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| **Nephrology Residency Program**  **(Postgraduate training program for nephrology)**  Program duration 2 years  **(2013; revised in 2020)** |

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# Introduction

The purpose of this curriculum is to define the process of training and the competencies needed for the award of a certificate of completion of training (CCT) in adult Nephrology. The clinical training experience of the nephrology fellowship program is designed to provide outstanding practical and academic training in every aspect of nephrology and prepares fellows for a productive career afterwards. This curriculum attempts to incorporate the advances and is an intensely academic one, designed not only to provide a broad knowledge of nephrology, but include the ability to integrate a number of equally important precepts- interpersonal skills, professional attitudes, humanistic qualities, and lifelong learning.

This Curriculum is a guide to what you are expected to learn in 2 years as Nephrology Fellow. It is also a guide to help you and the faculty meet these goals as you rotate through each phase of your fellowship. The general description, goals, objectives, expectation and benchmarks of each rotation are described. At the completion of each rotation your attending will evaluate your performance; every 6 months you will meet with the Program Director to review these evaluations and discuss any problems or areas that have been identified that require additional help or intervention. Our objective is to prepare physicians who have completed one year of residency training in Internal Medicine to become competent Nephrologists. The training will provide the fellow with exposure to a wide variety of renal diseases and electrolyte abnormalities and a chance to perform the procedures necessary for the diagnosis and treatment of end-stage renal disease. The program will allow the fellows to assume increasing responsibility in the management of renal disease in ambulatory, in-patient and intensive care settings. Finally, fellows will be expected to initiate a research project under the guidance of one or more faculty members. Renal fellows are expected to learn patient care, supervisory, and teaching skills. They will expand their medical knowledge base, as they apply evidence –based and cost-conscious strategies in patient care. Under the supervision of teaching attendings, fellows will develop progressive independence in their various responsibilities. As the most senior house staff members, fellows will recognize the important part they play as role models, counselors, and teachers to the more junior members of the teams. The consult fellows will serve as consultants to other services in the hospital and in out-patient setting.

# Goals and Objectives

The nephrology postgraduate training program provides cutting-edge training in all aspects of nephrology. Two tracks are provided for in our program - a **clinical**, and an **academic** track.

The nephrology training program provides an in-depth exposure to the broad spectrum of kidney diseases and electrolyte abnormalities encountered in clinical nephrology. The dialysis and transplantation units are an integral part of the nephrology training program. The attending nephrologist makes daily rounds and medical and surgical fellows care for the dialysis and transplant patients as part of their training. The duration of the overall training is 3 years: the first year (11 months) covers specific modules of internal medicine, second and third year (22 months) is directed for specific modules in nephrology including clinical nephrology and kidney replacement therapy.

# 2. Description of the Specialty Nephrology

## 2.1 Understanding of specialty nephrology and specialist nephrologist

*Nephrology* is the medical specialty that involves the care of patients with all forms of kidney disease.

This includes treatment of patients with:

- kidney disease without impairment of excretory kidney function (e.g. including proteinuria, hematuria, recurrent urinary tract infection and kidney stone disease) acute kidney injury or chronic kidney disease

- conditions that primarily or solely affect the kidney (such as some forms of glomerulonephritis)

- disorders which affect the kidney as part of a multi-system disease (such as diabetic nephropathy)

- disorders that are linked to changes or abnormalities in kidney physiology (such as acid base disturbances)

- end-stage kidney disease (patients with a kidney transplant, receiving any form of dialysis, or undergoing active supportive treatment of kidney failure)

A significant part of this Nephrology service involves the early detection of kidney problems, the prevention and management of progressive kidney disease, and the management of secondary complications arising as a result of kidney disease. However, kidney disease is a long-term condition for many patients, and can impact on all aspects of life. The care, support and treatment of patients with end-stage kidney failure, with and without Kidney Replacement Therapy, are important aspects of Nephrology. A coordinated approach involving access to, and support from, the whole range of health professionals is required to ensure that nutritional, lifestyle, social and psychological needs are met alongside the physical needs of patients. The complexity of renal healthcare requires integrated multi-professional working to provide a high quality service.

