

DM PEDIATRIC NEPHROLOGY

GUIDELINES FOR COMPETENCY BASED POSTGRADUATE TRAINING PROGRAMME FOR DM IN PEDIATRIC NEPHROLOGY

1. PREAMBLE:

While there has been improvement in nutritional status and immunization coverage over the last three decades, chronic non-communicable diseases involving various systems are now becoming an important cause of mortality and morbidity in childhood. There is an increasing demand for specialized care of children with chronic diseases. Children with kidney diseases are often diagnosed and referred in late stages of the disease. Most of them are not treated appropriately due to lack of expertise and want of diagnostic and therapeutic infrastructure. A phenomenal progress has taken place that has revolutionized management of children with renal diseases. However, children with renal diseases in our country have been largely denied the benefits of advanced medical management. For pediatricians to provide optimal treatment for these children, special training and in-depth knowledge are necessary. It is imperative to provide suitable facilities for appropriate and relevant training in pediatric nephrology to promote growth of the specialty in the country. The training should emphasise on preventive aspects, early diagnosis of common diseases and their optimum management with available resources including dialysis and transplantation. The primary goal of the training programme for DM in Pediatric Nephrology is to develop clinicians who have acquired the operational skills, professionalism and knowledge necessary to direct a pediatric nephrology service, including dialysis and kidney transplantation.

The program includes 36 months of training and is designed to provide the experiences necessary for the DM students to develop the knowledge and skills to function as an independent pediatric nephrologist and fulfill the requirements as mandated by the Medical Council of India.

Eligibility for admission: M.D in Pediatrics

Goals:

The goal of the course shall be to produce a competent specialist in the area of Pediatric Nephrology:

1. who shall be competent to handle the health needs of patients in the speciality and provide secondary and tertiary level of care,
2. who shall be able to practice the speciality ethically,
3. who shall be aware of the contemporary advances and developments in the subject,
4. who shall acquire a spirit of scientific inquiry and is oriented to the principles of research methodology and epidemiology, and
5. who shall have acquired the skills for teaching medical and paramedical professionals.

A. Objectives:

The objectives of the training programme will be to enable the student:

1. To develop a scientific approach, based on the understanding of the pathophysiology and epidemiology of pediatric renal disease,
2. To provide primary, secondary and tertiary care to children with renal disease,
3. To provide the skills for management of emergencies in unstable children with renal problems and provide renal care to critically ill children in the intensive care unit,
4. To implement a follow up plan in children with chronic disease,
5. To be able to work in a team along with intensivists, pediatricians, pediatric surgeons and others to provide comprehensive care to children with renal disease,
6. To be able to set up and manage an independent Pediatric Nephrology unit including dialysis,
7. To develop adequate communication and counselling skills,
8. To recognize the importance of family, society and socio-cultural environment in the treatment of the sick child with renal disease,
9. To review and analyse literature, seek evidence and apply to clinical practice,
10. To develop basic research skills and carry out research projects in the field of Pediatric Nephrology, and
11. To develop basic teaching skills and be able to train undergraduates, postgraduates, nursing and paramedical staff regarding care of children with renal disease.

2. *SUBJECT SPECIFIC LEARNING OBJECTIVES*

- **Cognitive Domain: Theoretical Knowledge**

- 1) Understand the normal renal anatomy and physiology from fetal life to adolescence.
- 2) Understand the normal physiology and pathophysiology of body fluids, acid-base and electrolytes including neonates and infants.
- 3) Understand the basic principles involved in pathology of renal diseases in children and their assessment as applicable to pediatric nephrology practice.
- 4) Understand the basics of pathologic interpretation of the biopsy, including all the components: light, immunofluorescence, electron microscopy and immuno-histochemical staining.
- 5) Be conversant with the etiology, pathophysiology, diagnosis and management of common neonatal and pediatric renal diseases in an out -patient, inpatient and emergency settings.
- 6) Demonstrate knowledge about biomedical, clinical and cognate sciences and how to apply them in the management of children with kidney diseases.
- 7) Know and apply the basic and clinically supportive sciences and present evidence-based recommendations for diagnostic and therapeutic decision making in children with renal diseases.
- 8) Recognize the importance of inter-disciplinary approach in the management of various pediatric renal diseases and obtain relevant specialist / ancillary services' consultation where appropriate.
- 9) Acquire knowledge for the prevention of renal diseases in children.

- **Practical and Clinical skills**

- 1) Understand the presentation (history and clinical examination), evaluation and management of congenital and acquired renal disorders in neonates, infants and children.
- 2) Order relevant investigations and competently interpret the results of laboratory studies including urinalysis and the results of general and renal imaging procedures performed in children with kidney and urinary tract disorders.
- 3) Formulate and implement treatment plans, and monitor the effectiveness of their interventions for various renal diseases including management of acute

kidney injury, chronic kidney disease and end-stage renal disease in a holistic manner.

