Transition to Adult Care: Adolescents Care

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Overview

The effects of a chronic illness on adolescents in most cases can significantly touch both biological and psychological development, sometimes deteriorating also their cognitive and social relationships. Transition of these patients from pediatric hepatologists (PHs) to a service for adults, if based simply on their chronological age without adequate parties' preparation, is therefore a challenging condition. This is in fact complicated by the intrinsic still ongoing adolescence process and the usual scarce information of Adult Hepatologist/General Practioner (AH/GP) on the long-term outcome of these possibly "unfamiliar" diseases as well. For these reasons, pediatricians are often encouraged by specific subspecialties' scientific associations to develop strategies for overcoming barriers, putting emphasis in general on patients' self-management, improvement of knowledge about their own condition, supporting the decision-making process, and improving the links with the new doctors. Several models of transition for a number of pediatric onset chronic diseases (e.g., diabetes mellitus, cystic fibrosis, rheumatologic, and renal diseases) have already been suggested. However, the levels of evidence of this growing number of publications reported in the recent years are still low [1]. Interestingly, there is only a structured transition program proposed for patients with pediatric onset chronic liver disease (CLD) including those

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undergoing liver transplant (LT) [2]. Both CLD and LT populations in the last decades have significantly increased their survival rates and quality of life as well. In this chapter, we describe problems expected at the time of transition, any impacts on morbidity and mortality in adulthood, and information to AH/PH for ensuring continuity of care for young adults affected by diseases they may be unaccustomed.

34.1 Introduction

Transition is an active and evolving process that addresses the medical, psychosocial, and educational needs of young people as they prepare to move from child- to adult-centered health care. Transition programs need to be developed in close collaboration with adolescents. The best clinical practices regarding transition should respect local circumstances, gender and the location of post-transfer medical follow-up [3]. It is well established that chronological age by itself is not sufficient to decide when to start and finish the transition process and that a flexible and individual approach would instead be preferable. The timing of an appropriate transition process should be based on the patient's psychophysical development, the family's socioeconomic conditions, and the availability of AH. The definitive transfer should also take place after the assessment of the adolescent's mental health, and when he/she has a good physical and emotional stability. However, there are examples of multidisciplinary transition units in which PHs follow patients together with AHs up to 18 years of age reserving even a 25-year limit for those rarer conditions that do not immediately have an available skilled AH [4]. For a more effective transition process, the Hepatology Committee of the European Society for Pediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN) recommends the following documents (Fig. 34.1):

- Letter from the PH with summary of the patient's clinical history
- Transfer plan with a list of dates and appointments
- Emergency plan in case of medical criticality
- A verification test completed by the patient for self-assessment of his/her own maturity in the management of the pathology

A nursing checklist should be proposed for the psychophysical assessment of the patient within the different stages of the transition process.

It is well documented that the implementation of an effective transition program requires an integrated and multidisciplinary effort, from both the pediatric and the adult staff, to create a team that is as multi-professional as possible, coordinated by a reference figure. Nursing staff could play a central coordinating role in the correct delivery of transition programs, allowing the young patient to progressively cut out a leading role in his/her health care.

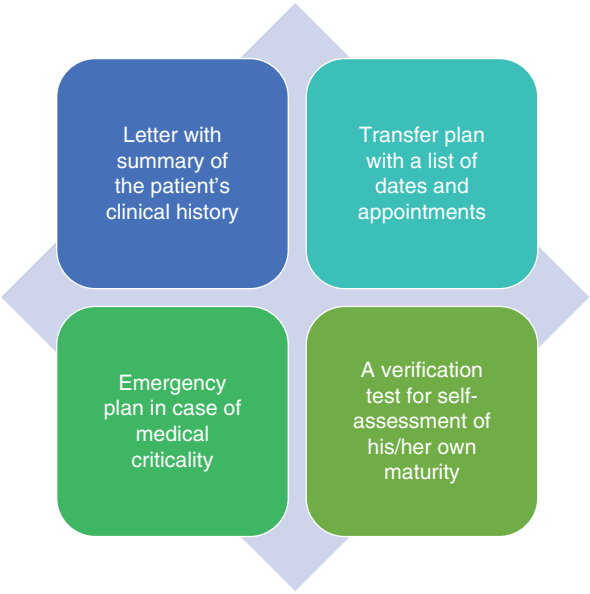

Fig. 34.1 Documents which should accompany the liver transplant adolescent at the moment of the Transition

