

***Residency Program  
Doctor of Medicine (MD)  
Curriculum (Phase-B)***

***Pediatric Nephrology***



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### 1. Introduction:

#### 1.1. Overview of the Specialty

The specialty of Nephrology developed as a sub-specialization of physicians who are predominantly concerned with the care of patients with Pediatric renal disorders. It is a branch of Pediatrics, concerned with prevention, investigation and therapy of, and research into, diseases involving the renal system. Care of patients with Pediatric renal disorders embraces a wide range of clinical activities and all Pediatric nephrologists are needed to have their ability to diagnose, treat and care for children with all forms of kidney disease. This requires knowledge of not only the diagnostic and therapeutic modalities available, but also an appreciation of the importance of the epidemiology and potential for prevention of congenital and hereditary renal diseases.

Although Pediatric nephrology is generally stereotyped as a highly practical skill based medical specialty, with invasive and interventional skills as high-profile components of the workload, competence in other areas of practice such as transplant immunology, different immunosuppressive agents and renal imaging are equally important.

Pediatric nephrologists generally work as hospital based specialists and need to integrate their work with not only community based primary care colleagues but also other hospital based physicians, e.g. Pediatric Surgeons, Transplant surgeons, Adult Nephrology, Radiology, Nuclear Medicines, Bio-chemistry, Pathology, Dieticians, Psychologists, Urologists, Pathologists, Dieticians and Cardiologists.

#### 1.2. Nephrology Residency Program

Residents will undertake a three year intensive Phase B training after completion of Phase A training in order to achieve the levels of knowledge, skills and expertise required

for clinical practice in the field of Pediatric nephrology medicine. It is a competency-based program emphasizing on meaningful integration and contextualization. The two years phase A training Program is designed to introduce and develop the broad range of core knowledge, skills, attitudes and behaviors required to become a competent physician. The knowledge and skills acquired during Phase A training are further focused and refined during Phase B training, which is a 3 year Speciality-specific training in Pediatric nephrology.

The teaching, learning and assessment of the curriculum are facilitated by the provision of comprehensive, educationally oriented supervision and support, which is provided to all trainees across both the phases of the Program.

**2. Goals and objectives:**

**2.1. Overall Goals:**

1. To prepare Pediatric nephrologists who would be able to meet and respond to the changing healthcare needs and expectation of the society.
2. To develop Pediatric nephrologists who possess knowledge, skills and attitudes that will ensure that they are competent to practice Pediatric nephrology safely and effectively.
3. To ensure that they have appropriate foundation for lifelong learning and further training in their specialty.
4. To help them to be critical thinkers and problem solvers when managing health problems in the community where they will serve.

**2.2. General Objectives:**

The educational and training process aims to produce Pediatric nephrologists who; -

- Can address all aspects of the healthcare needs of patients and their families
- Maintain the highest standards appropriate in their professional field
- Are aware of current thinking about ethical and legal issues.
- Are able to act as safe independent practitioners whilst recognizing the limitation of their own expertise and are able to recognize their obligation to seek assistance of colleagues where appropriate.
- Are aware of the procedures, and able to take appropriate action, when things go wrong, both in their own practice and in that of others.
- Will be honest and objective when assessing the performance of those they have supervised and trained
- Can take advantage of information technology to enhance all aspects of patient care
- Can develop management plans for the "Whole patient" and maintain knowledge in other areas of medicine which impinge on the speciality of Pediatric nephrology.
- Understand that more effective communication between them and their patients can lead to more effective treatment and care
- Apply appropriate knowledge and skill in the diagnosis and management of patients.
- Establish a differential diagnosis for patients presenting with medical problems by the appropriate use of the clinical history, examination and investigations
- Are competent to perform the core investigations and procedures required in their specialities.
- Develop clinical practice which is based on an analysis of relevant clinical trials and to have an understanding of their research methodologies

- Are able to apply the knowledge of biological and behavioral sciences in clinical practice
- Are able to identify and take responsibilities of their own educational needs and the attainment of these needs.
- Have developed the skills of an effective teacher.