*Nephrologist*

A Nephrologist has the knowledge, skills and attributes to manage a wide range of clinical services for patients with kidney disease in a variety of clinical settings including inpatient, outpatient hospital settings and dialysis units work closely with colleagues in many other specialties for example: Urologists managing patients with renal stone disease etc., Diabetologists managing patients with diabetes in whom renal problems are common, Obstetricians managing pregnancy complicated by kidney disease and Dermatologists dealing with skin problems following renal transplantation etc. A nephrologist may undertake to perform practical procedures in support of their units’ services to patients depending on the skill mix of the multidisciplinary team. These include diagnostic procedures such as kidney biopsy and ultrasound of the renal tract and procedures related to establishing vascular or peritoneal access for the delivery of dialysis treatment.

## 2.2. Specific program content: general knowledge

Fellow should be able to

* Demonstrate knowledge of commonly encountered nephrology problems
* Perform a thorough literature search for pertinent kidney issues
* Describe basic pathophysiology for common nephrology and hypertension-related conditions
* Follow-up on questions regarding optimal, evidence based patient care
* Demonstrate knowledge for effective case presentation and discussion of optimizing medical care for all types of kidney diseases
* Demonstrate improvement in performance on objective knowledge assessment
* Demonstrate knowledge and understanding of commonly encountered inpatient and outpatient nephrology problems
* Demonstrate knowledge of nephrology literature analysis
* Demonstrate informatics skills to promote evidence-based medicine and quality care application
* Solidify knowledge base by educating others (medical students, residents, co-fellows, faculty)
* Demonstrate in-depth pathophysiology for common and uncommon nephrology conditions
* Apply critical reading skills to current nephrology literature
* Read and review key journal publications on a regular basis
* Demonstrate a personal sense of altruism by consistently acting in one’s patients’ best interest
* Demonstrate understanding of the basic principles of patient autonomy

- Demonstrate leadership, serve as a role model for colleagues

## 2.3 Specific program content: general skills

Principal educational goals for

***1.Patient care:***

- Develop interviewing skills

- Develop physical examination skills

- Generate and prioritize differential diagnosis

- Develop rational, evidence-based management strategies

***2. Medical Knowledge:***

- Expand clinically applicable knowledge base of basic and clinical nephrology sciences

- Develop and apply an analytical approach to renal diseases and nephrology

- Learn to access and evaluate nephrology literature relevant to patient care

- Demonstrate improvement in performance on objective knowledge assessment

- Demonstrate knowledge and understanding of commonly encountered inpatient and ambulatory nephrology problems

- Demonstrate knowledge of nephrology literature analysis

- Demonstrate informatics skills to promote evidence-based medicine and quality care application

- Solidify knowledge base by educating others (medical students, residents, co-fellows, faculty)

- Demonstrate a level of knowledge appropriate for level of training compared with one’s peers

- Demonstrate in-depth pathophysiology for common and uncommon nephrology conditions

- Apply critical reading skills to current nephrology literature

- Read and review key journal publications on a regular basis

***3.Interpersonal & Communication Skills:***

- Communicate effectively with patients with kidney disease and their families

- Communicate effectively with physician colleagues at all levels

- Communicate effectively with all non-physician members of the health care team to assure comprehensive and timely care of patients with all forms of kidney disease

- Maintain comprehensive, legible records

- Learn to communicate effectively through concise, logical and clinically useful discharge summaries

***4.Professionalism:***

- Display the elements of professionalism: altruism, accountability, excellence, duty, honor and integrity, and respect for others

- Display the principles of confidentiality, integrity and conformed consent

- Recognize the signs of diminished professionalism, including abuse of power, arrogance, greed, misrepresentation, impairment, lack of conscientiousness and conflict of interest

***5.Practice-Based Learning and Improvement:***

- Identify and acknowledge gaps in personal knowledge and skills in the care of one’s patients

- Analyze nephrology practice experiences

- Develop and implement strategies for filling gaps in knowledge and skills

**6.Systems-Based Practice**

- Understand and utilize the multidisciplinary resources necessary to care optimally for hospitalized patients with kidney disease

- Learn to collaborate with other members of the health care team to assure comprehensive care of the patient with kidney disease

- Use evidence-based, cost conscious strategies in the care of patients with all forms of kidney disease

- Learn to analyze complex systems of care to result in improved patient outcomes