34.2 Recommended Strategies

A transition plan should be based on the patient's readiness and on a coordinated multi-professional team work, with transition monitoring until the completion of the first year in the adult service. When patients endorse more responsibility for their care too early, clinical outcomes are worse, indicating that indiscriminate promotion of self-management by adolescents may not be prudent. Assessment of adolescent executive function skills may help guide the development of individualized transition readiness guidelines to promote successful gains in self-management abilities as well as eventual transfer to adult medical services [5, 6].

(a) The **preliminary phase** of preparation should begin well before the planned transfer, preferably by introducing the process as early as adolescence starts (12–14 years), with educational interventions, practiced with clear language, aimed at helping patients to understand their own health condition, the sense of treatments, the origin of their symptoms, and monitoring strategies (for example, weight-based therapy changes, liver function tests, renal function monitoring, signs of infections, etc.). The implementation of this phase at least 3 years before the final transfer helps to make the whole transition process optimal. Issues related to treatment (treatment adherence, drugs' side effects) should be discussed at regular intervals with patients and parents. More important issues to highlight in this phase are sexuality (potential transmissibility in case of chronic infections, involuntary pregnancies, etc.), the vaccination calendar (e.g., vaccines for HBV, HAV, HPV), the damaging effect on the liver due to overweight/obesity, excessive consumption of alcohol, and/or illicit drugs.

(b) The preliminary phase must be followed by several **combined visits**, if possible, in a dedicated center (transition unit) or alternatively in adult-oriented and pediatric care centers, for a period of at least 12 months until a final assessment of the degree preparation for transfer. If a teenager is not yet ready, he can repeat this test until he/she is well prepared (even if some young people can never reach this level of independence). Parents should be supported to move from a "managerial" to a "supervisory" role during transition to help young people engage independently with the healthcare team.
(c) The **final pediatric visit without parents** should preferably take place around 18 years and in any case no later than 25 years of age, for those who have had difficulties to find an expert AH.

34.3 Main Barriers to Transition

Considerable medical advances in recent decades have allowed an ever-increasing number of patients with pediatric onset liver disease necessitating LT to survive in adulthood. A proportion of these patients has diseases that are highly specific to childhood, and exposure of these entities to AH may have been minimal. About 50% of these patients have been transplanted in the first 2 years of life, so they have no memory of life without a transplant. Moreover, living-related transplantation with donor and recipient coming from the same household may lead to complex family interaction in case of chronic graft failure.

Adherence to prescribed treatment in LT adolescents (LTAs) cannot be automatically expected and may be difficult to monitor. Available studies show in fact that the majority of adolescents with pediatric onset native/untransplanted liver disease may show reduced adherence to treatment in spite of their requirement for a permanent treatment because of the possibility of injury and/or progressive portal hypertension, which may lead to transplantation [7]. Screening tools on psychological and social aspects have been proposed to detect young patients at risk of nonadherence to treatment [8]. The scarce disease literacy and compliance with the pharmacological treatment, along with the lack of confidence in the AH, may similarly lead also to graft loss and the need for re-transplantation in LTAs. The causes for *nonadherence (NA)* to medication and for poor confidence in hospital visits following transfer to adult clinics are complex. They include the difficulties young people experience in the development from childhood to adulthood, their need to become self-reliant, and the different medical approach of pediatric and adult care [9]. The topic has recently been reviewed by Kelly and Wray [10].