### **3. Admission Requirements for Phase B Training:**

- Residents who has successfully completed Phase A training and passed Phase A Final Examination in Pediatric and Allied are eligible for enrolment in the Phase B Program.
- Candidates with FCPS / MD in General Pediatrics can be enrolled directly into Phase- B of the residency program.

### **4. Phase B Curriculum structure:**

The training is designed to develop both the generic and specialty-specific attributes necessary to practice independently as a consultant Pediatric Nephrologist. The aim is to train individuals to provide the highest standard of service to child with renal disorders. This includes the development of positive attitudes towards lifelong learning and the ability to adapt to future technological advances and the changing expectations of society.

#### **4.1. Phase B: Pediatric Nephrology Speciality Training:**

In-depth speciality-specific educational and training program in this phase will make the resident competent and prepare them for the speciality qualification. It will provide educational program covering the speciality of basic clinical practice in Pediatric Nephrology as well as Pediatric Renal transplantation, Haemodialysis, Peritoneal dialysis, Biostatistics, Research Methodology and Medical Education along with rotation to specific clinical training.

#### **4.1.1. Expected outcomes at the completion of the Phase B Program:**

Residents of this training Program will be equipped to function effectively within the current and emerging professional, medical and societal contexts. At the completion of the training program in Pediatric nephrology, as defined by this curriculum, it is expected that a new Pediatric nephrologist will have the clinical skills and theoretical knowledge for competent practice. It is expected that a new Pediatric Nephrologist will be able to:

- ◆ Utilize effective communication with patients and their families and with professional colleagues
- ◆ Be devoted to life long learning
- ◆ Be equipped to manage both acute and chronic renal diseases
- ◆ Identify the pathophysiology and manifestations of renal diseases, and modern therapeutics, which can be applied to patient diagnosis and management
- ◆ Apply appropriate skills to perform necessary diagnostic and therapeutic decisions
- ◆ Demonstrate a capacity to rationally analyze clinical data and published work
- ◆ Demonstrate an understanding of and commitment to the role of research in advancing medical care of renal disease
- ◆ Develop a commitment to compassionate, ethical professional behavior
- ◆ Identify Pediatric renal health issues of importance to the community and contribute constructively to debate about those issues
- ◆ Apply primary and secondary prevention strategies in Pediatric renal disease

**5. Teaching and Learning Methods:**

The bulk of learning occurs as a result of clinical experiences (experiential learning, on-the-job learning) and self-directed study. The degree of self-directed learning will increase as trainees became more experienced. Teaching and learning occurs using several methods that range from formal lectures to planned clinical experiences. Aspects covered will include knowledge, skills and practices relevant to the discipline in order to achieve specific learning outcomes and competencies. The theoretical part of the curriculum presents the current body of knowledge necessary for practice. This can be imparted using lectures, grand teaching rounds, clinico-pathological meetings, morbidity/mortality review meetings, literature reviews and presentations, journal clubs, self-directed learning, conferences and seminars.

**5.1. Phase B Training - Outdoor placement schedule:**

Pediatric nephrology specialty training comprises:

Adult nephrology	30 days
Urology	7 days
Cardiac anesthesia	7 days
Radiology	7 days
Nuclear Medicine	7 days
Department of Pathology	7 days
Clinical Pathology	7 days
Microbiology	7 days
BIRDEM	7 days
Inter departmental meeting.	Once in a months

**6. Record of Training:**

The evidence requires confirming progress through training includes:

- Details of the training rotations, the training plan agreed with weekly timetables and duty rosters; and numbers of practical procedures and outcomes.
- Confirmations of attendance at events in the educational program, at departmental and inter-departmental meetings and other educational events.
- Confirmation (certificates) of attendance at subject-based/skills-training/instructional courses.
- Recorded attendance at conference and meetings.
- A properly completed **logbook** with entries capable of testifying to the training objectives which have been attained and the standard of performance achieved.
- CME activity.
- Supervisor’s reports on observed performance (in the workplace): of duties, practical procedures, of presentations made and teaching activity; of advising and working with others, of standards of case notes, correspondence and communication with others.

