestasis. The purpose was to evaluate itching symptoms and their severity and the degree of distress the symptoms have on daily life. ItchRO covers 4 aspects, including patients' skin damage, mood changes, difficulty falling asleep and staying asleep. There are 9 items including patient scale, caregiver scale, and morning evaluation scale and evening evaluation scale. ItchRO's Flesch-Kincaid reading comprehension score is 92.0 and English grade level score is 2.0, indicating that children age 7-8 years whose native language is English can understand the items. Kennedy *et al* [21] translated the English ItchRO scale into French, German, Polish and Spanish, and performed two forward and reverse translations. The results of the study show that ItchRO is easy to understand and there is no significant difference between the clinical manifestations of the patients and the translation results.

Advantages of the tool: (1) The tool has few items and is easy to evaluate; (2) The language is simple and easy to translate; (3) The evaluation tool is divided into a report scale for children and parents, which is easy to use; Evaluation of different characteristics of night itching severity. Disadvantages are: (1) Lack of large sample research test, need to further verify the reliability and validity.

3.3.5. 5-D Itch Scale (5-D Itch Scale, 5-D)

The 5-D itch scale (5-D) was developed by Elman *et al* [22] in 2010 based on literature review and expert consultation design. The purpose is to effectively and reliably observe changes in itch. Applicable objects are patients with skin disease, liver disease, kidney disease, HIV/AIDS and burn itching. 5-D The scale includes 5 aspects of itching degree, duration, trend, distribution and dysfunction. It uses Likert scoring, has a total of 23 entries with a total score of 5-25 points. The higher the score, the more serious the itching. The reliability and validity were tested. Cronbach's α coefficient was 0.734. Kamath *et al* [20] developed the ItchRO itching assessment scale suitable for patients with liver disease based on the 5-D itching scale, providing an effective assessment tool for more detailed assessment of itching status in patients with liver disease.

The advantages of the tool: (1) The table has a long application time, which proves to have good reliability and validity; (2) It can evaluate the severity of itching from multiple angles. Disadvantages: (1) The scale is suitable for the evaluation of skin itching subjects, which is not targeted.

3.3.6. Stool Color Cards

Biliary atresia is a biliary occlusive disease, a common postoperative complication of PFIC patients, and its clinical manifestations are jaundice, white clay stools, and darkened urine [13]. Infant stool color cards (SCC) were developed in 2008 by Taiwan Hsiao *et al* [23] based on different stool colors of infants. The purpose was to assess whether children have biliary atresia. The applicable subjects are all people with abnormal stool color. There are 9 SCC color stools, 6 colors for abnormal stools, numbered 1 to 6; normal stools are 7 to 9. Based on the SCC screening of 216,419 newborns, the effective rate of patients with confirmed biliary atresia in 2004

was 72.5%; in 2005, 205,854 newborns were included, and the success rate of biliary atresia screening increased to 97.1% ($P = 0.004$), which indicates that the color chart of stool is used to screen children with biliary atresia. Chan *et al* [24] used systematic reviews to search the literature related to SCC in the database to evaluate the performance of SCC in various environments. The results showed that the sensitivity of SCC was 85% (95% CI, 72%-93%), specificity was 100% (95% CI, 100-100%), and the false positive rate was 0.059%, indicating that PFIC liver transplant patients can be used to observe color stools. The SCC card is used to early identify the presence of biliary atresia after liver transplantation.

The advantages of this tool are: (1) simple and easy to implement, suitable for dynamic evaluation of home caregivers; (2) low cost and easy to popularize. Disadvantages:

(1) Lack of large sample research and testing.

3.4. Comparison of PFIC Patient Assessment Tools

The basic situation of the PFIC patient assessment tool is compared according to the characteristics of eight aspects such as construction time, author, country, and applicable subjects (Table 1). As can be seen from the table, the content of the PFIC patient assessment tool focuses on the quality of life assessment and the evaluation of the severity of itching; the assessment tool applicable to PFIC patients began as early as 1998; there are many related studies in the United States; the assessment methods are self-assessment and other evaluations; PedsQL 4.0 and PedsQL™ have good reliability and validity on the evaluation scale.

Table 1. Comparison of the basic characteristics of PFIC patient assessment tools.

Evaluation Tool	Build time	Author	C/O	Suitable Object
HRQOL	1998	Mick <i>et al</i>	WHO	everyone
PedsQL 4.0	2013	Gellman <i>et al</i>	USA	2-18 people
PedsQL™	1999	Varni <i>et al</i>	USA	Children with cancer and chronic diseases
TtchRO	2018	Kamath <i>et al</i>	USA	Children with cholestasis
5-D	2014	Elman <i>et al</i>	USA	Patients with chronic skin itching
SCC	2002	Taiwan Pediatric Association	Taiwan	People with abnormal stool color

Table 1. Continued.