Another important aspect of transition is that AH also need to be familiar with the long-term consequences of pediatric liver disease or LT performed in childhood (Table 34.1).

Preventing adolescents from feeling abandoned in the transition to adult health services is a major challenge. If a dedicated service is not available in the vicinity of the patient, every effort should be made to identify the nearest and accessible one.

Table 34.1 Specific new onset issues during the follow-up of transitioning youth with LT well known by adult providers requiring special attention

Post-LT liver issues
• Possible recurrence of previous liver disease (e.g., AIH; PFIC 1–3)
• De novo NAFLD
• De novo AIH
• Liver fibrosis
• Hepatic artery thrombosis
• Graft loss and need for re-transplantation
• Need to simplify the therapy (reducing number of drugs)
• Poor adherence to immunosuppressors
Other organs/systems
• Linear growth impairment; delayed Tanner 5 pubertal stage
• Obesity, arterial hypertension, diabetes, metabolic syndrome, insulin resistance
• Poor renal function
• Epstein-Barr virus-related post-transplant lymphoproliferative disease
Social
• Lower school performances
• Lower physical health-related quality of life
• Feelings of limitation of freedom, loneliness
• Negative thoughts, problematic relationships
Sexuality/pregnancy/newborns
• Concern about transmitting illness to descendants
• Lack of understanding about genetic risk
• Immunosuppression effects on fertility and future children's health
• New possibilities for breastfeeding

Abbreviations: *AIH* autoimmune hepatitis; *NAFLD* nonalcoholic fatty liver disease; *PFIC* progressive familial intrahepatic cholestasis

NA in adolescence is often part of a constellation of other risky behaviors including alcohol and illicit drugs use, involuntary pregnancy, mental health problems, and legal problems. In adult settings, patients are expected to display behaviors consistent with self-management, for instance, independently discussing one's illness and concerns with the treatment team, scheduling and attending appointments, and so on. However, when patients endorse more responsibility for their care too early, clinical outcomes are worse, indicating that indiscriminate promotion of self-management by adolescents may not be advisable. Another relevant issue is that adolescents may lose insurance coverage into adulthood, which may restrict care. Addressing all of these topics early and repeatedly, however, is important in improving adherence and thereby maximizing long-term outcome. In the absence of a transfer process, patients may experience anxiety, confusion, distress, inability to manage the requirements of the new setting, increased risk of nonadherence, rejection, and even mortality. Regular meetings, specific training programs in adolescent medicine, as well as appropriate technological support (e.g., mailing lists, chat, SMS) for patients and PH interaction should be used regularly to improve the effectiveness of the transition program. To this end, websites including lists of specialists who are prepared to work with pediatric problems associated with transition, civic education campaigns by national societies, and mass media collaboration have been proposed to significantly help to create nationally based transition networks.

According to AH, the greatest barriers to optimal care are often represented by patients' poor adherence and limited knowledge and management capacity of their condition [11]. The persistent presence of relatives with their strong control on everything that happens to their kids is more frequent sometimes with a greater impact on the outcome of transition, than the poor adherence of young patients. If a formal transition program exists, negative consequences such as patient's inability to discuss the impact of their condition on their overall daily life, fitness, and sexuality are reported as less common [12].

34.4 Long-Term Management

Advancements in surgical techniques, organ procurement, pre- and postoperative management, and immunosuppression have led to outstanding strides in pediatric LT. As more and more recipients enter into adulthood, more attention is paid to the potential harm of chronic immunosuppressive therapy itself, with long-term side effects including:

- Renal insufficiency
- Cardiovascular disease
- Diabetes mellitus
- Opportunistic infection
- Post-transplant lymphoproliferative disorders (PTLDs)
- Osteopenia

