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GUIDELINES

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Egyptian paediatric kidney transplantation pre-transplant guidance highlights on donor and recipient assessment (R. N. 364)

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Abstract

Background Kidney transplantation for chronic kidney disease (CKD) in children is the best treatment option. It needs special medical and surgical expertise highly skilled in management of pediatric age group. Our Egyptian profile for causes of end-stage renal failure (ESRF) in transplanted children reflects prevalence of inherited kidney diseases IKD (43%), urologic causes (26%), glomerulonephritis (GN) (17%), and unknown causes (14%). Renal graft availability remains a great challenge.

Aim We need pediatric kidney transplantation (PKT) guideline since children have unique causes for ESRF compared to adults. Their transplant team should be skilled in management of children challenges. Recipients may not have one transplant per life. Long-standing immunosuppression will have its toxicity and need regular monitoring. Lots of data are extracted from adult guidelines lacking paediatric background. Young paediatric nephrologists need short version guidelines rich in educational figures for management plans. Children and their families need Arabic orientation booklets and supportive programmes. National Insurance System sponsors should be guided by National Pediatric Guidelines to minimize the centre's variations.

Methods Our National Pediatric Guidelines are evidence based adapted from international four source guidelines with permissions [KDIGO-2020, RA/BTS 2022-2018, EAU 2018] that were appraised with Agree 2 plus tool using PIPOH format health questions. We followed the 'adapted ADAPTE' CPG formal adaptation methodology that consists of three phases and 24 steps and tools. It was registered on the practice guideline registration international guideline registry with a registration number IPGRP-2023-12-27 CN 312.

Results Summary includes recommendations for assessment of (1) potential living adult donors for age, medical, surgical, immunologic, familial, metabolic, malignancy, and any donor morbidities and (2) transplant recipient assessment for age, weight, nutritional, psychosocial, immunological, infection states, primary native kidney disease, associated morbidities, the presence of genetic, immunologic, infection, and malignancy risks.

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Conclusion Pediatric kidney transplantation guidelines aim for better donor, recipient, and graft survival. Recommendations are tailored as adopted or adapted statements from evidence-based source guidelines to suit our local pediatric CKD profile.

Keywords Kidney transplantation, Donor recipient assessment, Genetics, Immunologic, Psychosocial, Morbidity, Infection, Surgical assessment

Background

Kidney transplantation for chronic kidney disease (CKD) in children is the best treatment option avoiding them all complications of dialysis. Transplanted children show better growth catchup, physical and mental performance, and quality of life [1]. Being an advanced, specialized health service for children, it needs special medical and surgical expertise highly skilled in management of paediatric age group. Our Egyptian profile for causes of end-stage renal failure (ESRF) in transplanted children reflects prevalence of inherited kidney diseases (IKD) (43%), urologic causes (26%), glomerulonephritis (17%), and unknown causes (14%). Therefore, contribution of geneticists and urologist in Paediatric Kidney Transplantation Guideline looks essential [2]. Renal graft availability is a great challenge in both living and deceased donor programmes. Living-related donor-based programmes are currently the legally permitted programme in Egypt which also ensure a better graft outcome.

Aim

Why do we need paediatric guidelines for kidney transplantation?

Paediatric kidney transplantation has unique causes for ESRF that is different than adults. Their transplant medical and surgical team should be skilled in management of that age group and its post transplantation challenges. Recipient may not have one transplant per life. Longstanding immunosuppression will have its toxicity or side effects and need regular monitoring specially as its GIT tolerance and metabolism show personal variation in children [3]. Lots of data are extracted from adult guidelines lacking paediatric background. Young paediatric nephrologists need short version guidelines rich in algorithms and educational figures related to common management plans in paediatric kidney transplant (KT). Transplanted children and their families need continuous orientation with Arabic booklets as well as supportive programmes. National Insurance sponsors paediatric kidney transplant (PKT) inside transplantation centres with national code that should be guided by the National Pediatric GL to minimize centre variations. Therefore, children need their own kidney transplant guideline.

Our Egyptian profile for causes of ESRT transplanted children through 2009–2017 in Cairo University Children Transplantation Center showed the prevalence of *IKD (43%), urologic causes (26%)*, FSGS (18%), and unknown cause 14% [2]. *Infection* status of transplant candidate recipient (TCR) children shows prevalence of CMV and HCV, while donors show CMV, EBV, HBV, and HCV. Therefore, each country transplantation centre should have clear *anti-infection strategy* for pre-transplant recipient vaccination, donor and recipient (D&R) viral screening, post-transplant *antiviral* prophylaxis, monitoring, and treatment strategies respecting our local profile. Rejection rate of 26% was reported in the same study, despite use of living donation (LD), low-risk recipient, and strong nongenetic immunosuppression (IMMS). Such data require analysis of risk factors in more extended research work, IMMS protocols update, and strict monitoring strategy for early identification and management of rejection. *Non-adherence* in adolescents is problematic worldwide. *Supportive programmes* and affording families with educational booklets in Arabic could be very helpful [2].

Methods

Our paediatric national guidelines for kidney transplantation are evidence based *adapted from* international four source guidelines with permissions [4–7] (**KDIGO 2020, RA/BTS 2022–2018, EAU 2018**) *that were appraised with AGREE 2 plus tool using PIPOH format health questions*. Recommendations are tailored as adopted and or adapted statements to suit our local, paediatric CKD profile, facilities, and expertise. The following article is concerned with (1) pre-transplant guidance (donor and recipient assessment), to be followed with (2) post-transplant guidance. Summary for EPG guideline is included in the appendix supplement and through the link EPG website. Highlights on important adopted and or adapted recommendations are presented in the discussion. *Tables and figures* are included in guideline *appendix* [8, 9].

We followed the 'adapted ADAPTE' CPG formal adaptation methodology that consists of three phases and 24 steps and tools [13–18]. *It was registered on the practice guideline registration for transparency (short prepare)* international guideline registry with a registration number IPGRP-2024 CN374, link http://www.guidelines-registry.org/index).

Setup phase 1 (paediatric kidney transplantation) was highlighted as one of the prioritized health topics for the EPG CPG adaption initiatives during phase 1 (setup). A preliminary search was carried out to revise and choose from the available existing Evidence-Based Pediatric Kidney Transplantation (PKT) CPGs to be our reference source. With 26 members, the Pediatric KT Guideline Adaptation Group (GAG) was established including transplant paediatric nephrologists, adult nephrologists, urology and vascular transplant surgeons, paediatric geneticist, lab immunologists, pathologist, and different paediatric subspecialities consultants, e.g. paediatric cardiologist, haematologist, endocrinologist, and oncologist. Members represent three Egyptian universities and an institute with transplantation code and experienced in paediatric transplantation. Six members of the PKT -GAG were involved in the development of the adapted ADAPTE and had previous experience with CPG adaptation. CPG methodologists provided capacity training for the PKT-GAG paediatric and nephrology consultants on the adapted ADAPTE from the start of the project. Continuous virtual meetings extending through 1 year starting at March 2023 were scheduled for interactive communications between working group members. Our scope was paediatric kidney transplantation including (1) pre-transplant guidance and (2) post-transplant recommendations. PKT target patient population for this CPG project include CKD children below 18 years old, target users paediatricians, paediatric nephrologists, nurses, and clinical pharmacists. Work group was divided into two panels assigned to cover each GL (1) pre-transplant and (2) post transplant with continuous communication at monthly virtual meeting with attendance of all working groups' members. For clarity, we will report the adapted recommendations of the EPG CPG/PKT in two separate guideline formats: (1) pre and (2) post PKT.