- 4) Perform competently all medical and invasive procedures, i.e., (a) percutaneous renal biopsy of native and transplanted kidneys, (b) placement of temporary vascular access or peritoneal catheter for renal replacement therapy (RRT), (c) Perform hemodialysis, acute and chronic peritoneal dialysis and continuous renal replacement therapy, and (d) Urine analysis.
- 5) Develop desired skills to independently manage emergency situations related to renal disease.
- 6) Communicate effectively and demonstrate caring and respectful behavior when interacting with children with renal and urinary tract problems and their families.
- 7) Be conversant with counseling techniques for the family / primary care takers.
- 8) Work with faculty and colleagues to provide patient-focused care.
- 9) Perform necessary patient care documentation in an accurate and timely manner.
- 10) Develop skills as a self-directed learner, recognize continuing educational needs and use appropriate learning resources to critically analyze relevant published literature in order to practice evidence-based medicine.

- **Writing Research articles**

- 1) Demonstrate competence in basic concepts of research methodology and epidemiology and be able to critically analyse relevant published research literature,
- 2) Locate, appraise and assimilate evidence from scientific studies,
- 3) Develop the expertise to perform a scientific study including formulating hypothesis, research questions, designing appropriate study, analyze and interpret the results,
- 4) Ability to write an in-depth manuscript describing a completed project,
- 5) Publication or presentation of case reports or clinical series at local, regional, or national professional and scientific society meetings.

- **Attitudes including communication skills**

- 1) Demonstrate respect, compassion, and integrity; a responsiveness to the needs of patients and society; and a commitment to excellence.

- 2) Demonstration of skill in listening to patients and families and the ability to effectively educate and counsel patients and their families on diagnostic and treatment decisions including initiation of dialysis therapies and prognosis.
 - 3) Develop the skills to interact with professional colleagues for the care of the renal patient.
 - 4) Demonstrate the ability to lead the consult service through interactions with referring and primary doctor.
 - 5) Effectively work with other members of the health care team, including referring physicians from other specialties, nurses, social workers and technicians, to implement a treatment plan.
 - 6) Effectively teach pediatric nephrology care to medical students, junior post graduate students and nurses.
 - 7) Adopt ethical principles in all aspects of pediatric nephrology practice/ research. (Professional honesty and integrity, humility, informed consent, counseling and recognize patients' rights and privileges).
- **Training in Research Methodology**
 - 1) Attend research methodology course to learn framing of research question, designing and conducting study, analysing and interpreting data and writing a paper.
 - 2) Participate in on-going research activities of the department to obtain experience in various aspects of research.
 - 3) Apply knowledge of study designs and statistical methods to the appraisal of clinical studies and other information on diagnostic and therapeutic effectiveness.
 - 4) Familiarize with ethics in research.

3. SYLLABUS

3.1 SUBJECT SPECIFIC THEORETICAL COMPETENCIES

3.1.1 Cognitive domain (Knowledge domain)

3.1.2 Affective domain (Attitudes including Communication and Professionalism)

3.2 SUBJECT SPECIFIC PRACTICE BASED OR PRACTICAL COMPETENCIES

The curriculum outlines competences that trainees must reach by the end of the programme (combining 3.1 and 3.2)

A. Investigation of the kidney

1. Renal Anatomy and Physiology

Knowledge	- To understand the embryology and development of genito-urinary system - To understand the development of renal function and physiology for the assessment of: a. GFR from height and plasma creatinine b. Calcium, phosphate & bone mineral metabolism c. Urinary concentrating and diluting ability d. Tubular handling of fluid and electrolytes e. Acid-base balance To explain the practicalities, limitations and special precautions of measurement of: a. Creatinine clearance b. Protein and calcium excretion c. Tubular handling d. Tests for urinary acidification
Skills	To appropriately request and interpret the above investigations
Multidisciplinary aspects	Laboratory Medicine Department
Resources	Clinical Physiology of Acid-Base and Electrolyte Disorders – Burton David Rose Principles of Renal Physiology – Chris Lote Pediatric Renal Investigations – Chapman & Taylor

2. Imaging

Knowledge	- To understand the role, limitations and interpretation of commonly used imaging modalities - To know the practicalities and safety precautions associated with each test - To understand the role of arteriography and percutaneous
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	nephrostomy tube placement
Skills	• To appropriately request the different radiological investigations • To be able to interpret scan images
Multidisciplinary aspects	• Liaison with radiologists in deciding the most appropriate investigations
Resources	• Nephro-urology radiology meetings/Posting in nuclear medicine unit • Bank of typical case images

3. Renal Biopsy and nephropathology

Knowledge	• To describe the anatomy of both native and transplant kidneys • To know the indications for renal biopsy • To describe the procedure of renal biopsy and its complications • To know the type of solutions used for light (LM), immunofluorescence (IF), and electron microscopy (EM) specimens immediately post-biopsy • To have a basic knowledge of handling and processing of renal biopsy tissue and utility of various stains (hematoxylin and eosin, periodic acid Schiff, Trichrome (Masson), silver-stains, and Congo red /immuno-fluorescence used in the diagnosis of renal disease.
Skills	• To counsel families in preparation for renal biopsy, thus allowing informed consent • To perform a native (and transplant) biopsy safely • To recognize the histopathologic characteristics of normal kidney on LM, IF, and EM • To recognize common histological appearances and consequences for diagnosis, prognosis and treatment • Able to interpret slides, including all the components: LM, IF and EM. • Obtain adequate clinical background and information from the

	appropriate nephrologist submitting the specimen to allow optimal interpretation of the biopsy.
Multidisciplinary aspects	Radiologist and pathologist
Resources	Nephropathology meetings Bank of typical case histology Training day for processing, staining and interpreting of renal biopsy samples