**6.1. Logbook:**

Residents are required to maintain a logbook in which entries of academic/professional work done during the period of training should be made on a daily basis, and signed by the supervisor. Completed and duly certified logbook will form a part of the application for appearing in Phase Final Examinations.

**7. Research:**

Development of research competencies forms an important part of the Residency Program curriculum as they are an essential set of skills for effective clinical practice. Undertaking research helps to develop critical thinking and the ability to

review medical literature. Every Resident shall carry out work on an assigned research project under the guidance of a recognized supervisor; the project shall be written and submitted in the form of a Thesis/Research Report at the beginning of training and should be submitted within 27 months of training in phase-B.

### **8. Assessment:**

The assessment for certification of the MD degree of the University is comprehensive, integrated and phase-centered attempting to identify attributes expected of specialists for independent practice and lifelong learning and covers cognitive, psychomotor and affective domains. It keeps strict reference to the components, the contents, the competencies and the criteria laid down in the curriculum. Assessment includes both **Formative Assessment and Summative (Phase final) Examinations.**

#### **8.1. Formative Assessment:**

Formative assessment will be conducted throughout the training phases. It will be carried out for tracking the progress of residents, providing feedback, and preparing them for final assessment (Phase completion exams).

There will be Continuous (day-to-day) and Periodic type of formative assessment.

- **Continuous (day-to-day) formative assessment** in classroom and workplace settings provides guide to a resident's learning and a faculty's teaching / learning strategies to ensure formative lesson / training outcomes.
- **Periodic formative assessment** is quasi-formal and is directed to assessing the outcome of a **block**

**placement or academic module completion.** It is held at the end of Block Placement and Academic Module Completion. The contents of such examinations include **Block Units** of the Training Curriculum and **Academic Module Units** of the Academic Curriculum.

#### **8.1.1. End of Block Assessment (EBA):**

End of Block Assessment (EBA) is a periodic formative assessment and is undertaken after completion of each training block, assessing knowledge, skills and attitude of the residents. Components of EBA are written examination, structured clinical Assessment (SCA), medical record review, and logbook assessment. Unsatisfactory block training must be satisfactorily completed to be eligible for phase final examination

**8.1.2.** Formative assessment for Academic modules for Biostatistics and Research Methodology and Medical Education to be done in the first nine months of Phase B training. Residents getting unsatisfactory grade must achieve satisfactory grade by appearing the re-evaluation examination to be eligible for the Phase B Final Examination.

#### **8.2. Summative Examination:**

Assessment will be done in two broad compartments.

- a) **Compartment A:** Consist of 3 (three) components.
1. Written Examination (Consisting of 2 papers).
  2. Clinical Examination (One long and four short cases).
  3. SCA and Oral (10 stations SCA, Oral one board consisting of 2 examiners).

Every Resident must pass all the 3 components of compartment-A separately. Candidates will be declared failed if he/she fails in one or more component (s) of the examination. He/she then have to appear all the 3 components in the next Phase B Final Examination.

b) **Compartment B:** Thesis and Thesis defense.

### 8.2.1. Written Examination:

**Two Papers: Contents of written papers listed in Annexure II**

#### Question type and marks:

- Two Papers (Paper I and Paper II); 100 marks each; Time 3 hrs for each paper. Pass marks-60% of total of 2 papers.
- **Each paper will consist of Two Groups:**
- **Group A:**
  - 10 short questions (5 marks each)
  - These will assess the knowledge of different level and its application
- **Group B:**
  - 5 scenario based problem solving questions (10 marks for each).
  - The questions should focus to assess the capability of handling clinical problem independently and comprehensively as a specialist.
  - Suggested format:-
    - A scenario followed by question(s).
    - Questions may include diagnosis, differential diagnosis, investigation plan, treatment, follow up and patient education.

### 8.2.2. Clinical Examination: Long case and Short case:

- There will be one long case and four short cases.