In adaptation phase 2, we identified health questions, using the PIPOH model (in the guideline booklet appendix). PIPOH model included the target patient population (P), intervention (S), professionals, and clinical specialties (P), outcomes (O), and healthcare setting (H). Literature search was conducted using MEDLINE/PubMed and Google Scholar portals. Eligible source CPGs were evaluated using the Appraisal of Guidelines for Research and *Evaluation (AGREE II) Instrument*.

**AGREE II* is a valid and reliable instrument with 23 items organized into 6 domains and is considered the gold standard for quality assessment of CPGs [14, 15 booklet references]. Documents for appraisal of source CPGs, health questions, and PIPOH model are included in guideline booklet. The first draft of the adapted CPG marks the last step of this phase.

**RIGHT-Ad@ pt checklist*, reporting the *adopted/adapted evidence-based clinical practice* guideline paediatric pre-transplant guidance, was used.

Finalization phase 3 involved in finalizing the initial draft of the adapted CPG, as well as determining whether it was acceptable and suitable to the Egyptian healthcare system. Thereafter, the document was sent out to a panel of four local paediatric nephrology reviewers including adult nephrologist and thereafter three international reviewers including two international paediatric nephrologists transplant consultants, one international surgical transplant consultant, and one methodology external reviewer. Reviewers' comments were revised. Updated draft was further reviewed within the KT-GAG, considering the national context.

*Finalized version of the revised CPG contained useful tools and strategies for implementation. *Registration number PREP-2023CN364 [8, 9] refers to summary of GL recommendations in appendix supplement and its implementation tools. Refer to original format at EPG web site after publication: www/http://epg.edu.eg/.

Results

Recommendation statements in guidelines stand for results in research articles. Recommendations are summarized in the attached supplement and discussed in the article as below.

Recommendations

A supplementary file is attached including summary of recommendations for assessment of (1) potential adult donors discussing contraindications for living kidney donation related to age, medical, surgical, immunologic, familial, metabolic, malignancy, and any donor morbidities and (*2*) *transplant recipient as*sessment discussing candidate age, weight, nutritional, psychosocial, immunologic, and infection states. Primary native kidney disease, associated morbidities, the presence of genetic, immunologic, infection, and malignancy risks. Assessment steps for donor and recipient were included in the figures.

Discussion

It will highlight important adopted/adapted recommendations discussing rationale behind.

R1: *Access to kidney transplantation in children* **(R1–15)** — our guideline starts its address to paediatric nephrologists

at CKD clinics, dialysis staff, and children's families, discussing *whom and when to refer to kidney transplantation?* **[EPG-R1–R15]**, thus confirming early orientation for families of CKD children at GFR 30 ml/min/1.7 m^2 with kidney transplantation, being their best treatment option as compared to dialysis (*EPG*) **(R1.8)**. A GFR 15 ml/min/1.7 (or higher level if severe symptoms) justify their referral to transplantation within 6–12 months of anticipated *dialysis***(R1.2)**. Earlier or later referral depends on donor availability, considering that pre-emptive KT show the best outcome **(R1.8)**. Non or late referral as recommended **(R1.9)** was related to miss communication between nephrologists, dialysis, transplantation teams, and patient family neglect despite being informed and educated. However, lack of donor remains as the most leading cause (*EPG*) **(R1.8)**. Dialysis support for cases with reversible barriers, until properly managed, was clear **(R1.2–R1–5)**, while absolute contraindications were raised as well **(R1.3)** (Table 1). Recommendations about living kidney donation, pre-emptive KT, and MDT members are included in **[R:1.8, R:1.10]**, *while those related to age*, weight, and nutritional assessment were clearly referred to (R:1.10]–[R:1.15]. Recommendations in this area *are adopted as KDIGO 2020*. Controversies for optimum lowest weight and height differ between centres were clarified in **[R:1.12, 13, 14]**. However, surgical team approval for child body habitus that accommodate adult size kidney is crucial (*EPG*) **[R:1.15]**. Superiority of pre-emptive KT has been widely discussed in the literature **R** [10–12]. (Table 1*summarizes indications for referral and delay and contraindicates kidney transplant*).

R2: *Assessment EPG R:2 of potential donor and transplant recipient* prior to kidney transplantation must be done simultaneously in paediatric KT, since children on dialysis or CKD clinics are regularly assessed and monitored for associated morbidities, while donors will be assessed just once available. D&R assessment steps are summarized in Tables 1, 2, 3, 4, 5, 6, 7 and 8.

Recipient assessment

R2: *Identification of the primary renal disease* — We preferred to be the start in recipient evaluation since *(1) despite clinical assessment is regularly done for CKD children in CKD clinics or dialysis wards, many remain with unknown cause (14% total transplants); *(2) early identification of IKD will lead to better donor selection and ensure their families about less recurrence risk; *(3) identification of diseases with high recurrence risk to inform donor and recipient and share with MDT discussion about treatment plan (KT vs dialysis); *(4) secondary immune complex renal damage related to drugs, infections, and autoimmune disease should be controlled prior to transplant to ensure clinical and serological remissions;

Table 1 EPG access to kidney transplantation

No	Yes	Manage barrier Delay
• Progressive neurological disease • Liver cirrhosis • Severe lung disease • Severe cardiac disease	Refer GFR < 15 mg/ml/1.7 m^2 and GFR > 15 mg/ml/1.7 m^2 if severe symptoms	• Active infection • Active malignancy • Unstable psychiatric • Non-adherence, substance abuse • Systemic manifestations • Hyperpara, active bone disease • Consultation recommendation

Table 2 Assessment targets

Chronic kidney disease cause	Medical (genetic, immunomediated, urological)
Recipient candidacy	Age, weight, nutritional assessment, immunological assessment, Psychological and surgical assessment Neurological, cardiac, hepatic, pulmonary, gastrointestinal tract, haematological assessments
Comorbidity	Diabetes mellitus, malignancy
Risk (R) stratification cause	Non-adherence, rejection R, infarction R, recurrence R, cardiovascular disease, bone disease R, diabetic R, malignancy R, surgical R

Table 3 Recipient assessment

• History data (age, sex, consanguinity, family history of renal disease)
• History about primary disease for chronic kidney disease, previous dialysis, or transplantation
• Clinical medical and urological assessment
• Genetic tests for suspected inherited kidney disease
• Blood group, HLA typing, PRA, cross match
• Complete blood picture
• Glomerular filtration rate (GFR), renal function, blood chemistry
• Liver functions, lipid profile, coagulation profile
• Fasting blood sugar, 2-h post prandial
• Urine analysis, culture
• Viral serology, immunoglobin G, immunoglobin M (hepatitis HBV, HCV, CMV, EBV, HIV)
• Skin test for tuberculosis
• X-ray chest, ECG, echocardiography
• Urologic evaluation: Ultrasound renal doppler (USRD), voiding cystourethrogram (VCUG), urodynamics, cystoscopy
Duplex scan if pervious femoral catheter's endoscopy
• *Immunologic tests HLA pre-TX*: Potential donor and recipient candidate should be tested for ALL HLA loci
(Recipient, donor), classes I and II antigens use AB titration method CDC. Poor mismatch results identify HR stratification
• *Psychosocial assessment* to identify potential barriers (substance abuse, non-adherence, lack of social support, ….)
For referral to pre-transplant programmes before transplantation