(B) Urinary Tract Infection (UTI) and Vesicoureteric Reflux

Knowledge	• To know the epidemiology of UTI • To understand current theories about renal scarring • To be aware of issues in diagnosis of UTI • To describe the role of ultrasound scan, MCU, DMSA and other investigations for UTI • To know the medical and surgical options in the management of UTI • To describe the mechanisms of action of antimicrobials and their adverse effects • To understand the secondary progression of renal damage and its prevention
Skills	• To appropriately manage urinary tract infection in different age groups • To show ability to counsel parents about relevant investigations of UTI, and possible management of siblings of children with reflux
Multidisciplinary aspects	• To know the appropriate follow-up into adult life • To recognize the role of microbiologists, urologists and radiologists • To be able to contribute to the development of strategies for management of UTI at local and regional level
Resources	• Microbiology department • Nephro-pediatric surgery-radiology meeting

(C) Structural Malformations

Knowledge	• To understand renal embryology and developmental anatomy • To describe the anatomy of the urinary tract and the sites and causes of urinary obstruction • To know the presentations of developmental variants and abnormalities, including obstruction • To describe the fluid and electrolyte disturbances occurring following the relief of obstruction • To be aware of the different reconstructive procedures performed, and their implications for future management • To be aware of other urological diagnoses, including genital anomalies • To know the importance of ambiguous genitalia and intersex in renal disease: structural as well as neoplastic
Skills	• To be able to provide medical support to urological services, especially following relief of obstruction
Multidisciplinary aspects	• Liaison with radiologists, obstetricians and surgeons in management decisions and antenatal counseling • To show ability to communicate and work together with other health professionals
Resources	• Department of Pediatric Surgery • Radiology meeting • Department/Division of Neonatology

(D) Disorders of Micturition

Knowledge	• To know the common renal and non-renal diagnoses associated with enuresis • To know the appropriate use of urodynamic studies • To explain the rationale for various management strategies in enuresis using behavioral and pharmacological therapies
Skills	• To be able to interpret urodynamic studies, and instigate appropriate management • To know the practicalities involved in enuretic alarms

Multidisciplinary aspects	• Liaison with urodynamic staff • Role of the psychologist
Resources	Pediatric urologists/surgeons Bank of images

(E) Neurogenic bladder

Knowledge	• To know the pathophysiology of neurogenic bladder • To know the role of basic urodynamic investigations • To know the appropriate surgical management of different types of bladder dysfunction • To understand the treatments available to regularize bowel and bladder habit
Skills	• To be able to appropriately assess the whole child with neurogenic bladder • To show ability to investigate and manage the upper and lower urinary tract
Multidisciplinary aspects	• To know the importance of shared care with surgeons and urologists
Resources	• Pediatric urology services

(F) Hematuria

Knowledge	• To know the pathophysiology of macroscopic and microscopic hematuria • To describe the methods of investigation in microscopic hematuria, including the role of renal biopsy • To understand the various findings of phase contrast microscopy and their meaning • To know the underlying causes of hematuria • To know the long term outcome of the underlying causes
Skills	• To be able to perform urinalysis • To demonstrate appropriate investigation and management of the child with hematuria, including role of imaging,

	urological assessment, and genetic and molecular studies
Multidisciplinary aspects	• To explain the mode of inheritance of hereditary nephritis, and implications for other family members • To appreciate the role of the pediatric surgeon • To understand the need for long-term follow up
Resources	• Nephropathology meeting • Pathology laboratory (microscopy of urine)

(G) Proteinuria

Knowledge	• To know the pathophysiology of proteinuria • To know the physiological and pathological causes of asymptomatic proteinuria • To describe the methods of investigation of asymptomatic proteinuria • To list the indications for renal biopsy • To know the long-term prognosis of the various conditions causing proteinuria
Skills	• To be able to differentiate between pathological and physiological proteinuria • To show ability to manage the child with proteinuria
Multidisciplinary aspects	• To understand the requirement of long-term follow-up

(H) Glomerular disease

Knowledge	• To describe the etiology, pathophysiology and immunological basis of glomerulonephritis • To know the different forms of presentation • To understand the clinical course and prognosis of acute and chronic glomerulonephritis • To know the indications for immunosuppressive agents, cytotoxic drugs, plasmapheresis and dialysis
Skills	• To appropriately investigate and manage the acute nephritic syndrome, and new presentation of chronic

	glomerulonephritis To demonstrate the appropriate use of general and specific measures to treat glomerulonephritis
Resources	Pathology laboratory

(I) Nephrotic syndrome

Knowledge	- To know the causes of nephrotic syndrome - To be aware of the pathophysiology of nephrotic syndrome, including latest research - To understand the investigation of nephrotic syndrome including indications for renal biopsy - To understand the complications of the nephrotic state - To know the pharmacology and side-effects of steroids, other immunosuppressive agents and other treatment modalities
Skills	- To appropriately investigate and manage initial episode of nephrotic syndrome and relapses and the complications - To appropriately investigate and manage steroid resistant nephrotic syndrome and the complications - To manage adverse effects of immunosuppressive medications - To demonstrate the appropriate use of general and specific measures to treat secondary causes of nephrotic syndrome
Multidisciplinary aspects	Liaison with local pediatricians in long-term management
Resources	Pediatrics, Pathology