Opportunistic infection and PTLD account for 30% of late mortality in pediatric LT recipients. As a result of the concern for potential side effect morbidities, there is a rise in interest in immune-suppression minimization and withdrawal. It is estimated that 20–25% of pediatric LT recipients will be operationally tolerant without immunosuppression, but it is not yet possible to forecast who are those in this group. Abnormal liver enzymes are common among long-term pediatric LT survivors, with up to one-third having abnormal transaminases, and nearly half often with abnormal gamma-glutamyl transferases 5 years post-LT. Furthermore, chronic hepatitis, liver fibrosis, or both have been described in 40–50% of otherwise asymptomatic 5-year survivors with normal liver function tests, supporting the need for protocol biopsies and further investigation. The long-term outcomes after LT strongly depend on adherence with medical regimen and lifelong intake of immunosuppression and close medical follow-up. A multidisciplinary approach aiming at fostering adherence should be used [13].

The most common cause of late graft loss is chronic and late rejection. NA was estimated to occur in 20–50% of LTAs and is the most common cause of late acute rejection in children who receive an LT [9]. NA is associated with increased medical costs as well and ultimately leads to death [14]. The American Society of Transplantation (AST) [15] confirmed transition as an obstacle to long-term graft survival for pediatric transplantation.

As children get older, the medication intake responsibility shifts from caregivers (usually parents) to child. By 9 years of age, 30% of children are expected to be responsible for taking their medication, which is a vulnerable time for NA. Pediatric LT recipients' medical and psychosocial needs change over time, and it may be challenging to identify NA. Subjective methods such as patient reports are poorly reliable; pill counts, refills, and electronic monitoring impose additional burden on the patient. The Medication level Variability Index (MLVI), i.e. standard deviation of consecutive immunosuppressive measurements, has been proposed to predict the degree of treatment adherence [16]. Variability Index greater than 2.5 in children was associated with increased risk of rejection and may be used to predict NA [17].

It is crucial to better identify high-risk populations, improve detection methods, and plan earlier interventions. The most reported barrier to adherence was forgetfulness and vomiting (70%), followed by bad taste and interruptions in routine (60%), anxiety, depression, and post-traumatic stress disorder. The medication regimen should be clear and simplified as possible. A systematic review of immunosuppressant adherence interventions in transplant recipients revealed only a few successful interventions, including counseling, increased clinic visits, mobile devices with automated reminders, and telemonitoring. It is important to address adolescent psychosocial health issues with the patients and their families and provide counseling on smoking, illicit drug use, alcohol use, birth control, and sexually transmitted disease [18]. In this context, primary healthcare professionals should be involved for the best therapeutic alliance [10, 19].

A number of important issues that need to be monitored in LTAs during transition are as follows:

(a) **Pregnancy/Lactation**

The goal of LT in the current days is not only to ensure survival but to also to attain a quality of life for patients similar or superior to their premorbid state, which for many women includes having a family. Fertility following transplantation is restored in the majority of women, as early as 1 month post-transplantation; hence, discussion regarding appropriate contraceptive use is imperative. There are however significant increased risks of unpredictable graft deterioration, preeclampsia, infections, and diabetes in the mother, and for the fetus, an increased risk of prematurity and low birth weight exists [20]. Acute cellular rejection (ACR) complicates between 10 and 17% of patients in the gestational period, and 3 and 12% of patients in the postpartum period. The incidence of ACR can be significantly reduced by delaying pregnancy for 1 year following LT. Graft loss directly related to ACR in pregnancy is rare with immunosuppression augmentation controlling the majority. An episode of ACR during pregnancy may identify those women who are already at an increased risk of graft loss due to poor graft tolerance and may benefit from augmented baseline immunosuppression. Immunosuppression should be continued throughout pregnancy. Common agents including azathioprine, tacrolimus, cyclosporine, and steroid therapy are generally safe, and any small risk to the fetus from the

medication is much outweighed by the risk of rejection and graft failure by discontinuation. Mycophenolate is associated with congenital abnormalities including external ear and other facial malformations such as cleft lip and palate and ideally should be discontinued with at least a 6 month wash out period before conception [21]. Female LT patients who are of child-bearing age on mycophenolate should use methods of birth control due to the known teratogenicity of this immunosuppressive agent.