### i) Long case: Marks-100

- Directly observed
- Two examiners for each examinee.
- History taking and examination by the examinee – 30min.
- Discussion on the case 20 min.(presentation 6min, crossing 6x2min and decision 2min).
- Examiners will not ask any question nor stop the examinee in any way during history taking and physical examinations.
- Discussion should be done preferably as per structured format and proper weightage on different segments of clinical skills.

### ii) Short cases : Marks-100

- Four in number
- Time 20-30 min. (Time will be equally divided for each short case)
- Crossing should be done with proper weightage on different segment of clinical skills.

### iii) Pass marks: 60% of total of Long and Short Cases

### 8.2.3. Structured Clinical Assessment (SCA): Marks-100

- 10 stations : 5 min each

### 8.2.4. Oral Examination: Marks-100

- One board consisting of 2 examiners.
- 20 minutes (9+9+2).

### 8.2.5. Pass marks in SCA and Oral: 60% of total (SCA and Oral.)

### 8.3. Thesis Evaluation:

- **Marks: Thesis writing-200; Defense-100: Marks for acceptance-60% of total.**

- To be evaluated by 3 (three) evaluators:- 2 subject specialists and one academician preferably involve in research and teaching research methodology.
- Among the subject specialists one should be external.
- Evaluators should be in the rank of Professor/Associate Professor.
- Supervisor will attend the defense as an observer and may interact only when requested by the evaluators.
- Thesis must be submitted to the controller of Exam not later than 27 months of enrolment in Phase-B.
- Thesis must be sent to the evaluators 2 (Two) weeks prior to assessment date.
- Evaluation will cover Thesis writing and its defense.
- For thesis writing evaluator will mark on its structure, content, flow, scientific value, cohesion, etc.
- For defense – Candidate is expected to defend, justify and relate the work and its findings.
- Assessment must be completed in next 3 months.
- Outcome of the assessment shall be in 4 categories – “Accepted”, “Accepted with minor correction”, “Accepted with major correction” and “Not Accepted”.

**8.3.1. Description of terms:**

- **Accepted:** Assessors will sign the document and resident will bound it and submit to the Controller of Examinations by 10 days of the examination.
- **Accepted with minor correction:** Minor correction shall include small inclusion/exclusion of section; identified missing references, correction of references and typographical and language problem. This should be corrected and submitted within 2 weeks.

- **Accepted with major correction:** Task is completed as per protocol with acceptable method but some re-analysis of result and corresponding discussion are to be modified.
- To be corrected, confirmed by Supervisor and submit within 3 (Three) weeks.
- **Not Accepted:** When work is not done as per protocol or method was faulty or require further inclusion or confirmation of study.
- To complete the suggested deficiencies and reappear in defense examination during its next Phase Final Examination.
- Candidate has to submit his/her thesis and sit for examination and pay usual examination fess for the examination.

8.3.2. Residents must submit and appear Thesis defense at notified date and time. However non- acceptance of the Thesis does not bar the resident in appearing the written, clinical and oral exam.

**8.4. Qualifying for MD/MS Degree:**

On passing both the compartments, the candidate will be conferred the degree of MD/MS in the respective discipline. If any candidate fails in one compartment he/she will appear in that compartment only in the subsequent Phase-B exam.

**9. Supervision and Training Monitoring:**

Training should incorporate the principle of gradually increasing responsibility, and provide each trainee with a sufficient scope, volume and variety of experience in a range of settings that include inpatients, outpatients, emergency and intensive care. All elements of work in training rotation must be



supervised with the level of supervision varying depending on the experience of the trainee and the clinical exposure. Outpatient and referral supervision must routinely include the opportunity to personally discuss all cases. As training progresses the trainee should have the opportunity for increasing autonomy, consistent with safe and effective care for the patient. Trainees will at all times have a named Supervisor, responsible for overseeing their education.