(J) Systemic lupus erythematosus (SLE)

Knowledge	- To describe the pathogenesis of SLE and underlying immunological mechanisms - To list the histological classification of lupus nephritis - To describe the clinical course of lupus nephritis - To describe the different treatment options
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Skills	• To perform a relevant clinical examination to diagnose and assess a patient with SLE • To plan and interpret investigations, including renal histology and immunology • To appropriately manage acute renal failure due to SLE, including use of plasmapheresis • To show ability to undertake long-term management of the patient with lupus nephritis
Multidisciplinary aspects	• To appreciate the role of other specialists, especially rheumatologists • To counsel the patient about long-term implications of SLE, including problems with renal transplantation and impact on reproductive potential
Resources	Adult nephrology, rheumatology services

(K) Other Vasculitis

Knowledge	• To understand the pathophysiology and immunology of vasculitis • To know the different causes of vasculitis • To know the presentation of vasculitis, patterns of multisystem involvement and spectrum of disease • To describe the investigation and monitoring of the patient with vasculitis • To list the different therapeutic options available, including adverse effects
Skills	• To perform a relevant multisystem clinical examination • To be able to appropriately investigate and treat vasculitis, including use of immunosuppression, in the short and long-term
Multidisciplinary aspects	To work with other specialists including rheumatologists
Resources	Pediatric and adult rheumatology clinics

(L) Hemolytic uremic syndrome (HUS)

Knowledge	• To understand the pathophysiology of microangiopathic hemolytic anemia • To know the epidemiology of VTEC, <i>S. dysenteriae</i> • To know the presentation and clinical course of diarrhea-positive and atypical HUS • To be aware of non-renal manifestations of HUS • To understand the long-term consequences and prognosis of D+ HUS • To understand principles of treatment, including conservative, and the role of plasma exchange and dialysis • To understand the investigation of atypical HUS • To be aware of the long-term management of atypical HUS including implications for transplantation
Skills	• To be able to investigate, diagnose and manage the initial presentation of HUS • To appropriately initiate dialysis and plasma exchange

(M) Interstitial nephritis

Knowledge	To list the causes of interstitial nephritis and tubulointerstitial disease, and the relationship to systemic conditions
Skills	To appropriately investigate and manage the child with interstitial nephritis, including use of corticosteroids

(N) Hypertension

Knowledge	• To define and understand how to diagnose hypertension • To know the common renal and non-renal diagnoses implicated in hypertension in different age groups • To describe the possible mechanisms causing primary (essential) and secondary hypertension • To describe the investigation of hypertension including the use of arteriography and renal vein sampling ; nuclear imaging • To describe the mechanism of action and side-effects of
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	anti-hypertensive agents • To understand vascular interventions in renal artery stenosis
Skills	• To show ability to appropriately investigate the child with hypertension • To be competent in the management of hypertensive emergencies • To be competent in the management of chronic hypertension, and in using the different classes of drugs • To be able perform and interpret ABPM read out and modify prescription
Multidisciplinary aspects	• Liaison with local pediatricians; interventional radiologist
Resources	• Intensive care unit; Radiology services

(O) Nephrolithiasis

Knowledge	• To know the etiology of renal stone formation, including underlying tubular abnormalities • To know the biochemical and radiological investigation of renal stones • To understand the acute and chronic medical (including prevention of the development of renal stones) and surgical management of renal stones (including lithotripsy)
Skills	• To demonstrate ability to appropriately investigate the child with renal stones • To show ability to manage the child with renal stones
Multidisciplinary aspects	• To involve pediatric urologists where indicated • To show understanding of the significance of the family history and genetic implications in some cases
Resources	Departments of Laboratory Medicine, Pediatric Surgery, Urology and Radiology

(P) Tubular disorders

Knowledge	• To understand the different presentations of primary and secondary tubular disorders • To know the different causes • To understand the investigation of tubulopathies
Skills	• To be competent in the investigation and management of tubular disorders
Multidisciplinary aspects	• To understand the role of other specialists (hepatologists, neurologists, biochemists, geneticists) in the diagnosis, management and treatment of these disorders • To be able to provide dialysis support to other specialists
Resources	Metabolic clinics, Endocrine clinic Biochemistry department

(Q) Cystic disease

Knowledge	• To list the different causes of renal cystic disease in different age groups • To describe the mode of inheritance and methods of screening • To know the clinical course and associated features of autosomal recessive and autosomal dominant polycystic kidney disease
Skills	• To appropriately examine and investigate the child with renal cysts in different age groups • To appropriately manage the child with polycystic kidney disease
Multidisciplinary aspects	• To appreciate the implications of a diagnosis of autosomal dominant polycystic kidney disease on other family members • To recognize the importance of genetic counseling
Resources	• Radiology services

(R) Genetic disorders (Inherited diseases of the kidneys)

Knowledge	• To know the presentation and management of commonly encountered inherited renal disease including renal involvement in syndromes, familial nephritis and polycystic kidney disease • To understand basic genetic principles
Skills	• To be able to advise parents of the risks of recurrences and the need for family screening in commonly inherited diseases
Multidisciplinary aspects	To understand the role of the geneticist in diagnosis and counseling, including antenatal diagnosis
Resources	Geneticist