Table 4 EPG donor assessment

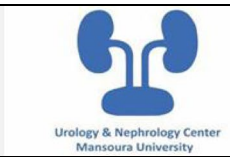
• History, age, sex, relation, consanguinity, +ve family history of renal disease
• Clinical examination, weight, height, BMI < 32%, full clinical assessment
• Psychological evaluation (competent, willing, psychosocially stable)
• Blood pressure (three times assessment, ambulatory blood pressure)
• Investigations results, as recommended, for both donor and recipient
Donor data include the following:
• Complete blood picture, PT, PTT
• Urine analysis and culture, albumin/creatinine ratio
• GFR, blood chemistry
• Liver functions
• Fasting blood glucose, lipid profile
• Viral serology (HIV, hepatitis B, C, CMV, EBV)
• Skin test for TB, urine Ziehl-Neelsen PCR for tuberculosis
• Screening for malaria, schistosomiasis in endemic areas
• Screening for hypercoagulability
• (APC, anti-phospholipids, ADNA, ANCA, APLA2ab….)
• ECG, echo, chest X-ray, 1C
• Renal imaging: USRD, CTA, MRA, isotopic scan
• Endoscopy: Upper/lower
• Mammogram: Prostate-specific antigen PSA
• Cystoscopy
• Renal biopsy
• Genetic tests

and *(5) urologic causes of ESRD may need extended imaging, metabolic workup, genetic testing, and surgical intervention prior to KT.

R2.1: *Identification of genetic kidney disease (IKD)* (refer to guideline supplement) — genetic recommendations require special discussion in any Pediatric Kidney Transplantation Guideline [6, 13, 14], IPNA 2020 [13], BTS 2018 [6], and Kidney International Reports (2022) [14]. Therefore, this area was well covered in our EPG/PKT recommendations by chair of scientific committee for Egyptian Genome Project and Inherited Kidney Disease (IKD) Group. Reasons behind our concern are as follows:

1) Egyptian profile for IKD 2009–1017 showed IKD 43% of total paediatric transplants, PKD 2%, hyperoxaluria 5%, Alport 3%, NPHS 35%, cystinosis 2%, genetic FSGS 42%, and syndromic 11% [2] (Fig. 1).
2) Genetic Expert team is essential for assessment of renal phenotype/genotype of recipients, genetic tests required, interpretation of results, proper donor selection, and family counselling (*refer to R2.1a*). Disease-specific recommendations for PKD, SRN, familial haematuria, and hyperoxaluria should receive special concern *[R2.1b]*. Living-related donor assessment *[R2.1c]* ensures proper donor selection for better graft outcome as well as avoid donor risk of de novo disease if missed diagnosis as carrying the mutation (Figs. 2 and 3) illustrates workup for living donor genetic assessment (refer to recommendations summery supplement) supplement.

Table 5 Guidelines for contraindications of living donation (donor selection)



Nephrology and transplantation unit Guidelines for contraindications of living donation Donor Selection		
	Absolute	**Relative***
Age **(Consider the Egyptian law)**	• **Below 21 years** • **More than 65 years**	**60-65 years**
Unwillingness	**Should be excluded**	---
Mental illness	**Should be excluded**	---
Active substance use	**Should be excluded**	---
GFR	**Below 80 ml/minute for > 30 y old** **Below 90 ml/minute for < 30 y old**	**80-100 ml/min in male** **80-90 ml/min in female**
Proteinuria	**> 300 mg/day**	**150-300 mg/day**
Hematuria	**Persistent dysmorphic hematuria more than 5 RBCs/HPF**	---
Pregnancy	**Current**	---
Malignancy	• **Active** • **History (lung, breast, UT, GIT, testicular, hematologic, melanoma)**	**History of curable cancer (e.g. carcinoma in situ of cervix) with complete cure & no residual risk**
Infection	• **Active** • **Old urinary Tuberculosis** • **Transmissible (HBV, HCV, HIV)**	**HCV antibody positive/PCR negative donor to HCV patient**
Disorders requiring anticoagulation	**Should be excluded**	---
History of thrombosis with risk factor(s) for future episodes	**Should be excluded**	---
Hypertension	• **Uncontrolled** • **More than one drug** • **End organ damage.**	• **Borderline Blood Pressure readings** • **Easily controllable with only one medication** • **Strong family history**
Obesity	**BMI more than 40**	**BMI 30-40 (no other abnormality)**
Diabetes Mellitus	• **Overt** • **Impaired glucose tolerance**	• **Strong family history** • **Impaired glucose tolerance**
Urologic anomalies	**Significant**	**Borderline** **(e.g. multiple renal arteries)**
Urinary stones	• **Recurrent** • **Bilateral**	• **One episode >10 years ago** • **Current small asymptomatic stone on the side of potential donation with no previous episode.** • **Exclude metabolic abnormalities.**
Chronic illness	**Significant**	**Mild**
A donor with a relative contraindication would only be accepted (case by case) if he/she is: • **Age > 50 years (except for multiple renal arteries) -The only available donor** • **Agreed on by the unit committee and by other specialties if needed.** • **Strongly willing, fully understanding the possible risk of donation & informed consent is taken** • **Having only one relative contraindication (isolated medical abnormality) -A parent (preferable)**		
Approved by unit committee: 20/1/2014 - Revised: 16/2/2018.		

Table 6 Pre-transplant preparation policy steps in Nephrology and Transplantation Unit/Urology and Nephrology Center, Mansoura University

Step 1 (Donor &Recipient) Clinical assessment, Blood Grouping
Recipient; Clinical assessment and identification of the original kidney diseases. Donor; ABO matching, urine analysis 2, clinical evaluation, preliminary consent.
Step 2 (Donar & Recipient) Lab and Haematology workup . DUS.
• Kidney function tests (urine analysis, serum creatinine, 24-hour urinary protein and creatinine clearance), sodium, potassium, calcium, phosphorus, uric acid, fasting and 2 hours blood sugar, HBA1C for diabetics, liver function tests, lipid profile, CBC, INR. • Abdominal ultrasonography US RD. • Ask for Recipient PTH (if not already performed) • Ask for Diabetic recipients: HBAIC If not.
Step 3 (Donar & Recipient) Infection Screening
• Viral profile: HBSAg, HCV Ab, HIV Ab, CMV IgG, Epstein Bar • Non-contrast CT chest, abdomen, and pelvis. (Non-contrast for Recipient, With contrast for Donor). • Donor: Re check Urine analysis for (3rd time).
Step 4 (Donar & Recipient)
• Urine culture. • Tests for TB : Urine TB PCR, urine acid fast staining, Tuberculin test.
(Donar & Recipient) Immunologic assessment
Step 5 (Donar & Recipient) Cross match
Step 6 (Donar & Recipient) HLA-DR
Step 7 (Donar & Recipient) HLA-A&B
Step 8 (Recipient) PRA
Step 9 (Donar & Recipient) Imaging
Recipient; • Chest X-ray, CT. • PUT, MCUG , CTU, MRI, Urodynamic Donar • Chest X-ray, CT • UTP, CTA & CTU, MRA • Renogram. • DMSA if > 10% difference in size.
Step 10 (Donar & Recipient) Endoscopy
Recipient: • Upper GIT endoscopy if needed. • Cystoscopy is performed during final admission for transplantation if indicate e.g. prolonged use of cyclophosphamides. voiding disorders and low UT anatomical or functional causes. Donor: Cystoscopy is crucial.

Table 7 Donor approval contents

It's not a commitment. I can stop at any time. The physician may turn me down as a donor.
I will be examined by independent medical team. Information obtained is confidential.
I will be tested for AIDS, hepatitis, other infectious diseases. I should have long-term follow-up after donation.
I agree being included in registry.
I know there is other treatment options than transplantation that can keep the recipient alive as dialysis.
I know there is a risk of recurrence or graft failure (A).