## 2.4 Academic knowledge in nephrology

**Investigation of Kidney Diseases**

Fellows are encouraged to develop knowledge and expertise in the following areas, including indications, contraindications, complications, interpretation of results, cost effectiveness, and application to patient care of:

1. Urinalysis, including dipstick and sediment

2. Measurement of renal plasma flow and GFR, including interpretation of serum creatinine concentration

3. Measurement of glomerular filtration rate, kidney concentrating and diluting capacity

4. Measurement of microalbuminuria

5. Measurement of proteinuria, using semiquantitative and quantitative methods

6. Assessment of urinary acidification

7. Assessment of renal sodium and potassium handling

8. Renal radiology a. Urography b. Ultrasonography c. Radionuclide scans d. Computed tomography e. Magnetic resonance imaging f. Renal circulation imaging (angiography)

9. Kidney biopsy: indication, contraindication and interpretation

**Glomerular Diseases – primary and secondary glomerulopathies**

Fellows should acquire a general understanding of the following areas:

1. Structure and function of the normal glomerulus and how alteration of these leads to the cardinal features of glomerular injury (proteinuria and reduced GFR)

2. Principal immunologic mechanisms causing human glomerular diseases and the features that distinguish them by immunofluorescence and electron microscopy

3. Fundamental features of the normal immune response and an awareness of current concepts of autoimmunity and the factors that may be responsible for and mediate immunologic glomerular injury

4. The causes, clinical decision making, and treatment of common and uncommon causes of hematuria and proteinuria

5. Etiology and clinical findings of glomerular syndromes. including nephrotic syndrome, nephritic syndromes, and rapidly progressive glomerulonephritis manifesting as renal-limited processes or associated with systemic disease

Fellows should develop an in-depth knowledge of idiopathic glomerular diseases with respect to pathology, clinical features and response to treatment of:

1. Minimal change nephropathy presenting in adolescents and adults, especially the response to corticosteroid treatment, the development of acute renal failure in adults. and the association with malignant tumors

2. Primary and secondary Focal segmental glomerulosclerosis (FSGS), including its various pathological and clinical syndromes. The demographics, clinical course, and outcome of the clinicopathologic syndromes of 'primary" focal sclerosis, including collapsing FSGS, glomerular tip lesion, and perihilar FSGS

3. Inherited causes of Nephrotic syndrome, including genotype-phenotype correlations and syndromic proteinuric kidney diseases

4. Membranous nephropathy, including the clinical, pathological, and diagnostic features of both idiopathic membranous nephropathy and secondary membranous disease, and in-depth knowledge of the controversies regarding treatment of this disease

2. Membranoproliferative glomerulonephritis (MPGN), including infection-, autoimmune-, monoclonal immunoglobulin- associated MPGN; MPGN with masked immune deposits, complement-mediated MPGN and MPGN without immunoglobulins or complement

5. IgA nephropathy, especially its clinical course, natural history, and prognostic markers

6. Post infectious glomerulopathies, including bacterial, viral, parasitic, rickettsial, and fungal infections, and their epidemiology, clinical course, and response to therapy, especially with respect to HIV infections

7. Systemic amyloidosis and kidney damage

8. Diabetic glomerular disease

9. Thrombotic Microangiopathies, including Hemolytic Uremic Syndrome (HUS) and Thrombotic Thrombocytopenic Purpura (TTP)

Fellows should develop an in-depth knowledge of glomerular diseases associated with systemic diseases with respect to pathology, clinical and serological features, and response to treatment of:

Necrotizing and crescentic glomerulonephritis:

1.Anti-glomerular basement membrane disease

2. Immune complex diseases, including lupus nephritis, postinfectious glomerulonephritis, and Henoch-Schoenlein purpura

3. Pauci-immune glomerulonephritis and small vessel vasculitis

Fellows should acquire a general understanding of current concepts of the pathophysiology of diabetic glomerulosclerosis (DGS), including:

1. Epidemiology and course of nephropathy in insulin dependent diabetes mellitus (IDDM)

and non-insulin-dependent diabetes mellitus (NIDDM)

2. Pathophysiologic mechanisms and histologic manifestations of diabetic nephropathy (DN)

3. Strategies for prevention of DN

4. Various ways in which diabetes mellitus (DM) may affect the kidneys and urinary tract

5. Cardinal clinical and histological features, as well as the epidemiology and course of DGS

in patients with IDDM and NIDDM

**Tubulointerstitial kidney damage and Urinary Tract Infections**

During the course of their training Fellows must acquire knowledge and understanding of the following diseases:

-Acute tubulo-interstitial nephritis: drug induced, secondary to infectious disease, systemic disease associated (Sarcoidosis, Sjoegren syndrome, Systemic Lupus Erythematosus, IgG4-related disease), malignant neoplasms associated, idiopathic.