(S) Fluid and electrolyte disturbances

Knowledge	• To understand the physiology underlying fluid and electrolyte imbalance in the child without primary renal disease • To know the principles of treatment of fluid and electrolyte imbalance • To know the endocrine diseases associated with electrolyte imbalance and their management
Skills	To be able to manage fluid and electrolyte imbalances in non-renal disease including overdose
Resources	• Intensive care unit • Endocrine clinics

(T) Acute Kidney Injury (AKI)

Knowledge	• To know the differential diagnosis of AKI • To know the investigation including role of renal biopsy • To describe the methods to correct fluid and biochemical abnormalities and to know the indications for dialysis • To describe the principles of dialysis and filtration • To know the treatment of reversible causes of AKI
Skills	• To perform a reliable and accurate clinical assessment of

	the patient's fluid status • To be able to appropriately manage the complications of AKI – conservative and dialysis • To be able to select and practically manage the different dialysis modalities including peritoneal dialysis, hemodialysis and hemofiltration • To be able to commence correct treatment of the underlying cause • To manage the patient with multiorgan failure or systemic disease requiring acute renal replacement therapy
Multidisciplinary aspects	• To recognize the role of nurses in the management of AKI • Liaison and share care with the intensive care unit
Resources	Intensive care and neonatal intensive care units

(U) Chronic Kidney Disease (CKD)

Knowledge	• To know the epidemiology of CKD • To list the causes of CKD • To know the investigations required in a child with new presentation of CKD, including assessment of the degree of renal failure and reversibility of the condition • To understand the natural history and prognosis of common diseases causing CKD, and treatment strategies that may ameliorate the condition • To understand the factors involved in failure to thrive in CKD • To describe the pathophysiology, investigation and indications for treatment in the management of renal bone disease • To describe the pathophysiology of renal anemia, and its investigation and management, including use of erythropoietin and iron therapy
Skills	• To identify and appropriately manage the underlying cause

	• To manage the child with CKD including biochemical disturbance, bone disease and anemia • To appropriately counsel the family to facilitate the selection of dialysis modality and prior to referral for renal transplantation • To make an accurate clinical assessment of nutritional status and to use appropriate dietary advice with the assistance of dietitians • To prescribe and monitor treatment for hyperlipidemia • To show ability to prevent, diagnose and manage renal bone disease • To diagnose and appropriately treat renal anemia
Multidisciplinary aspects	• To appreciate the role of the multiprofessional team including dietitian, psychologist, social worker • To understand the role of the dialysis nurses and transplant coordinator • To audit biochemical and hematological results against national guidelines • To appreciate the impact of CKD on cardiovascular disease in adult life
Resources	• Chronic kidney disease clinics • Multidisciplinary team meeting

(V) Transplantation

Knowledge	Pre-Transplantation • To understand the ethical issues surrounding organ donation/ transplant • To know the principles of recipient selection, indications and contraindications • To describe the theoretical and practical application of blood grouping, HLA matching and donor-recipient cross
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	matching • To know what is involved in a transplant work-up • To know the advantages and disadvantages of deceased versus live related donor transplantation • To know the acceptability criteria for deceased organ donation • To describe the advantages and disadvantages of preemptive transplantation Transplantation • To understand the unique needs of children undergoing organ transplantation • To know the basic surgical procedures involved • To know the medications used, including side-effects and recent advances and trials • To know the approach towards handling deceased organ transplantation Post-Transplantation • To know the indications for and knowledge of the procedure of renal transplant biopsy • To understand the immune mechanisms of rejection • To know the recurrence rate of the original disease, and other complications pertaining to the original diagnosis and their management
Skills	Pre-transplantation • To assess the suitability of a patient for renal transplant • To discuss the issues of transplantation Transplantation • To be able to manage the peri-operative transplant period • To assess renal transplant function • To plan and modify immunosuppressive therapy Post-transplantation

	• To be competent in the diagnosis and management of acute rejection episodes • To understand the role of fine needle cytology and histopathology for diagnosing rejection • To be able to manage the stable transplant patient • To be able to advise the child, family and school • To be able to diagnose and manage chronic rejection • To be aware of the diagnosis and management of the short and long-term complications of transplantation • To counsel patients with a failing graft and discuss future management on renal replacement therapy
Multidisciplinary aspects	To understand the role of the transplant coordinator To appreciate the role of the multidisciplinary team
Resources	• Transplant clinics • Tissue typing laboratory • Transplant surgeon

(W) DIALYSIS

1. Hemodialysis

Knowledge	• To describe the principles of hemodialysis and compare and contrast with other methods of dialysis • To describe the anatomy of the neck veins, and their assessment • To describe the methods of vascular access and arterio venous fistulas, and their complications • To understand the principles of water treatment and maintaining water quality • To define the methods to assess adequacy of hemodialysis • To list the complications occurring during dialysis • To list the particular infections which may occur in patients on dialysis, and to define strategies to prevent blood-borne viral infections in patients on hemodialysis
Skills	• To be able to plan the initiation of hemodialysis