Content structure	Assessment content	Assessment methods	Cronbach's
26 aspects, 100 items	Physical, psychological, social relationships, environment	self-completion	0.65-0.93
4 aspects, 23 items	Physical, emotional, social and school	self-completion and caregiver-completion	0.88-0.90
4 aspects, 15 items	Physical, emotional, social and school	self-completion and caregiver-completion	0.83-0.86
4 aspects, 9 items	Skin damage, mood changes, difficulties staying asleep, falling asleep	self-completion and caregiver-completion	-
5 aspects, 23 items	duration, degree, direction, disability and distribution	self-completion and caregiver-completion	0.734
9 kinds of stool color pictures	Stool color	caregiver-completion	-

USA, United States of America; C, country; O, organization; -, no result.

4. Discussion

In summary, there are problems in the care of PFIC patients because there is no unified standard for the care of PFIC patients. Nurses mainly care for PFIC patients based on intuition and traditional work experience. They are subjective and fail to dynamically and effectively identify disease changes and high-risk factors. There are few studies on psychological care of PFIC patients and their families. Studies have shown that patients with PFIC and their parents who have undergone a jejunal gallbladder skin anastomosis biliary shunt have negative psychology due to the inability to accept stomas and insufficient stoma processing ability [25]. Twenty-six percent of patients after liver transplantation have psychological disorders, showing anxiety and depression [26]. Through searching domestic and foreign literature, the current mental health status of PFIC patients and their families has not been paid attention to, and related mental health assessment and nursing have not been perfected. Additionally, the multidisciplinary collaboration model of PFIC patients is not perfect. Patients with PFIC have a long course of disease with a complex condition and require multi-disciplinary teams to collaborate to provide comprehensive care. At present, the

care of PFIC patients fails to take advantage of the multi-disciplinary teams' cross-collaboration, which makes PFIC nursing limited. Furthermore, there is a lack of scales specifically for patients with PFIC. PFIC is a rare disease with a low morbidity and therefore it is difficult to collect sufficient sample sizes. The developed scale lacks the reliability test of large samples and it is difficult to ensure the validity of the scale.

To better promote the development of PFIC patients in the field of nursing, the content of PFIC patient care should be improved. To provide better care for PFIC patients, medical staff should formulate and perfect nursing indicators, clarify the standard of nursing, and form an objective and appropriate evaluation tool to improve the level of PFIC nursing services. Nurses should patiently listen to patients and their families, and give spiritual comfort, introduce disease-related knowledge, help them treat the disease correctly, teach patients and their families home care measures, and enhance their confidence in dealing with the disease. They should also strengthen interdisciplinary teamwork and form a multi-disciplinary cooperation model in line with national conditions, promote interdisciplinary exchanges and cooperation, and provide professional health guidance for

PFIC patients from the fields of nutrition, rehabilitation, wound stoma and other fields. Attention must be paid to the construction and application of the scale. It is necessary to conduct multi-center cooperation to increase the number of PFIC patients included in the study and provide sufficient sample sizes for scale construction. Scale-based assessment can objectively help nurses to identify high-risk patients and dynamically observe changes in patients' home conditions. Therefore, it is important to form a scale-based nursing system for PFIC patients, provide patients with precise nursing services, and improve the quality of nursing work for PFIC patients.

5. Conclusion

As a rare disease, PFIC mainly requires care for itching, improving medication compliance, diet, postoperative complications, etc. In terms of scale evaluation, quality of life scale and itching scale evaluation are the main evaluation tools. The research on PFIC patient care is still in its infancy, and there are few related nursing studies. Nurses can improve the care of PFIC patients from multiple perspectives, including the formation of multi-disciplinary and multi-center teamwork; giving psychological support to the families of patients; and constructing the PFIC nursing scale. Therefore, nurses have much room for research and progress in improving the level of PFIC patient care.