3) Paediatric Kidney Transplantation Guidelines should focus on early identification of IKD since its recurrence is rare and their diagnosis determines their management plan **[R2.1d]**, e.g.:

- Donor selection depends on inheritance pattern; dominant variants justify nonrelated donors, while recessive variants allow related donors in most genetic diseases after thorough GT of the related

Table 8 Parents approval contents

We were informed for kidney transplant that has estimated survival (NG)
We were informed about risk of recurrence, graft failure, infections, other complications
We were asked to have a second opinion (NG)
We know that dialysis is an option, and that a pre-emptive transplant with a living donor remains superior
We were informed about the procedure and its challenges
We were informed about patient-family education and re-habitation programmes
We accept continuous review and follow-up and inclusion in registry list

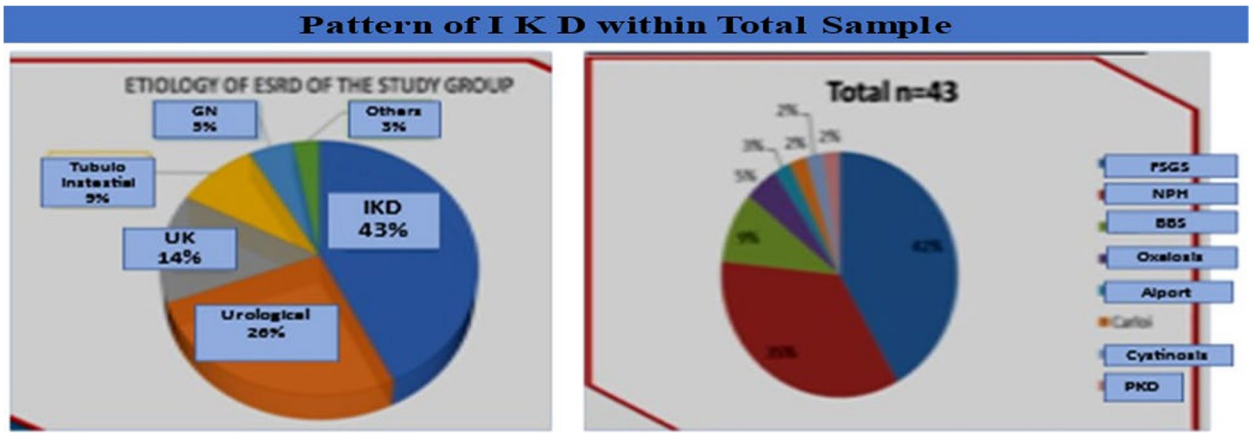


Fig. 1 Primary renal disease among transplanted children, Cairo University Children Hospital 2009–2017, total cases 128 (Moustafa B. 2019) [2]

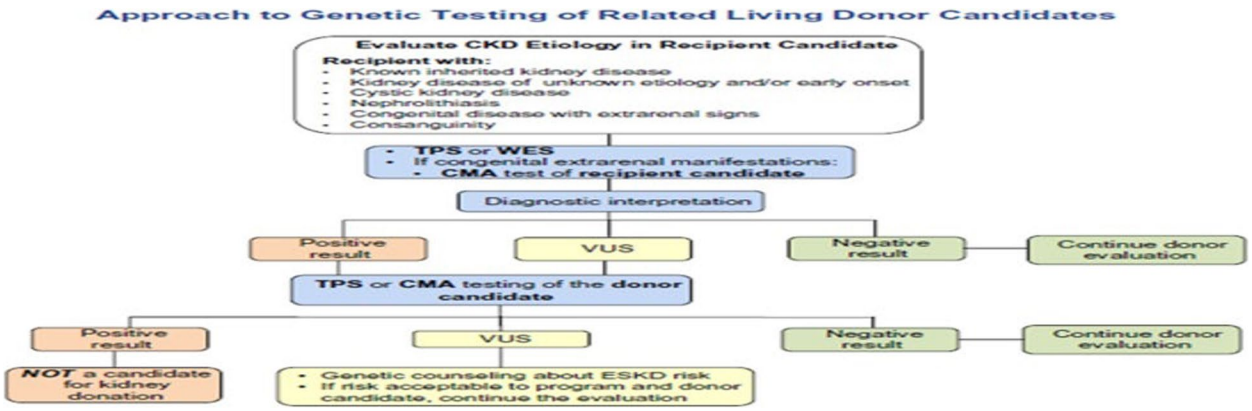


Fig. 2 EPG genetic recommendation for related living donor

donor. Both D&R should be genetically tested to avoid graft loss and ensure donor safety, especially in re-transplant with previous graft loss related to disease recurrence, e.g. FSGS, a HUS, and C3 GN.

- Combined liver/kidney transplantation and not kidney alone for hyperoxaluria type 1.
- Ensure safety of potential-related doners with same mutations from getting de novo disease, e.g. Alport, aHUS, and C3GN.
- Early identification with target GT will avoid patients with FSGS of plasma exchange section (PES) sessions and will allow a better donor selection and ensure family with low recurrence risk. Primary FSGS was a very common cause for childhood SRNS, especially when start early and progress to ESRF rapidly. NPHSI, NPHS2, Alport COL4A 3,4,5, beside others are the most reported types.

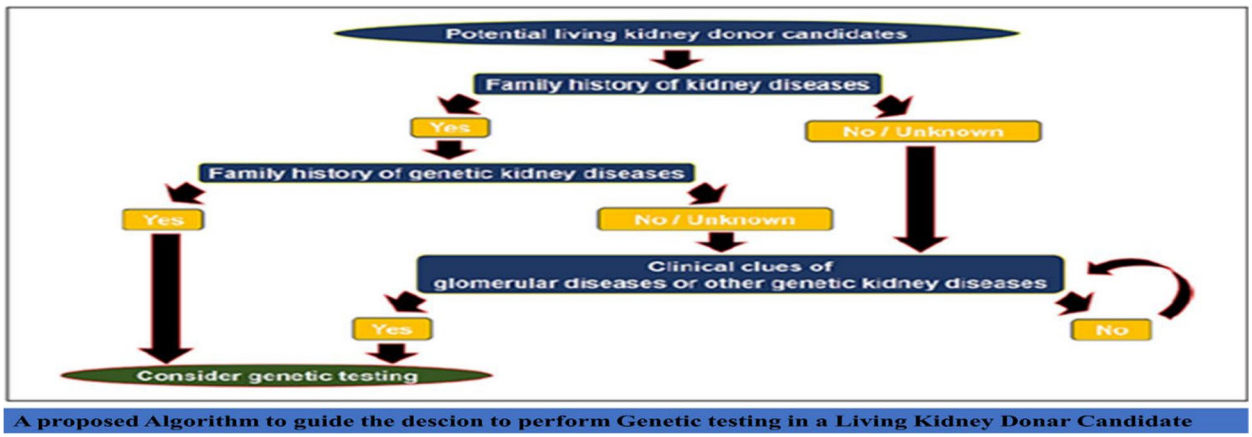


Fig. 3 EPG proposal algorithm

- Identification of mutation in a HUS and C3GN will avoid potential donors with mutations and confirm the need for complement inhibitor in some TCR to avoid recurrence.

General and specific recommendations **[R2. 1a, b]** (*refer to guideline supplement*) afford needed knowledge to ensure both recipient and donor safety and better transplant outcome [14] (Figs. 2 and 3) show suggested workup for living donor. For extended recommendations in this area, refer to guideline link or article supplement, EPG Paediatric Kidney Transplantation Guidance.