	• To manage different forms of vascular access, and their difficulties • To assess the functional status of AV fistula and cannulate • To operate hemodialysis machine and respond to alarms; disinfection of machines and circuits • To be able to handle dialyzers and the dialyzer tubings appropriately • To adjust the prescription of hemodialysis based on adequacy and monitor change • To manage the complications of hemodialysis • To diagnose, investigate and treat infection
Multidisciplinary aspects	• To understand the role of the nurses in preparing the patient physically and psychologically for hemodialysis, and in the long term management • To counsel patients about blood borne infection • To work closely with the microbiologist in developing protocols and in audit and management of infection
Resources	Hemodialysis technician and nurses Departments of Nephrology, Microbiology and Surgery

2. Peritoneal Dialysis

Knowledge	• To describe the principles of acute and peritoneal dialysis, and know the advantages and disadvantages compared to hemodialysis • To describe methods to assess adequacy of peritoneal dialysis and ultrafiltration • To describe the anatomy and outline the surgical procedure of insertion of peritoneal dialysis catheters • To know the complications of peritoneal dialysis, both infective and mechanical
Skills	• To be able to prescribe peritoneal dialysis and monitor change and measure adequacy • To perform peritoneal equilibration test (PET)

	• To operate and troubleshoot PD cyclers • To manage the complications of peritoneal dialysis
Multidisciplinary aspects	Pediatric surgeon

(X)armacology

Knowledge	• To define the principles of pharmacokinetics and drug handling in renal impairment • To list ways in which different classes of drugs act on the nephron • To describe how drugs may affect renal function • To list the effects of hemodialysis, hemofiltration and peritoneal dialysis on drug prescribing • To describe the principles of drug interactions especially immunosuppressive agents
Skills	• To prescribe safely to patients with renal disease
Multidisciplinary aspects	• To educate patients regarding importance of compliance and reporting of problems with medication
Resources	Pharmacologists

(Y) Psychosocial and Ethical issues

Knowledge	• To understand the impact of chronic illness on the child, adolescent, parents, siblings and extended family • To understand the ethics of research in children • To know the process of informed consent in different ages • To know the procedures for clinical trials
Skills	• To demonstrate competence in communication skills at initial diagnosis and thereafter • Liaison with pediatricians and other health professionals • To show interest in ethical discussions within the department • To show ability to take informed consent
Multidisciplinary aspects	• To understand the role of the psychologist, psychiatrist,

	social worker, teacher and religious leaders • To understand the care of the dying child
Resources	Multidisciplinary team meeting

(Z) Teaching skills

Knowledge	• To understand the principles of adult learning and different teaching techniques • To understand the role of clinical audit and research
Skills	• To demonstrate formal and informal teaching skills at undergraduate and postgraduate level, and to other professionals within the multidisciplinary team • To demonstrate continuing self-education and self-reflection • To show support or active involvement in research • To show ability to critically evaluate literature reviews, audit and research papers • To demonstrate ability in oral presentation skills and manuscript preparation

(A1) Nutrition

Knowledge	• To develop basic knowledge of nutritional requirements of children with acute kidney injury and chronic kidney disease including those on dialysis and transplantation
Skills	• To be able to counsel and provide nutritional advice for children with chronic kidney disease
Multidisciplinary aspects	• Nutritionist

Competency in Procedural /Practical Skills:

The post graduate student should be able to perform independently the following procedures

- **Renal biopsy**

Satisfactory performance of percutaneous biopsy of native and transplant kidneys entail:

- knowledge of indications for the procedure,
- obtaining informed consent,
- performance of the procedure itself including minimizing patient discomfort, and
- interpretation of results of the biopsy.
- ***Central venous access insertion for hemodialysis***

Satisfactory placement of vascular access entails:

- knowledge of informed consent,
- proper Seldinger technique,
- knowledge of vascular anatomy,
- minimizing patient discomfort, as well as
- functional catheter placement and recognize/manage complications
- ***Acute peritoneal dialysis catheter insertion***

Satisfactory placement of peritoneal catheter placement entails:

- knowledge of informed consent,
- proper technique,
- minimizing patient discomfort, as well as
- functional catheter placement.

In addition they should be able to perform independently the following:

To be able to write a prescription, conduct and supervise acute and chronic intermittent hemodialysis

- Entails knowledge of proper indications for hemodialysis,
- knowledge of first dialysis precautions,
- writing of dialysis order which includes choosing dialysis filters,
- estimating dry weight and modification during special circumstances (critically ill child, in-born errors of metabolism),
- choosing dialysate composition,
- understanding and treatment of complications, and
- modifying dialysis prescription for inadequate clearance in chronic hemodialysis patients.

To be able to write a prescription, conduct and supervise acute and chronic peritoneal dialysis:

- Entails knowledge of proper indications of peritoneal dialysis,

- writing orders for peritoneal dialysis which includes dialysis prescription (volume of dialysate, frequency of exchanges, and use of different hypertonic solutions),
- understanding and treatment of complications, and
- modifying dialysis prescription in special situations (lactic acidosis, metabolic disorders) and inadequate clearance in chronic peritoneal dialysis patients

To be able to write a prescription, conduct and supervise continuous renal replacement therapy (CRRT)

- Entails knowledge of proper indications of CRRT,
- writing orders for continuous renal replacement therapy (flow rate of dialysate, choosing ultrafiltration rate,
- choosing dialysate composition including the use of bicarbonate based solutions),
- understanding and treatment of complications, and
- modifying dialysis prescription for inadequate clearance in patients undergoing continuous renal replacement therapy

To be able to write a prescription, conduct and supervise slow low efficiency daily dialysis (SLED)

- Entails knowledge of proper indications of SLED,
- writing orders (flow rate of dialysate,
- choosing ultrafiltration rate,
- choosing dialysate composition,
- understanding and treatment of complications, and
- modifying dialysis prescription for inadequate clearance in patients undergoing SLED

To be able to write a prescription, conduct and supervise plasmapheresis

- Entails knowledge of proper indications of plasmapheresis,
- writing orders (volume of plasma replacement,
- choosing rate of plasmapheresis, monitoring,
- understanding and treatment of complications, and modifying plasmapheresis prescription based on the goal of plasmapheresis.