-Chronic tubulo-interstitial nephritis: a. Drug-induced - lithium nephropathy, analgesic nephropathy; b. Metabolic disorders associated – uric acid nephropathy, hypokalemic nephropathy, hypercalcemic nephropathy; c. Heavy metal exposure associated – lead nephropathy, cadmium and arsenic nephropathy; d. Radiation nephritis e. Immunological mechanism associated (Sarcoidosis, Sjoegren syndrome, Systemic Lupus Erythematosus, IgG4-related disease) f. Infection associated; g. Endemic nephropathies

- Urinary tract infection: asymptomatic bacteriuria, cystitis, pyelonephritis, papillary necrosis, tuberculosis of urinary tract

**Fluid and Electrolyte Disorders**

Fellows must acquire knowledge and understanding of the following areas:

1. Physiology of sodium balance, including sensors of extracellular volume, effecter systems, tubular sodium transport processes, and the regulation of renal sodium excretion

2. Hypovolemia: pathophysiology, causes, clinical features, diagnosis, and management

3. Edematous disorders: pathophysiology, causes, clinical features, diagnosis, and management

4. Clinical use and complications of diuretics

5. Physiology of water balance, including tonicity sensors, effecter systems, the countercurrent mechanism for urine concentration, the cellular physiology of collecting duct water reabsorption, and the regulation of water excretion by the kidney

6. Hyponatremia: pathophysiology, causes, clinical features, diagnosis, and management

7. Hypernatremia: pathophysiology, causes, clinical features, diagnosis, and management

8. Evaluation and management of the polyuric patient

9. Physiology of potassium balance, including the regulation of transcellular potassium movement, tubular transport processes for potassium reabsorption and secretion, and the regulation of potassium excretion by the kidney

10. Hypokalemia: pathophysiology, causes, clinical features, diagnosis, and management

11. Hyperkalemia: pathophysiology, causes, clinical features, diagnosis, and management

12. Disorders of sodium, water, and potassium balance in end-stage renal disease

13. Disorders of calcium, magnesium, phosphate metabolism

**Acid-Base Disorders**

Fellows should develop an in-depth knowledge of

1. Acid-base chemistry and buffering

2. Determinants of arterial carbon dioxide tension and carbon dioxide balance

3. Determinants of plasma bicarbonate concentration and hydrogen ion balance, including renal acidification processes and the physiology of bicarbonate reabsorption, titratable acid excretion, and ammonium excretion

4. Clinical evaluation of acid-base disorders

5. Renal tubular acidosis: pathogenesis, clinical features, causes, diagnosis, and management

6. Uremic acidosis: acid-base homeostasis in ESRD

7. Other types of metabolic acidosis: pathogenesis, clinical features, causes, diagnosis, and management

8. Metabolic alkalosis: pathogenesis, clinical features' causes, diagnosis, and management

9. Respiratory acidosis: pathogenesis, clinical features, causes, diagnosis, and management

10. Respiratory alkalosis: pathogenesis, clinical features, causes, diagnosis, and management

11. Mixed acid-base disturbances

**Inherited Kidney Diseases**

Fellows should acquire knowledge of the following areas:

*Genetics of inherited diseases*

a. Understanding of Mendelian genetics

b. Understanding of gene linkage analysis

c. Knowledge epidemiology, pathogenesis, clinical presentation, diagnosis and treatment of

1. Autosomal Dominant Polycystic Kidney Disease

2. Autosomal Recessive Polycystic Kidney Disease

3. Nephronophthisis

4. Autosomal Dominant Tubulointerstitial Kidney Disease

5. Medullary Sponge Kidney

6. Tuberous Sclerosis complex

7. Von Hippel-Lindau disease

8. Simple cysts

9. Alport syndrome and Thin Basement membrane nephropathy

10. Fabry disease

11. Nail-Patella syndrome

**Hypertension**

Fellows must acquire knowledge and understanding of the following areas during the course of their training:

1. Epidemiology of hypertension

2. Pathogenesis and natural history of primary hypertension

3. Evaluation of the hypertensive patient

4. Nonpharmacologic therapies of hypertension

5. Pharmacology and clinical use of antihypertensive agents

6. Hypertension in renal parenchymal disease during chronic dialysis and after renal transplantation

7. Renovascular hypertension: pathogenesis, causes. clinical features, screening and diagnostic tests, and management

8. Oral contraceptive-induced hypertension

9. Pheochromocytoma: pathophysiology, clinical features, diagnosis, and management

10. Primary aldosteronism: pathophysiology, clinical features, diagnosis, and management

11. Other forms of secondary hypertension: Cushing's syndrome, congenital adrenal hyperplasia, coarctation of the aorta, thyroid disease, hyperparathyroidism, acromegaly, sleep apnea, and drugs

1. Hypertensive emergencies and urgencies

**Renal Disease in Pregnancy**

Fellows must acquire knowledge and understanding of the following areas during the course of their training:

1. Changes in the anatomy and function of the urinary tract during pregnancy, focusing on the relevance of these changes to clinical circumstances, stressing alterations in the calyces and ureters, renal hemodynamics, and tubular function (principally potassium and glucose)

2. Changes in acid-base metabolism in pregnancy, focusing on normal pH, HCO3, and

PCO2

3. An integrated view of volume homeostasis during pregnancy. This includes knowledge of the normal gestational changes in weights intravascular and extracellular volume status, renal salt handling, and the production of volume-regulating hormones.

4. Altered osmoregulation in pregnancy, focusing on changes in plasma sodium and osmolality levels, as well as on certain disorders of water metabolism peculiar to gestation

5. Course and control of blocked pressure in normal pregnancy

6. Tests of kidney function, including indications for renal biopsy during pregnancy

7. Familiarity with the clinical spectrum and management of renal disorders in gestation. This includes: pathogenesis and treatment or urinary tract infections; acute renal failure (especially those primarily associated with gestation, *i.e.,* septic abortion, abruption, preeclampsia, acute fatty liver, and idiopathic postpartum renal failure); and chronic glomerular and interstitial renal diseases antedating pregnancy.

8. Recognition of the presentation of stone disease during gestation and familiarity with the effect of pregnancy on patients with nephrolithiasis

9. Familiarity with the administration of both acute and chronic kidney replacement therapy in pregnant women

10. Knowledge of the effects of pregnancy on the natural history of renal allografts and of the conditions required for undertaking pregnancy in transplant recipients

11. Recognition and treatment of the hypertensive disorders of pregnancy, particularly preeclampsia and its variants such as HELLP syndrome. This includes the use in

gravidas of antihypertensive drugs and the prevention and treatment of eclampsia,

including the administration of magnesium sulfate.

12. Capability to perform preconception counseling pertinent for the maternal and fetal prognoses for women with chronic hypertension and/or underlying kidney disorders

**Onco-nephrology**

Fellows must acquire knowledge and understanding of the following areas during the course of their training:

A. Trainees must acquire knowledge and understanding of the following areas during the course of their training:

1. Cancer and kidney disease

2. Multiple myeloma and amyloidosis

3. Anticancer drugs and kidney disease: chemotherapeutic agents, immunotherapies, immune checkpoint inhibitors, targeted therapies.

4. Metabolic complications: tumor-lysis syndrome, cancer-related glomerulonephritis

5. Cancer therapy in chronic kidney disease and in ESKD

**Kidney Stone disease**

Fellows must acquire knowledge and understanding of the following areas during the course of their training:

1.Nephrolithiasis epidemiology, pathogenesis, clinical manifestation and clinical evaluation; general treatment

2.Specific types of the stones: calcium stones, uric acid stones, struvite stones, cystine stones and nephrocalcinosis

**Renal cell carcinoma and benign kidney tumors**

**Acute Kidney Injury (AKI)**

Fellows must acquire knowledge and understanding of the following areas during the course of their training:

1. Normal regulation of renal and glomerular hemodynamics

2. Differential diagnosis of acute renal failure a. Pathophysiology of prerenal azotemia

b. Pathophysiology of intrinsic renal failure including acute glomerular diseases, acute tubular necrosis, and acute interstitial disease; c. Pathophysiology of obstructive AKI