Currently, the majority of neonates born to organ recipient mothers on chronic immunosuppressive therapy are formula fed. However, over the past few years, evidence has grown, suggesting that breastfeeding might be possible and beneficial. Low concentrations of tacrolimus and its metabolites, M-1 and M-3, in colostrum show that neonates ingest trace amounts of the drug [22]. There are multiple factors that can increase the fraction of unbound tacrolimus, including but not limited to low albumin concentration and low red blood cell count. Tacrolimus crosses the placenta with in utero exposure being approximately 71% of maternal blood concentrations. The lower fetal blood concentrations are likely due to active efflux transport of tacrolimus from the fetus toward the mother by placental P-glycoprotein. To date, tacrolimus has not been linked to congenital malformations but can cause reversible nephrotoxicity and hyperkalemia in the newborn. In contrast, very small amounts of tacrolimus are excreted in the breast milk and are unlikely to elicit adverse effects in the nursing infant [23].

(b) **Surveillance of the Appearance of Other Hepatic and Non-hepatic Diseases**

- *De novo autoimmune hepatitis* (AIH) after orthotopic LT should be suspected in any unexplained graft dysfunction, in LTAs transplanted for an indication different from autoimmune liver diseases. It is still not clear whether the pathogenesis is autoimmune directed against the "self" or alloimmune against the "nonself" after orthotopic LT. Passive transfer of autoantibodies from the organ, induction by viral infection, drug therapy, and ischemic injury of rejected transplanted organ are the main hypothesized mechanisms. Both typical (antinuclear and anti-liver kidney microsomes) and atypical circulating autoantibodies have been found to be associated with de novo AIH. De novo AIH cytochrome P450 2C19 (CYP-2C19) is a hepatocellular autoantigen of novel liver microsomal (LM) autoantibodies [24]. Management includes the same therapy of classical AIH with steroids and azathioprine.
- ***De novo progressive familial intrahepatic cholestasis type 2*** (PFIC-2) is caused by mutations of the bile salt export pump (BSEP [ABCB11]), an ATP-binding cassette (ABC) transporter exclusively expressed at the canalicular membrane of hepatocytes. An absence of BSEP from the canalicular membrane causes cholestasis and leads to liver cirrhosis, which may necessitate liver transplantation in early childhood. After transplantation, autoantibodies against BSEP can be formed and be detected in patient's serum and at the canalicular membrane, thus causing severe de novo cholestasis due to BSEP inactivation. Missense changes in the BSEP gene resulting in the

complete absence of BSEP explain the lack of tolerance, a prerequisite of autoantibody formation toward BSEP [25].