Supervisors are responsible for supervision of learning throughout the program to ensure patient and / or laboratory safety, service delivery as well as the progress of the resident with learning and performance. They set the lesson plans based on the curriculum, undertake appraisal, review progress against the curriculum, give feedback on both formative and summative assessments as well as sign the logbook and portfolio. The residents are made aware of their limitations and are encouraged to seek advice and receive help at all times.

The Course Coordinator of each department coordinates all training and academic activities of the program in collaboration with the Course Manager. The Course Director of each faculty directs guides and manages curricular activities under his / her jurisdiction and is the person to be reported to for all events and performances of the residents and the supervisors.

### **10. Curriculum Implementation, Review and Updating:**

Both Supervisors and Residents are expected to have a good knowledge of the curriculum and should use it as a guide for their training program.

Since Pediatric nephrology has historically been rapidly changing speciality the need for review and up-dating of curricula is evident. The Curriculum is specifically designed to guide an educational process and will continue to be the

subject of active redrafting, to reflect changes in both Pediatric nephrology and educational theory and practice. Residents and Supervisors are encouraged to discuss the curriculum and to feedback on content and issue regarding implementation at Residency Course Director. Review will be time tabled to occur annually for any minor changes to the curriculum. The Curriculum will be reviewed with input from the various subspecialties of Pediatric nephrology.

### **11. Phase B Syllabus**

The educational process in Pediatric Nephrology aims to provide basic knowledge, intellectual, clinical and transferable skills to produce competent specialists in this subject. These specialists will be capable of providing specialized care of the highest order to patients with renal disorders in the community as well as clinical tertiary centers. They shall recognize the health needs of the community and carry out professional obligations ethically and keeping their standards by engaging in continuing medical education. The program also aims to introduce the candidate to the basics of scientific medical research.

#### **11.1. Learning Objectives:**

##### **A. SCIENTIFIC BASIS OF PEDIATRIC NEPHROLOGY**

###### **I. Basic Principles in Pediatric nephrology**

1. Explain renal physiology and anatomy
2. Explain renal biochemistry
3. Apply clinical skills to diagnose and manage Pediatric kidney diseases.

###### **II. Basic and Advanced Life Support**

1. Perform and supervise the resuscitation of patients  
Course curriculum in Pediatric Nephrology Program for lectures:

<b>A. Basic Science</b>	
1.	Embryology and Applied Anatomy
2.	Renal Function During Fetal Life
3.	Glomerular Circulation and Function
4.	Tubular Function
5.	Vasoactive Hormones
6.	Endocrine Control
7.	Nutrition and Metabolism
8.	Sodium, Potassium, Body Fluids and Acid Base Balance
9.	Calcium and Phosphorus
10.	Electrolytes and Fluid Management
11.	Neonatal Fluid and Electrolyte Management
12.	Renal Physiology
13.	Renal Clinical Pathology
14.	Renal Histopathology and Immunology
15.	Pharmacology
16.	Basic Medical Statistics, Computer Use
17.	Molecular Biology
18.	In Vitro Methods I Renal Research
19.	Animal models: Advantages and disadvantages
20.	Clinical investigation
21.	Genetics

**Pediatric Renal Disorders**

Know the importance of genital abnormalities, ambiguous genitalia and intersex, and their associations with renal and other diseases.
Be able to lead and co-ordinate multi-disciplinary teams including radiologists, urodynamic nurse, urological and plastic surgeons, obstetricians and geneticists.

**Renal Function tests:****Procedure**

Renal biopsy
Peritoneal dialysis, Haemodialysis, Central line catheterization,
Paracentesis

**Urinary tract infection**

Know the epidemiology and microbiology of urinary tract infection (UTI) and the role of host defense mechanisms
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understand the clinical signs and symptoms of UTI in different ages of children
Know the appropriate antimicrobials to treat UTI
Understand the management of vesico-ureteric reflux (VUR), reflux nephropathy, and the secondary progression of renal damage
be able to investigate and manage UTI in different age groups appropriately
Be able to counsel families on the inheritable nature of VUR.