To be able to perform urine analysis at bedside

- To perform correctly urinalysis and interpret findings and to know the limitations of interpretation as applied to patient care.

Procedure	O	A	P	SJ
Renal biopsy				
Hemodialysis catheter access				
Acute peritoneal catheter insertion				
Urine analysis				

O- Observed; A- Assisted; P- Performed independently; SJ- Supervised junior colleague

4. TEACHING AND LEARNING METHODS

Clinical postings: Recommended schedule for three years training

The training of the post graduate student shall be a residency program with graded responsibility in the management of patients entrusted to his/her care. The participation of the students in all facets of the educational process is essential. The post graduate student shall take active part in seminars, group discussions, clinics, journal reviews, CPC and clinical meetings. The post graduate student shall also participate in training of post graduates, nursing and paramedical staff. They shall also be involved in research activities pertaining to the subject.

The post graduate student is required to work full time in the Department of Pediatric Nephrology, participate in the patient care and academic and research activities as described below. The trainee should attend not less than 80% (Eighty percent) of the training during the calendar year.

Orientation programme: The post graduate student would first familiarize himself/herself with the faculty of the department and other allied specialties; general working of the hospital, the Wards, admission norms, geography of the hospital, location of the various services, discharge protocol, ordering investigations and other administrative aspects that may be help in them during their training period.

The clinical postings will divided between the out-patient services, sub-specialty clinics, wards, dialysis, intensive care unit and electives.

The training will consist of intensive training in Clinical Nephrology in order to develop the fundamental skills and knowledge required to evaluate, diagnose and formulate management plans for various renal diseases in out-patient and in patient setting and in emergency cases. During the postings in ward, the DM student will be directly involved in patient care and present clinical cases to the faculty and receive one-on-one instruction and feedback in history taking, physical examination and management. The senior DM students will also engage in supervising and teaching junior colleagues. The faculty will interview, examine and discuss assessment and plans with the DM students for all inpatient consultations and emergency cases. The DM student will also undertake 24 hour calls as per the schedule of the department and will report to faculty on call. The student will also learn to counsel the patients and care takers. It will be the responsibility of the DM student to maintain documentation regarding the care of the patients treated in the unit. This will include preparation of discharge summaries, scheduling of treatment protocols for chronic diseases and transplant patients, and preparing medical reports.

During the postings, the DM student will perform various procedures initially under supervision of faculty or senior trainees and later independently like percutaneous renal biopsy of both native and transplanted kidneys, placement of temporary vascular access for hemodialysis or continuous renal replacement therapy, placement of peritoneal catheter for acute peritoneal dialysis, prescribing , supervising and trouble- shooting acute and chronic hemodialysis, peritoneal dialysis, continuous renal replacement therapy, plasmapheresis and performing urinalysis.

The total period of the course is 36 months. Of this, 30 months will be spent in the pediatric nephrology unit; 6 months will be meant for rotations in related specialties.

Suggested posting schedule

Mandatory

- | | |
|---|-------------|
| ○ Pediatric Nephrology including hemodialysis service | 30 months |
| ○ Pediatric Urology/Surgery | 1 month |
| ○ Adult Nephrology | 1-2 months |
| ○ Renal Pathology | 15 -30 days |

Electives (at least three of the below - 3 months)

- PICU/NICU
- Radiology
- Nuclear medicine
- Posting to an external Pediatric Nephrology unit
- Genetics
- Transplantation immunology and diagnostics

- (i) **Academic sessions:** In addition to bedside teaching during clinical rounds and in out-patient setting, formal teaching is necessary. The departments may select a mix of the following: sessions:

Journal club/Review	Once a month
Medical audit	Once a month
Seminar; lecture	Twice in a month
Case discussions	Once a week
Interdepartmental case or seminar	Once a month

Attend accredited scientific meetings (CME, symposia, and conferences)

Additional sessions on basic sciences, biostatistics, and research methodology, teaching methodology, medical ethics and legal issues related to pediatric nephrology are suggested.

- a) **Journal Club/Review:** Once per month of 1 hour duration-. The presentation of journal club includes a brief review of the scientific context of the paper, the data, an analysis thereof, and a critique/discussion of the experimental approach/study design and results. In journal review, relevant articles from recommended journals are reviewed. Each post graduate student shall present at least 6 journal club/reviews in one academic year and attend at least 12 others.
- b) **Seminars/Topic review:** Seminar twice every month of 1 hour duration. Aim is to provide didactic seminars on topics that cover the broad field of Pediatric Nephrology and includes basic sciences relevant to the topics being discussed. Each post graduate student shall present at least 6 seminars/symposia in one academic year and attend at least 12 others.
- c) **Case presentation** in the ward once a week for one hour. Post graduate students will present a clinical case for discussion before a faculty and discussion made pertaining

to its management and decision to be recorded in case files. Alternatively, a case is selected and presented by a post graduate student (with faculty input) from those encountered by the post graduate student in hospital and in outpatient clinics. Important literature review associated with the case may also be presented. The case is analyzed in order to make key teaching points. Each post graduate student shall present at least 6 clinical cases in one academic year and attend at least 12 others.