- **Cancer.** An increased risk for *cancer* after solid organ transplantation is well established. This increased risk is chiefly attributed to lifelong immunosuppression, but the cancer risk pattern is markedly modified by patient-specific factors such as age, history of alcohol abuse, smoking, and transplant indication. In LTA recipients, risk-modifying factors are often absent or different from the typical adult LT recipients. The cancer risk pattern in young patients is therefore likely to differ from the pattern in older patients. In addition, the immune system may not be fully developed in children. However, there is a lack of large studies investigating the spectrum of post-LT cancers and risk factors specifically in pediatric and young adult patients. In studies involving both adults and children, risk factors specific to children and young adults are usually not reported. Most studies of pediatric populations have focused on Epstein-Barr virus-related post-transplant lymphoproliferative disease (PTLD), but few have assessed other types of cancer [26]. PTLD is seen in up to 15% of patients after pLT, and mortality rates of 30%, in single reports of up to 50%, have been described. In addition to optimal antiviral therapy, the choice of the immunosuppressive regimen can significantly influence the risk of PTLD and is an ongoing focus of preclinical and clinical research [27]. The largest studies on this topic included all types of solid organ transplant patients or only kidney transplant patients, but there are no large studies on young LT patients. A unique cancer risk pattern exists among pediatric and young LT recipients. Non-Hodgkin lymphoma is the most common cancer type in these patients. The risk of other cancers increases considerably in young adulthood, after the second decade of life, compared to childhood, and this merits consideration in transition programs. This also calls for strategies to reduce cancer risk, and such strategies may include cancer surveillance recommendations specific to young adult transplant recipients.
- **De novo non-alcoholic fatty liver disease (NAFLD).** Post-transplant steatosis has not been well studied in pediatric liver transplant recipients. The possibility of steatosis-associated chronic liver damage has not been an analytical focus in descriptions of long-term liver graft histology. Steatosis prevalence has been reported in 10–43% of pediatric liver transplant surveillance biopsies in cross-sectional studies. Only few studies evaluated longitudinally whether steatosis persists, and if it should be classified as obesity-related *NAFLD* or due to other conditions, or pertinent to long-term graft damage itself. Hepatic steatosis commonly develops early post-transplant in children and adolescents, but it rarely persists. Biopsies that did have steatosis with NASH characteristics were all for-cause, mostly in patients with NAFLD risk factors and/or confounding causes of liver damage [28].
- **Metabolic syndrome.** During the post-transplant period, the use of immunosuppressants, corticosteroids, calcineurin inhibitors, and the presence of risk factors, including nonalcoholic fatty liver disease (NAFLD), and

kidney complications have been largely implicated in the development of a post-transplant *metabolic syndrome* (PTMS) [27, 29–31]. Strategies to reduce the progression of PTMS should include careful screening of patients for diabetes, dyslipidemia, and obesity, and to support weight reduction with a carefully constructed program, particularly based on diet modification and exercise. With early identification and appropriate/aggressive management, excellent long-term health outcomes and acceptable graft survival can be achieved. Impaired glucose tolerance after pediatric liver transplant is driven by inadequate insulin secretion. It is quite common but not detectable with the fasting laboratory values screening recommended by current guidelines. Calcineurin inhibitors suppress insulin secretion in these patients in a dose-dependent manner. Given the recent focus on long-term outcomes and immunosuppression withdrawal in these children, longitudinal studies are warranted to investigate whether the impaired glucose tolerance is reversible with calcineurin inhibitor minimization [32, 33].

- ***Kidney function***. It can be reduced (17–32% of patients after LT), as a consequence of long-term immunosuppression, but may also be caused by the underlying disease (e.g., Alagille's disease). Furthermore, long-term influence on kidney function of many chronic liver diseases existing already before LT is unknown [27].

(c) **Education, Professional Occupation, and Parental Health Status**

The approach of the AH is often perceived as inadequate by transition patients. LTAs may feel a sense of abandonment or be uncertain regarding transfer to adult care and often tend to remain strongly linked to the PH, still relying on a strict involvement and control by the parents, although the patient's self-perception on the degree of control of his own illness is essential to facilitate a better adherence to therapy. For parents, leaving pediatric care services is more challenging than for patients. They feel anxious about the future, worried about being labeled as over-advocating or being "difficult" in the transition process and afraid of not being adequately informed about their health condition. Furthermore, failure to connect with an adult healthcare provider post transition has been demonstrated to predict future complications in diabetic patients. In this context, LTAs may display regressive behavior during transition, and as a result, transition services should identify this and provide supporting emotional and psychological support. A number of studies show overall psychological well-being improvement in LTAs with psychological interventions, indicating an important role for the psychologist during transition. When agreeing to take care for LTAs, AH should consider that most patients are still attending school, though only one-third is in age-appropriate school grades and—compared to their peers—educational level/academic performance are often lower [2].