**Disorders of micturition**

know the physiology of normal micturition and understand the normal acquisition of bladder control
know the causes of disturbed micturition
pathophysiology of the neuropathic bladder
understand the role of urodynamics in the investigation of disturbed micturition
be able to interpret urodynamic studies, and instigate appropriate management
Know the appropriate medical and surgical management of different types of bladder dysfunction
Understand management strategies for enuresis including behavioral and pharmacological therapies
be able to lead and co-ordinate other professionals, including urodynamic staff, specialist nurses, urologists, neurologists, neurosurgeons continence advisers and psycho-social support.

**Haematuria and Proteinuria**

know the causes of, and appropriate investigations for, haematuria and proteinuria
understand glomerular and tubular handling of protein
be able to differentiate between pathological and physiological proteinuria, and develop a diagnostic care pathway
be able to lead and co-ordinate investigation and management of a child with haematuria and /or proteinuria, working with radiologists, urological surgeons, histologists and geneticists

**Glomerular disorders**

understand the aetiology, pathophysiology, genetic and immunological basis of glomerular disease
know the different forms of presentation, and clinico-

	pathological correlations
	understand the clinical course and prognosis of acute and chronic glomerular disease
	know the indications for therapy e.g. immunosuppressive agents, cytotoxic drugs, plasmapheresis and dialysis
	be able to diagnose and manage nephritic and nephrotic syndromes

**Nephrotic syndrome**

	know and understand the pathophysiology and genetics of nephrotic syndrome
	be able to detect and manage the associated complications of the nephrotic state
	be able to investigate and manage the various forms of the nephrotic syndrome

**Vasculitis**

	know and understand that vasculitides presenting with renal disease may also affect other organ systems
	know the appropriate use of tissue diagnosis from other including skin
	be able to lead and co-ordinate the investigation and management to involve other specialities including neurology, ophthalmology and rheumatology
	be able to prescribe appropriately specific therapies including plasmapheresis

**Haemolytic uraemic syndromes**

	know and understand the disorders that comprise the haemolytic uraemic syndrome (HUS), their aetiology, genetics, multi-system clinical manifestation, pathogenesis and outcome
	Know the epidemiology, public health aspects of verocytotoxin-producing Escherichia. Coli infection
	be able to apply specific therapies in the management of the haemolytic uraemic syndromes, including plasma infusions and plasma exchange
	work with other specialities including Pediatric intensive care surgery and neurology

**Interstitial nephritis**

	know the causes of interstitial nephritis and tubulo-interstitial disease, and the relationship to systemic conditions
	liaise with histopathology, toxicology, microbiology and ophthalmology departments

**Cystic disease**

	know and understand the causes, clinical manifestations and outcomes of renal cystic diseases
	understand the modes of inheritance and methods of screening
	be able to investigate and manage cystic kidney disease, including liaising with hepatologists and geneticists

**Nephrolithiasis and Nephrocalcinosis**

	know and understand aetiology of renal stone formation and nephrocalcinosis, including underlying metabolic and genetic disorders
	understand the acute and chronic medical and surgical management of renal stones including lithotripsy
	be able to investigate and manage the child with renal stone and nephrocalcinosis, in conjunction with radiologists and urologists

**Tubular disorders**

	know and understand the different causes and clinical presentations of primary and secondary tubular disorders
	investigate and manage tubular disorders with particular emphasis on the correction of acid base and electrolyte disturbance
	liaise with other specialities including metabolic medicine and genetics

**Hypertension**

	be able to define hypertension according to normal pressure data in children
	understand the techniques of blood pressure measurement, their advantages and limitations
	know the renal and non-renal diagnoses implicated in hypertension in different age groups, and the mechanisms causing primary (essential) and secondary hypertension
	be able to investigate and manage acute and chronic hypertension, hypertensive crises, encephalopathy and cardiac failure
	be able to liaise with professionals in other specialties, including interventional radiology, ophthalmology, cardiology, and vascular surgery