- d) **Clinical renal pathology Conference:** Once a month of 1 hour duration. The biopsies performed during the preceding month will be discussed. The post graduate student will summarize the clinical aspects of the case followed by interpretation of the renal biopsy in conjunction with faculty from pathology. Each post graduate student shall present at least 6 cases in one academic year and attend at least 10 sessions.
 - e) **Inter-departmental seminar or Grand Round:** Presentation of cases in clinical combined / grand rounds (Neonatology, Pediatrics, Pediatric Surgery, Radiology, nutrition) once in a month. Each post graduate student shall present at least 3 cases in one academic year and attend at least 8 sessions.
 - f) **Mortality and Morbidity/Audit meet:** Once a month for one hour to discuss the mortality and departmental statistics.
- (ii) **Teaching in the out-patient setting, during clinical rounds:** The faculty should engage in briefly discussing with the post graduate students various common and uncommon cases presenting in the OPD. There would be at least one consultant-led ward round daily that includes referral in other departments and ICU. This would be a service round with individual case presentation and brief discussion. In addition, at least 02 teaching rounds per week are recommended involving detailed discussion on admitted clinical cases. Besides theoretical aspects, emphasis must be laid on bedside assessment and practical management issues.
- (iii) **Others:** These include non-formal teaching during the discussion on management strategies for specific sub groups of children with renal diseases.
- a) **Dialysis meets:** Once a fortnight for one hour to discuss the various aspects of the children undergoing maintenance hemodialysis or peritoneal dialysis.
 - b) **Transplant meets** – once a fortnight for one hour to discuss transplant workup and also discuss management issues in children who have been transplanted.

- (iv) **Conference, CME's and Workshops:** Participating and contributing to the organization of such meets is desirable. During the 3-year period of training; he/she should attend at least one national or international and one state level meet.
- (v) **Paper Presentation/ Publication:** During the training programme, the trainees must have presented at least one paper in a national or international conference and have at least one publication in a peer reviewed journal.
- (vi) **Teaching by trainees:** The post graduate student will assist and be involved in the teaching of under graduate medical/ nursing students and those training for MD (Paed). He/she will learn the use of various teaching – teaching media (eg. audiovisual aids) in this exercise.

5. LOG BOOK

The Postgraduate student of a Postgraduate Degree Course in Super specialties shall maintain Log Book of the work carried out by them and the training programme undergone during the period of training including details of surgical operations assisted or done independently.

The Log Book shall be checked and assessed by the faculty members imparting the training.

Periodical evaluation of Log Book to be done by the Head of the Department.

The Evaluation of the candidates in both theory and practical aspects will help the candidate in the improvement of his/her knowledge skills & attitude.

COMPETENCY ASSESSMENT:

Overall:

1. Communication / Commitment / Contribution / Compassion towards patients and Innovation -	10 Marks
2. Implementation of Newly learnt techniques -	10 Marks
3. Documentation of case sheets / discharge Summary / Review -	10 Marks
4. Number of cases presented in Clinical Meetings/ Journal Clubs / Seminars / Papers presented in Conference. -	10 Marks
5. No. Of Medals/ Certificates won in the conference / Quiz competitions and other academic meetings with details. -	10 Marks

Total	50 Marks

Assessment

- I - February - First Year
- II - August - First Year
- III - February - Second Year
- IV - August - Second Year
- V - February - Third Year
- VI - May - Third Year

VIVA INCLUDING COMPETENCY ASSESSMENT – 100 Marks (50+50)

THEORY EXAMINATION

Paper I: Basic Sciences as applied to the subject including physiology, anatomy, embryology epidemiology, pharmacology, biochemistry, pathology, genetics and biostatistics

Paper II: Clinical nephrology

Paper III: Dialysis, Transplantation and Nephro-urology

Paper IV: Recent advances in Pediatric nephrology

Each paper will contain:

1. Essay questions (2) - 2 X 15 = 30 Marks
2. Short Notes (10) - 10 X 7 = 70 Marks

Total 100 Marks

CLINICAL EXAMINATION:

Particulars	Time for candidate to examine the cases	Time for examiners to question the candidates	Maximum Marks
Long Case	1 Case x 60 Minutes	60 Minutes	100
Short Case	2 Cases x 15 Minutes	30 Minutes	100
Ward Rounds	3 Patients x 10 Minutes	30 Minutes	100
OSCE	5 Stations x 3 Minutes	15 Minutes	50
Viva Voce		15 Minutes	100
Log Book			50
	TOTAL		500

OSCE: (5 Stations)

1. Clinical Scenario - 2 stations
2. Hemodialysis scenario
3. Arterial Blood gas/dyselectrolytemia interpretation
4. Pathology slide/specimen
5. Radiology