34.5 Final Considerations

The transition from adolescence to adulthood is punctuated by numerous changes in physical, emotional, social, and cognitive development, many of which are "physiological."

LTAs have a dual body of experience. One is due to the presence of a preexisting chronic disease in general, the other to the LT.

The definitive activation of a well-established transition process in case of hepatobiliary diseases with pediatric onset and/or LT is still limited by the lack of randomized studies and consolidated sources from literature. Several transition models have been developed, but it is not yet known whether a transition process based on one of these standardized schemes is superior to a process in force in other national and nonnational realities.

Experience implementing a successful transition process underscores the importance of support of key decision makers from both pediatric and adult practices and/or health systems, hospitals, and the early and ongoing engagement of parents and/or caregivers and young adults. Along with physicians, other implementation team members to consider are social workers, nurses, clinic administrators, information technology staff, home care clinicians, and insurers. With the teams identified, defining the transition program's goals, strategies, outcomes, measures, and timeline at the start, allowing the time needed to test and implement the transition improvements are key [34].

Families also need assistance with their new role in the health care of their young adult. In transitioning adolescents with certain chronic conditions as LT, the transfer to AH can vary according to the adolescent's needs and availability of adult care clinicians with appropriate specialty knowledge. Last but not least, strategies including clinical research, innovation, and quality improvement targeting both traditional as well as patient-reported outcomes remain necessary to improve successful transition to adult care of adolescent recipients of pediatric LT [14].

▶ Tip Main criteria for starting transition remain to be focused on age although recent evidence indicates the need also for other emerging discriminators.

Consider that major barriers may be represented by the adult medicine approach itself which is felt unfriendly by young patients, parents' interference, and some lack of trust in the new specialist.

Take into account that poor communication and collaboration between PH and AH has a role as well.

Key Points

- Although there is broad agreement that preparation is needed to help adolescents and young adults during transition process, there is no consensus regarding what constitutes a successful healthcare transition.
- The key elements for an effective transition include correct timing, preparation, and education. A joint structure including pediatric and adult staff would be the "ideal" introduction for young people to the adult medical world.
- It will be crucial to evaluate to what extent a well-structured and planned transition removes barriers, influences medical adherence, reduces the prevalence and severity of complications, and improves health-related quality of life.

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Further Reading

Antonini TM, Girard M, Habes D, et al. Optimization of the transition process of youth with liver disease in adulthood: a position paper from FILFOIE, the French network for paediatric and adult rare liver diseases. Clin Res Hepatol Gastroenterol. 2020;44:135–41. https://doi.org/10.1016/j.clinre.2019.07.018.

(Recommendations and tools designed to optimise the transition process focus on 3 key time points: preparation before the transfer, the transfer process to the adult service, and finally reception and follow-up within the adult-care service)

Lawrence ZE, Martinez M, Lobritto S, et al. Adherence, medical outcomes, and health care costs in adolescents/young adults following pediatric liver transplantation. J Pediatr Gastroenterol Nutr. 2020;70:183–9. https://doi.org/10.1097/MPG.0000000000002553.

(The time around transition from pediatric to adult health care models represents a period of increased vulnerability for pediatric LT recipients).

Nakanishi C, Miyagi S, Tokodai K, et al. Pediatric living-donor liver transplant recipients without transition after reaching adulthood. Ann Transplant. 2019;24:18–24. https://doi.org/10.12659/AOT.911544.

(Having the same team perform both adult and pediatric transplantation and post-transplant care appears beneficial for young adult recipients).

Nasr AS, Rehm RS. Understanding the long-term impact of living-related liver transplantation on youth and young adults and their family. J Pediatr Nurs. 2020;55:217–23. https://doi.org/10.1016/j.pedn.2020.09.004.

(Qualitative/quantitative data show positive effect of living-related liver donation on pediatric patients as they transition from childhood to adolescence/young adulthood).