<b>RENAL FAILURE</b>	
<b>Acute renal failure</b>	
	be able to investigate and manage the underlying cause of acute renal failure
	be able to assess and manage fluid and electrolyte disturbances, hypertension and nutrition
	be able to select and prescribe the appropriate dialysis modality, working with renal nurses, Pediatric intensive care staff, interventional radiologists and surgeons
	be able to provide nephrological support in the management of patients with multi-organ failure or systemic disease
<b>Chronic renal failure</b>	
	know and understand the presentation, clinical course and prognosis of diseases causing chronic renal failure
	be able to investigate and manage chronic renal failure
	understand the pathophysiology of systemic complications, including bone disease and anaemia
	be able to assess the degree of renal failure, monitor its progression and instigate the appropriate renal replacement therapy
	be able to manage the effects of chronic renal failure including biochemical disturbance, renal bone disease and anaemia
	be able to assess and manage growth and nutrition, including the use of enteral feeding and growth hormone
	be able to identify and manage cardiovascular risk factors including hyperlipidaemia and hypertension
	be able to counsel children, young people and families on the diagnosis and implications of permanent kidney failure, including the need for dialysis and transplantation
	Familial and hereditary renal diseases and syndromes

**DIALYSIS AND PLASMAPHERESIS****Haemodialysis**

	know and understand the principles of haemodialysis and its comparison with other methods of dialysis
	know and understand the various techniques for obtaining vascular access, and the complications of access and of dialysis itself
	be able to manage different forms of vascular access, and their complications, working with dialysis nurses, vascular

	surgeons and interventional radiologists
	be able to plan and prescribe haemodialysis and monitor its efficacy and adequacy
	be able to diagnose and manage the complications of haemodialysis

**Peritoneal Dialysis**

	know and understand the principles of peritoneal dialysis, the different available modalities and the advantages and disadvantages compared to haemodialysis
	know and understand the surgical procedure of insertion of peritoneal dialysis catheters, and the complications of peritoneal dialysis access and of the dialysis itself
	be able to diagnose and manage the complications of peritoneal dialysis, and of peritoneal dialysis access, working with dialysis nurses, and surgeons
	be able to plan and prescribe peritoneal dialysis and monitor its effects and adequacy

**Plasmapheresis**

	understand the principles of plasmapheresis, its indications, techniques and complications
	be able to prescribe and manage plasmapheresis, working with dialysis nurses, access surgeons and interventional radiologists, and other specialties including PICU staff and laboratory staff
	be able to assess the clinical response

**TRANSPLANTATION****Pre-Transplantation**

	understand the advantages and disadvantages of cadaveric versus live-related donor transplantation, the advantages and disadvantages of pre-emptive transplantation, and how cadaveric donors are selected and organs obtained and preserved
	understand the principles of matching recipient and donor, the immunological basis of graft rejection and tolerance, the importance of blood group and HLA matching and donor-recipient cross matching
	understand what is involved in a transplant work up, including working with transplant surgeons and co-ordinators, tissue-typing laboratories and adult transplant team
	be able to assess the suitability of a patient for renal

	be able to counsel the patient and family about the benefits and complications of transplantation
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**Transplantation**

	understand the anatomy and basic surgical procedures involved in transplantation, their complications and treatment
	know the range of immuno-suppressives used in transplantation, their mechanisms of action, monitoring their benefits and side-effects
	understand what is involved in a transplant work up, including working with transplant surgeons and co-ordinators, tissue-typing laboratories and UK Transplant
	be able to manage fluid and electrolyte balance and blood and blood pressure in the peri-operative transplant period, and adjudicate the medication required for a successful transplant
	be able to assess renal transplant function

**Post-Transplantation**

	understand the mechanisms of change in transplant function and identify their causes, including acute rejection and chronic allograft nephropathy
	know the recurrence rate of original disease, and other complications pertaining to the original diagnosis and their management
	know the indications for and knowledge of the procedure of renal transplant biopsy
	know the effects and risks of immuno-suppression
	be able to diagnose and manage acute and chronic rejection and disease recurrence
	be aware of issues relating to concordance affecting graft survival
	be able to counsel patients with a failing graft and discuss future management on renal replacement therapy