R2.2: Identification of diseases with recurrence risk (RR) — adopted/adapted R BTS 2018, KDIGO 2020

FSGS show 20–50% recurrence. *Primary types* show high incidence with early graft loss that makes LDKT not totally accepted NG BTS. *Genetic types* show low risk; however, related donor must be genetically tested for nephrin and podocin among others, to exclude the variant (*1B KDIGO*). Prior graft loss due to recurrence is considered a contraindication to LDKT unless donor and recipients are informed about the risk and approving *NG BTS. Routine pre Kt PE is not recommended* (*2D KDIGO*). *Membranous GN RR does not contraindicate* transplantation; however, D&R should be informed (*NG BTS, 1B KDIGO*) especially if prior graft loss (*GL*) (*2D KDIGO*). Anti-PLA2R ab should be tested prior to KT (*2C KDIGO*).

SLE risk for recurrence is small, D/R must be informed (*B2 BTS*), and KT to be done when recipient is in clinical and serological remission with minimal IMMS (*1D KDIGO*). Antiphospholipid pre-transplant assessment will determine anticoagulant plan (*1C KDIGO*).

ANCA vasculitis and good pasture disease recurrence risk (RR) do not contraindicate KT, transplantation when clinically nonactive for 6 months to 1 year and disappearance of antibodies (NG BTS, D KDIGO). Alport S recurrence is low but with a risk for de novo anti-GBM B2BTS www.transplantationjournal.com.

MPGN: *We* suggest candidates with C3G to be screened for genetic or acquired causes of alternative complement pathway dysregulation for treatment plan and assessment of recurrence risk (RR) (*2C KDIGO*). Recurrence risk fluctuates from 48% to reach 80% in re-transplant. Secondary types improve with treatment of the cause (*2C KDIGO*). We suggest candidates with C3G to be screened for genetic or acquired causes of alternative complement pathway dysregulation for treatment plan and assessment of RR (*2C KDIGO*). Genetic types show high RR. It is accepted for KT after discussion with MDT, pre-transplant GT for D/R, avoiding living-related donors, and considering both recipient disease recurrence and donor de novo disease *NG-(BTS)*.

aHUS: We suggest grading RR, as HR, MR, LR, NG, and BTS, to determine role and availability of complement inhibitor or combined liver-kidney transplant *NG BTS*. We prefer nonrelated donor after completing genetic tests. Deceased donors KT in available countries are preferred since negative genetic tests do not totally exclude the variant *NG(BTS)*.

R3: Immunological assessment [EPG; R3.1–3] [refer to supplement] RSHI/BTS 2015, BTS 2018

EPG R3.1 as well as BSHI/BTS 2015 [R17], BTS18 [R5], and IPNA 2020 [R13] confirmed the value of blood group and HLA compatibility of donor and recipient for successful transplantation (*AI BTS 2018*) and also confirmed.

EPG R3.2 is that early and frequent screening of *HLA-specific antibodies* every 3 months or after any allo-sensitization event (*1A BSH1 2015*) [15–17].

R3.3 recommends use of *complement dependant cytotoxicity (CDC) and flow cytometry* (*1A BSH12015*) [15–18], pointing to high sensitivity of Luminex technology and allowing assay using beads coated with multiple classes 1 and 2 HLA (A, B, C) and HLA (DR, DP, DQ) that give bead assay with semiquantitative numeric fluorescence value (*MFI*).

Crossmatch using CDC detects HLA and non-HLA, IgG, and IgM, and crossmatch with flow cytometry can detect ab classes that are not detected by CDC being more sensitive [17]. Both are to be done preliminary and 1 week prior to transplant.

R3.4 recommends orientation of *transplantation team* with basic applied lab immunology kidney transplant workup regarding needed tests, sensitivities, and specificities, when to be repeated, and assessment of rejection risk with lab parameters with their accepted levels by most HLA labs.

R3.4 discussed limitations in *desensitization for ABO*, and HLA incompatible transplantation in our country was discussed since it needs special expertise and facilities that are unavailable in many countries and makes donor change as a better option (*1A BSH1 2015*) [17, 18].

When discussing *immunological assessment guidance in children versus adults*, we must consider that children have longer expected age survival that makes its age-related graft survival looks shorter, and a situation that makes a call for retransplant is possible. Therefore, rigours avoidance of sensitization in first transplant is protective for future graft. The strong immune system of children despite post-KT immunosuppression constitutes another challenge. IMMS dose is high and might be toxic in pre-sensitized. In GIT and hepatic pharmacokinetics, drug intolerance varies between children, thus making frequent monitoring a must. Children's strong immune system makes their antigen-specific tolerance not yet a reality [19].

The Cairo University Children Paediatric Transplantation 9-year registry reported for *HLA (1, 11)*: zero mismatch 4%, < 3/6 41% and > 3/6 55% and for *DR*: *zero* $%, 1/2 86%, all *recipients PR*: < 20% by Luminex (FC), and *final CM*: negative by CDC just before transplantation (Fig. 4).

R4: *Psychosocial assessment recommendations — KDIGO 2020* in EPG are comprehensive because of the following:

- Our community is lagging psychosocial support team and tools prior or after KT **[R 4.2a, b, c]**.
- Team's target that recipients should include *nonadherent adolescents **[R4.3], [R4.4], [R4.9**] who need referral to supportive programmes and for *those with cognitive or learning defects **[R4.1]**, psychosocial disorders **[R4.2]**, without social care **[R4.3]**, and who need extra support after TX **[R 4.3]– [4–9]**.
- *Team members should include the following*: Transplant psychologists, social worker, specialized nurse, family members or caregivers, and treating doctor.
- Tools to be used for assessment need family and treating doctor involvement. *SIPAT assessment* tool with its Arabic format is suggested in our EPG, for use in our community *prioritizing its use for adolescent* recipient being already an approved tool. EPG suggest putting a modified form for children with involvement of their families and care givers as recommended area for future research moderated by

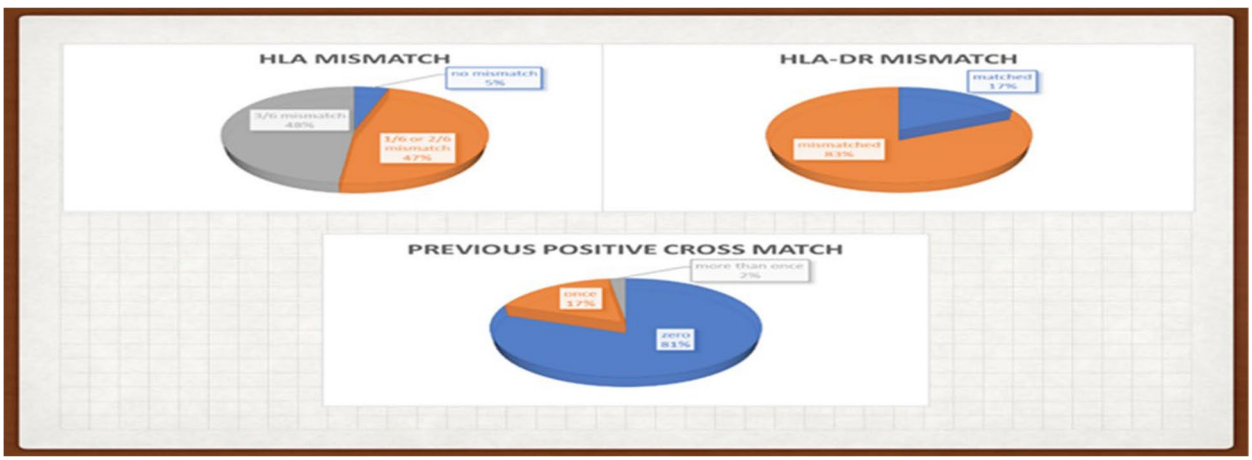


Fig. 4 Egyptian profile immunological status (HLA, CM) transplanted children 2009–2017, Cairo University Children Hospital (CUCH) (Moustafa B. et al. 2019) [2]