References

- [1] Bull LN, Thompson RJ. Progressive Familial Intrahepatic Cholestasis. *Clin Liver Dis*. 2018; 22 (4): 657-669.
- [2] Gaur K, Sakhuja P. Progressive familial intrahepatic cholestasis: A comprehensive review of a challenging liver disease. *Indian J Pathol Microbiol*. 2017; 60 (1): 2-7.
- [3] Gunaydin M, Bozkurter Cil AT. Progressive familial intrahepatic cholestasis: diagnosis, management, and treatment. *Hepat Med*. 2018; 10: 95-104.
- [4] Alastair B, Nanda K, Lora T, et al. Systematic review of progressive familial intrahepatic cholestasis. [J]. *Clinics and research in hepatology and gastroenterology*, 2019, 43 (1).
- [5] The 22nd Conference of the Asian Pacific Association for the Study of the Liver: APASL 2012-Taipei, Taiwan-16-19 February. [Z]. 2012: 6.
- [6] Torfgard K, Gwaltney C, Paty J, et al. Symptoms and daily impacts associated with progressive familial intrahepatic cholestasis and other pediatric cholestatic liver diseases: A qualitative study with patients and caregivers [J]. *Journal of Pediatric Gastroenterology and Nutrition*, 2018, 67: S208-S209.
- [7] Serrano D, Gauthier M, Harrington M, et al. Psychometric validation of the Itch-Reported Outcome (ItchRO™) assessment in pediatric patients with Alagille syndrome or progressive familial intrahepatic cholestasis [J]. *Hepatology*, 2016, 64 (1): 284A-285A.
- [8] Van Vaisberg V, Tannuri ACA, Lima FR, Tannuri U. Ileal Exclusion for Pruritus Treatment in Children with Progressive Familial Intrahepatic Cholestasis and other Cholestatic Diseases [published online ahead of print, 2019 Nov 5]. *J Pediatr Surg*. 2019; S0022-3468 (19) 30664-5.
- [9] Arnell H, Bergdahl S, Papadogiannakis N, Nemeth A, Fischler B. Preoperative observations and short-term outcome after partial external biliary diversion in 13 patients with progressive familial intrahepatic cholestasis. *J Pediatr Surg*. 2008; 43 (7): 1312-1320.
- [10] E J, D H, A M, et al. Ursodeoxycholic acid therapy in pediatric patients with progressive familial intrahepatic cholestasis. [J]. *Hepatology*, 1997, 25 (3).
- [11] Abdelhamid N, Elkoofy N, Ghobrial C, et al. Zinc status in infants and children with cholestatic liver diseases and its effect on growth [J]. *Journal of Pediatric Gastroenterology and Nutrition*, 2018, 66: 1116.
- [12] Racha K, Claudia P, Sara K, et al. Cholestasis beyond the Neonatal and Infancy Periods. [J]. *Pediatric gastroenterology, hepatology & nutrition*, 2016 (1): 1-11.
- [13] Kaur S, Sharma D, Wadhwa N, et al. Therapeutic interventions in progressive familial intrahepatic cholestasis: Experience from a tertiary care centre in North India [J]. *Indian Journal of Pediatrics*, 2012, 79 (2): 270-273.
- [14] Nemati H, Kazemi K, Mokarram A T. Neurological Complications associated with Pediatric Liver Transplant in Namazi Hospital: One-Year Follow-Up [J]. *Int J Organ Transplant Med*, 2019, 10 (1): 30-35.
- [15] The World Health Organization Quality of Life Assessment (WHOQOL): development and general psychometric properties [J]. *Soc Sci Med*, 1998, 46 (12): 1569-1585.
- [16] Yee K, Moshkovich O, Llewellyn S, et al. A web-based survey of itch severity after surgical treatment of progressive familial intrahepatic cholestasis in children and adolescents [J]. *Hepatology*, 2018, 68: 1047A.
- [17] PedsQL 4.0 [M]//GELLMANM D, TURNER J R. *Encyclopedia of Behavioral Medicine*. New York, NY: Springer New York, 2013: 1449.
- [18] Wassman S, Pfister E D, Kuebler J F, et al. Quality of life in patients with progressive familial intrahepatic cholestasis: No difference between post-liver transplantation and post-partial external biliary diversion [J]. *Journal of Pediatric Gastroenterology and Nutrition*, 2018, 67 (5): 643-648.
- [19] Varni J W, Seid M, Rode C A. The PedsQL: measurement model for the pediatric quality of life inventory [J]. *Med Care*, 1999, 37 (2): 126-139.
- [20] Kamath B M, Abetz-Webb L, Kennedy C, et al. Development of a Novel Tool to Assess the Impact of Itching in Pediatric Cholestasis [J]. *Patient*, 2018, 11 (1): 69-82.
- [21] Kennedy C, Abetz-Webb L, Lambe J. Challenges in recruiting patients for the linguistic validation of pro instruments developed for rare diseases: A case study with alagille syndrome [J]. *Value in Health*, 2014, 17 (7): A575.
- [22] S E, S H L, V G, et al. The 5-D itch scale: a new measure of pruritus. [J]. *The British journal of dermatology*, 2010, 162 (3).

- [23] Hsiao C H, Chang M H, Chen H L, et al. Universal screening for biliary atresia using an infant stool color card in Taiwan [J]. *Hepatology*, 2008, 47 (4): 1233-1240.
- [24] Chan P, Soon Y, Bennett T, et al. The performance and efficiency of the infant stool color card as a screening tool for biliary atresia: A systematic review [J]. *Journal of Gastroenterology and Hepatology*, 2019, 34: 205.
- [25] Kwak A, Dabrowska M, Jankowska I, et al. Health related quality of life in children with progressive familial intrahepatic cholestasis after partial external biliray diversion [J]. *Pediatrica Wspolczesna*, 2005, 7 (3): 201-204.
- [26] Vimallesvaran S, Nevus L, Deheragoda M, et al. Allograft histology and biopsychosocial health 10 years after liver transplantation in children [J]. *Transplantation*, 2019, 103 (8): 92.