transplant psychologist and social workers **[R4.2.C]** [20]. SIPAT has no paediatric version; it is used for both children and adults. So far, there are no published studies on its use in children [21]. As with other psychosocial tests for children, a qualified psychologist will decide whether a child can complete the psychosocial assessment independently or with parental assistance. Parental involvement in the assessment is crucial for children below 12 years old since the cognitive and emotional development of younger children cannot express their concerns about such complicated details of KT. Adolescents (13–18 years old) generally have a mature cognitive capacity to understand the transplantation and its implications, but they may vary in their emotional maturity and honesty. Most experts consider the age of 12–13 years as the minimal age for independent completion of psychosocial assessment [22, 23].

- Psychosocial assessment [SIPAT] suggested for children (Table 9)

A. Readiness level (patient/family) includes **[R4.6]**.

- Knowledge about disease that causes RF
- Process of transplantation
- Willingness for transplant
- Compliance and adherence
- Life style needed changes after transplant (diet, exercise, fluids, habits).

B. *Social support system: Available, functioning and reliable, and housing condition*
C. Cognitive function: Learning and academic status
D. *Psychological status* (anxiety, depression, trustfulness vs deceptive behaviour) (*see appendix*)

Stanford Integrated for Transplant (SIPAT), Stanford University Medical Center (Maldonado et al. 2008) [20]

- EPG recommends support and educational programmes for transplanted children and their families to reduce nonadherence and improve child willingness, readiness, family lifestyle, and social support. *KDIGO 2020 psychosocial recommendations were totally adopted with permission* in our EPG and translated to Arabic language (see EPG appendix implementation tools English and Arabic formats) [20].

R5: Morbidity assessment for cardiac, haematological, malignancy, and bone disease in children (KDIGO 2020)

Paediatric recommendations for assessment of morbidities require to respect their unique challenges. Adapted recommendations considered that (1) paediatric specialist consultation to approve child candidacy is essential in some situations, and (2) our source guideline KDIGO recommendations are mainly addressed for adults.

Therefore, adaptation was crucial to suit children CKD profile. The following recommendations related to each speciality were highlighted since they present for the transplant nephrologist a grey area that needs specialist advise.

R5.1: *Pulmonary recommendation* — We suggest chest imaging prior to KT for all R. candidates and also pulmonologist assessment and extended imaging for asthmatics, tuberculous, smokers, cystic lung lesions, interstitial fibrosis, pulmonary hypertension, autoimmune diseases, syndromic, and metabolic, for exclusion of those with severe obstructive or restrictive lung disease from KT (*KDIGO 2020, GPP*).

Table 9 Psychosocial assessment modified SIPAT suggested for use in paediatric kidney transplant (child's families are involved)

A. Patient readiness level
1. Knowledge about disease that causes kidney failure
2. Process of transplantation
3. Willingness for transplant
4. Compliance and adherence
5. Life style needed changes after transplant (diet, exercise, fluids, habits)
B. Social support system: available, functioning, and reliable housing condition
C. Cognitive function, learning and academic status
D. Psychological disorder anxiety, depression, trustfulness vs deceptive behaviour
Psychosocial assessment charts (Table 10)
Psychosocial assessment charts/SIPAT
Refer to guideline supplementary Table 10
Stanford Integrated for Transplant (SIPAT), Stanford University Medical Center© (Maldonado et al. 2008, Maldonado et al.)
The patient's total score SIPAT examiner

R5.2: *Neurological recommendations* — Progressive neurodegenerative diseases, syndromic, genetic, metabolic with extra-renal manifestations, impaired cognitive function, or severe psychiatric disorders need neuro and psychosocial consultation for transplantation candidacy. Assessment should be considered if their quality of life is expected to be improved after transplant or not, and supportive programmes should be available for those approved for KT (*GPP — good practice point*).

R5.3: *CVD recommendations* raised the high significance of BP assessment, ECG, echo, and tissue Doppler in assessment and cardiac consultation for any child indicated for kidney transplantation. Those with cardiac disease, abnormal echo indices, dyslipidaemia, uncontrolled hypertension, arrythmias, thrombotic history, long period on dialysis, and pulmonary hypertension should have rigorous assessment by a cardiologist. Left ventricular dysfunction (ejection fraction < 30%, severe valvular disease, severe heart failure, pulmonary pressure > 60) contraindicates transplantation. Multisystem renal diseases as autoimmune D, syndromic children, and metabolic disorders as children with hyperoxaluria with high oxalate load should do cardiac US with speckle tracking US at time of diagnosis and followed yearly or according to results and disease evolution (*C. (OxalEurope) 2022*). Cardiac MRI may be requested prior to transplantation (*NG* [24] European Hyperoxaluria Consortium *(OxalEurope) Registry 2022*).

Antihypertensives should be used to control hypertension prior to KT (*2A KDIGO*), to be stopped only at the day of the operation to allow adult graft perfusion on operation (*NG KDIGO 2020*).

R5.4: *Haematological recommendations*: We do not recommend routine thrombophilia screening (*1C KDIGO*), only in candidates with reported thromboembolic events or positive family history (*2C KDIGO*). Systemic lupus erythematosus patients or those with features of antiphospholipid syndrome should be screened for APL Abs (*2C KDIGO*). Children on anticoagulants or antiplatelets should not be excluded from kidney transplant (*NG KDIGO*).

- Single antiplatelets (aspirin, clopidogrel) can be continued while waiting for KT *(NG KDIGO*). The decision to delay KT for those on dual antiplatelet is to be made in consultation with haematologist and when the risk of stopping medication or operating while on treatment exceeds the anticipated benefit of transplantation. Antiplatelets except aspirin should be stopped 5 days prior to transplantation unless risk of thrombosis is high (*NG KDIGO*) **[R5.4]**.
- *Clopidogrel*, as a platelet aggregation-inhibiting drug, in addition to inhibition of cyclooxygenase pathway by *aspirin* has not been approved for paediatric use. However, it has been long used off-label and reported its safety [25].
- Although *rivaroxaban* and *dabigatran* have been approved as *ODACs* for use in paediatrics, we do not suggest its use except when there is expertise using DOACs perioperatively and access to *DOACs reversal agents* (*NG. KDIGO*). Considering that there is limited data on its safety and effectiveness of *reversal agents* in paediatric patients and being expensive and not available in our institution, therefore *prothrombin complex concentrate PCCs* might be used as an alternative option [26]. In a recent survey of paediatric haematologists on paediatric PTS requiring reversal of life-threatening bleeding secondary to direct factor Xa inhibitor DFXaL, they found a 44% preference for use of adexanet alfa which is used for reversal of rivaroxaban with 55% choosing *PCC* [27]. Rodriguez, V. initial phase 2 trial is using a newer drug *ciraparantag*, which can neutralize DFXaL [apixaban & rivaroxaban] and heparin [28]. *Idarucizumab* is currently being investigated in children [29].
- *Therefore, EPG recommends switch to warfarin* as oral anticoagulant with available reversal agent vit. K as an alternative option considering the limited expertise with DOACs reversal **[R5.4]**.
- *Low-molecular-weight heparin* should not be recommended for postoperative routine use and should be avoided in HIT **[R5.4]**. All scenarios discussed should be approved by transplant haematologist.
- Candidates with *sickle cell disease or thalassemia* not to be excluded from KT, in the absence of active or severe extra renal sickle cell disease, and after haematologist assessment (*IC KDIGO*)
- *Leukaemia*, *lymphoma*, *PTLD*, and *prior hematologic malignancy* to be transplanted only after achieving long remission and approved by transplant consultant haematologists and oncologist (*NG KDIGO*). *Oncologist consultation* for candidacy should be done for all premalignant or HR of accelerated progression: *www transplant journal.com*.

R5.5: *GIT recommendations — although* KDIGO consider upper endoscopy not a routine indication for all recipient, it is EPG suggested as routine for our TCR children since gastrooesophageal reflux GERD will be identified. Long-term use of steroids and some IMMS after transplant are not GIT tolerated and require proper upper GIT assessment **[R5.5]** (*GPP*).

We recommend delaying KT with *acute pancreatitis*, high S amylase for 3 m until resolved (**NG**), and not to exclude chronic pancreatitis from KT (*NG KDIGO*).

IBD are not excluded from KT. Delayed if active, screened for bowel cancers, and time of KT should be approved by gastroenterologist (*NG KDIGO*).

R5.6: *Delay cases with acute hepatitis* until recovery — cases with liver cirrhosis should be well assessed by hepatologist for oesophageal varices, screened for hepatocellular carcinoma, to decide management plan as liver kidney transplant (*KDIGO*).

R5.7: *Diabetic CKD children are candidates for kidney transplantation since* we do not have pancreatic-kidney transplant option; they need well assessment and metabolic control prior to TX and frequent follow-up. Combined use of steroids and TAC in such HR group should be well assessed per case (*GPP*).

R5.8: *Mineral bone disease (MBD), hyperpara*, is common among CKD children as they are mostly on conventional dialysis 3 h/3 days/week, which do not allow proper phosphate clearance, and severity of pre-transplant SHPT can lead to post-transplant THPT hyperparathyroidism and an increased risk of graft loss [30, 31]. Secondary hyperparathyroidism (SHPT) and tertiary hyperparathyroidism (THPT) with bone disorders ar a great challenge in children that is expected to progress especially after long use of steroids after transplant. Bone problems will be evident within the first month after transplant. Risk factors include age, sex, frailty, previous fractures, hyperpara, and cumulative steroid exposure. Therefore, several nephrologists stress the importance of treating SHPT before kidney transplantation to reduce the incidence and prevent complications of THPT in transplant recipients [32, 33]. Post-TX vitamin D, bisphosphonates calcitonin, and cinacalcet should be used. Since cinacalcet is expensive and non-affordable, and surgery remains as controversy in children, management of bone problems in children remains a challenge.

EPG R5 recommends measuring Ca, phosphorous, and PTH before transplantation. Treat hyperpara medically or surgically before TX as KDIGO-CKD-mineral and bone disorder (*CKD-MBD guideline D2*) [34]. Parathyroidectomy should be considered for those with failed medical treatment or severe complications of hyperpara B KDIGO. Parathyroidectomy in children when failure of medical treatment deserves further surgical expert care **[R5.8]**.

R6: Infection status assessment

Pre-TX viral screening for infection for donors and recipients is crucial. Recipient vaccination and boosting as well as post-transplant viral monitoring and antiviral prophylaxis are adopted from *KDIGO 2020*, considering our local profile as reported in 9 years registry 2009–2017 of Egyptian transplanted children in Cairo University Children Hospital [2] that showed all donors and recipients were HBVsAg and HIV Ab negative at the time of transplantation, thanks to compulsory HBV vaccination. Recipients with + CMV constitute ¼ of total paediatric transplants where HR (D + R −) 18% and most common CMV status was (D + R +) 79%. All donors showed normal Ab titre for HCV, while 20% of the recipients showed low titre viremia; they were all on HD, and many received direct-acting anti-hepatitis C virus drugs (DAAD) prior to TX (Fig. 5) [2].

- *Our national EPG strategy* for children with *HCV* prior to KT needed to be tailored, since they showed the following: *high incidence among CKD on HD, *low virulence genotyping, and *seronegative donor availability. Such status suggests pre-KT antiviral treatment unless the available donor is HCV +. DAAD approval by ethical committee based on local clinical trials supports the start of treatment with regular PCR monitoring after KT. Accepting TCR with short remission after treatment is related to time of donor availability.

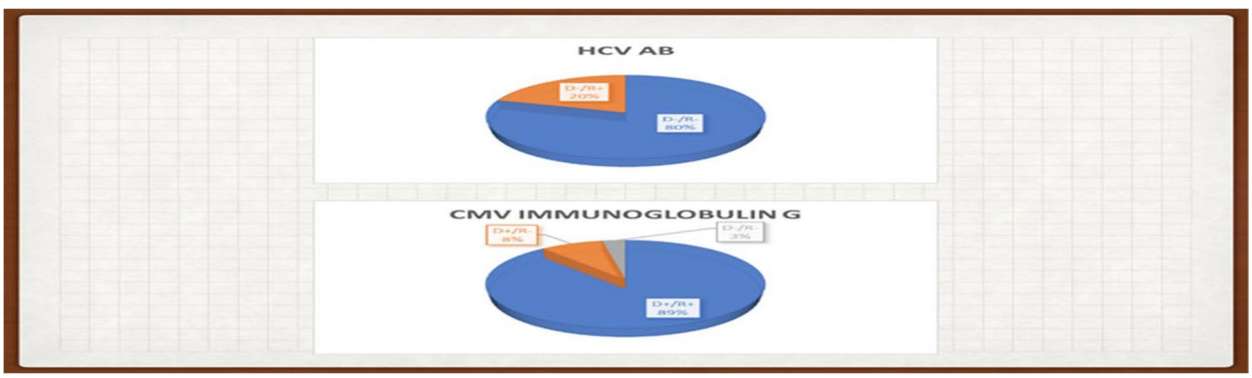


Fig. 5 Viral status (HCV, CMV) transplanted children 2009–2017, Cairo University Children Hospital (CUCH) (Moustafa B. et al. 2019) [2]

- *Compulsory HBV* vaccination in children and boosting those with low titre prior to TX, screening of D&R with HBVs and core Ab, and non-accepting HBV donors protect TCR from acquired infection. Our protocol for other viruses is *adopted as KDIGO* **[EPG 6.1]**.
- *EBV and CMV* were adopted as KDIGO (refer to Recommendations) **[EPG R6.1]**.
- Since *TB in our community* starts to show up despite vaccination, we confirm pre-transplant TB screening workup and, whenever, sterile pyuria for its exclusion **[EPG R6.2]**.
- Recurrent and complicated *UTI* should be treated before KT and followed *as recommended by KDIGO* **[EPG R6.4]**.

R7: *Urological assessment (R1 to 10)* of paediatric recipient is crucial in our area, since 33% of total paediatric transplants are 2ry to urological causes. Our national recommendations are mostly adopted/adapted from EAU and KDIGO considering our local paediatric urological profile of kidney and UT challenges and HR factors as well as good practice points GPP reflecting our transplant surgeons experience, e.g. EPG recommend.

- **R1**: *Cong. anomalies of kidney and urinary tract (CAKUT)* and voiding dysfunction, stones, obstructive uropathies, and VUR. We recommended extending imaging including VCUG, urodynamics, cystoscopy, urine cultures, metabolic workup, and genetic testing (*NG KDIGO*). Some cases will need pre-transplant surgical intervention as augmentation cystoplasty and cutaneous stoma. We recommend transplant surgeon with paediatric urology experience to lead management plan (*GPP*).
- **R2**: *Long duration of oliguria* or anuria because of contracted defunctionalized bladder needs bladder training, intermittent catheterization, bladder cycling, and augmentations prior to KT (*GPP*). Some controversies were raised related to timing and acceptance of these techniques [35, 36].
- **R3** and **4**: *Previous urological interventions* or transplantation may modify surgical approach (*NG KDIGO*).
- **R5** and **6**: Previous femoral vascular accesses need duplex scan, and infected peritoneal catheter should be removed (*NG KDIGO*).
- **R2, 4, and 5**: Those with *coagulation risks* needing anticoagulants are recommended for duplex scan, revising history of previous thrombosis, and haematologist consultation for different scenarios, considering benefit risk for each (*EAU strong and GPP*). Low-molecular-weight heparin is not routine for each case (*EAU strong*) (refer to previously mentioned EPG antiplatelet and anticoagulant haematological recommendation *[EPG R5]* and areas for local adaptation based on availability of anticoagulants and reversing drugs) (*EAU weak, KDIGO NG, and GPP*).
- **R4** and **5**: *Nephrectomy for polyurea*, heavy proteinuria, with hypoalbuminemia, persistent renal infection, uncontrolled hypertension, PKD with significant enlargement, infection, and failed graft (*2D KDOGO*)
- **R6**: *Metabolic stone* workup for diagnosis of hyperoxaluria and genetic testing to identify types 1 and 2 and for proper treatment decision with proper control of oxalate load by dialysis staff prior to surgery (*2C KDIGO, GPP*)
- **R7**: *Voiding disorders* (neurogenic bladder, bladder neck, PUV) EPG emphasize the significance of MCU to assess the urethra, bladder capacity and contour residual urine, VUR, and urodynamics for neurogenic bladder evaluation that needs neurological consultation as well (www.transplantjournal.com).
- **R8**: *PUV, PUJ, and ureteric strictures*, and VUR: We suggest US, ascending, MCU, DTPA, and DMSA *(GPP).*
- **R9**: Structural anomalies *CAKUT* need US, ascending, MCUG, and non-contrast CT with vascular and urological assessment prior to transplant *(NG KDIGO) (GPP)*
- **R10**: Transplantation for cases with prior bladder augmentation/division and ileal conduit. It can be done successfully; however, infection complications may be higher due to need for CIC (*NG KDIGO*).

Donor assessment

Adults transplant nephrologists were assigned for this topic since our ethical attitude recommends donor safety as an important issue to be included in ped. KT guidance. They used *BTS 2018* recommendations to adopt/adapt the recommendations. Tailoring some points to suit our legal and ethical culture was considered in our local protocols, e.g. minimal and higher limits for age, relative and absolute contraindications, and case-by-case unit conference discussion for relative contraindication if only there is available donor, strongly willing and fully informed and accepting all the risks with written consent, preferably a parent (Table 5). Timing of donor and recipient assessment steps differ among different local centres (Table 6). However, all core contents of donor assessment and selection (unwillingness, pregnancy, mental illness, active substance use, obesity, hypertension, DM, disorders requiring anticoagulants, infection, malignancy, GFR, proteinuria, haematuria, urologic anomalies, stones) all adopt international British statements. Genetic and familial diseases require

GT for recipient, followed by donor testing and family counselling as discussed in EPG recipient assessment recommendations for genetic diseases **[R2.1]**. For donor selection, recessive mutation allows related potential donors after exclusion of the variant in the donor. Dominant mutation does not allow potential-related donors even if asymptomatic, to avoid donor de novo disease (refer to recipient genetic recommendations in *EPG GL* **[R2.1]** and (Figs. 1, 2 and 3).

Conclusion

Since paediatric kidney transplant is unique in some respects when compared to adults, therefore, children need their own, considering their paediatric morbidities and risk factors in their pre-transplant assessment. Since we use living-related donors in our country, we included donor assessment in our guidance to ensure his and her safety. Recommendations are tailored as adopted or adapted statements from evidence-based source guidelines to suit our local paediatric CKD profile, aiming for a better transplant outcome [10].

Abbreviations

AntipLA2Rab	Anti-phospholipase A2 receptor antibodies
CKD	Chronic kidney disease
CPGs	Clinical practice guideline
CDC	Complement dependent cytotoxicity
CAKUT	Congenital anomalies kidney urinary tract
DAAD	Direct-acting antivirus c drugs
D/R	Donor/recipient
DTPA	Diethylenetriamine pentaacetate
DMSA	Dimercaptosuccinic acid
ESRF	End-stage renal failure
EAU	European Association Urology
EPG, CPG, PKT	Egyptian Clinical Practice Guideline; Pediatric Kidney Transplantation
FC	Flowcytometry
GAG	Guideline Adaptation Group
GT	Genetic testing
GPP	Good practice point
GERD	Gastrooesophageal reflux disease
HR, MR, LR	High, mid, and low risk
IKD	Inherited kidney disease
IMMS	Immunosuppression
KDIGO	Kidney Diseases Improving Global Outcomes
LD	Living donation
MDT	Multidisciplinary team
MCU	Micturition cystourethrography
PKT	Paediatric kidney transplant
PKT-GAG	Pediatric Kidney Transplant Guideline Adaptation Group
PES	Plasma exchange sessions
RA/BTS	Renal association/British Transplantation Society
RR	Recurrence risk
SHPT	Secondary hyper-para thyroid
THPT	Tertiary hyper-para thyroid
TCR	Transplant candidate recipient
TX	Transplantation
VCUG	Voiding cystourethrography
VUR	Vesicourethral reflux

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s43054-024-00299-7.

Additional file 1: Summary of Recommendations. Supplementary tables: Table 10. Stanford Integrated for Transplant (SIPAT). Table 11. Patient Health Questionnaire [PHQ]. Table 12. Guidelines for Deferment from Transplant List

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• The CPG full statements' references and documents for the development of the source CPGS will be made accessible and freely downloadable from official websites of the Egyptian Pediatric Clinical Guidelines Committee guideline at its web site (http://epg.edu.eg/).

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BM, corresponding, first author, access to transplantation, and writing and revising manuscript. NAS, contributed to transplant genetics. AB, draft reviewing and SM and MEIS, writing access to transplantation. NS for transplant immunology, MKH for psychological assessment, and MGS access to dialysis and reviewer for the draft. AS access to dialysis, reviewer for the draft, revising manuscript editing with editing of tables and figures, DS for GIT assessment, NS for cardiac assessment, MB for orthopaedic assessment, MEG for haematological and oncological assessment, KME for diabetic and endocrinal assessment, EAM for transplant hepatologist and viral serology assessment, MSK recurrent risk assessment, MAE for donor assessment, MEG for donor assessment, BAE for urology assessment, TAA for vascular assessment, and ME urology assessment for donor and transplant. TO, YSA, and AAB, methodology members, they allow regular zoom meetings for evidence-based training in source de novo and adaptation guidelines, shared source guideline appraisal, PIPO formatting for health questions, and revising evidence grading for recommendations. Revising the manuscript critically for important intellectual content, all work group. Approval of the version of the manuscript to be published, all collaborators of paediatric kidney transplantation pre-transplant guidance. All work group members have read and approved the manuscript. Acquisition and interpretation of data, group members according to their specialities.

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