3. Mechanisms of acute AKI in the postoperative patient

4. Mechanisms of AKI in patients with hepatobiliary disease

5. Causes of AKI in patients with cancer and immunosuppression

6. Causes of AKI in patients with AIDS

7. Metabolic consequences of AKI: a. Hormonal b. Nutritional c. Electrolyte d. Acid-base e. Volume

8. Evaluation and management of AKI a. Radiologic techniques in AKI b. Biochemical evaluation of AKI c. Role of the kidney biopsy in AKI d. Non-dialytic therapy e. Dialytic therapies: *role of hemodialysis; role of peritoneal dialysis; role of continuous therapy*

9. Hemodynamic monitoring of the critically ill patient

10.Management of electrolyte/acid-base disturbances in the critically ill patient

11. Fluid management of the critically ill patient

12. Use of vasoactive drugs in the critically ill patient

13. Role of extracorporeal therapy in the management of drug overdose, specifically ethylene glycol, methanol, lithium, theophylline, salicylate, and barbiturate

**Chronic Kidney Disease (CKD)**

Fellows must acquire knowledge and understanding of the following areas during the course of their training:

course of their training:

1. Various etiologies of chronic renal failure (CKD)

2. Evaluation, diagnosis, and treatment of CKD resulting from glomerular, interstitial, vascular, and obstructive processes including:

a. Diagnosis of glomerular processes b. Diagnosis of interstitial processes c. Diagnosis of prerenal processes

d. Diagnosis of obstructive processes

e. Diagnosis of systemic processes that led to CKD, specifically: diabetes mellitus; hypertension; ischemic renal disease

3. Current concepts and the results of clinical studies pertaining to the role of hypertension, dietary composition, and divalent cations on the progression of chronic renal diseases

4. Pre-dialysis management of CKD with particular regard to diet, anemia, metabolic bone diseases, and drug dose adjustments

5. Role of anemia in the management of patients with CKD

a. Management of the anemia of chronic renal failure with the use of iron, erythropoietin and other appropriate agents

6. Indications for initiation of ESRD therapy and placement of ESRD access in patients with CRF

7. Appropriate use of drugs, including dose modification, for patients with progressive

CRF

8. Interpretation of radiographic tests, including intravenous pyelography, computed tomography, ultrasound, and radionuclide scan, in patients with CKD

*Disorders of Mineral and Bone Metabolism*

must acquire knowledge and understanding of the following areas during the course of their training:

1. Calcium and phosphorus balance in humans

2. Renal handling of calcium, magnesium, and phosphorus

3. Physiology of calciotropic hormones, specifically parathyroid hormone, vitamin D, calcitonin, and parathyroid hormone-related peptide

4. An integrated view of calcitropic hormone regulation in normal situations and in the context of acute and chronic renal failure

5. Bone physiology

6. Methods to diagnose and treat different types of renal osteodystrophy, the interpretation of bone turnover markers, bone mineral density and bone biopsies

7. Pathogenesis and treatment of calcium nephrolithiasis, urate nephrolithiasis, infected stones, and cystine stones

8. Surgical procedures necessary for the treatment of stone disease

***Kidney Replacement Therapies (KRT)***

**Hemodialysis**

The renal fellow is expected to become knowledgeable about:

- Kinetic principles of hemodialysis

- Indications for dialysis

- Short-term and long-term complications of each mode of dialysis and their management;

- Principles of dialysis access (acute and long-term vascular and peritoneal), including indications, techniques, and complications including thrombosis and infections.

- Urea kinetics and protein catabolic rate

- Dialysis modes and their relation to metabolism

- Nutritional management of dialysis patients

- Dialysis water treatment and delivery systems

- Artificial membranes (various dialyzers) used in hemodialysis and biocompatibility concept

- Psychosocial and ethical issues of dialysis.

- Pathophysiology of disorders of calcium and phosphorus metabolism

- Contributing factors to accelerated atherosclerosis in hemodialysis patients

- Reverse epidemiology of cardiovascular risk factors in hemodialysis patients

**Peritoneal Dialysis**

Fellows must acquire knowledge and understanding of the following areas

-Principles of peritoneal dialysis, including membrane physiology, dialysis solutions and their mechanism of action

- Relative therapeutic and lifestyle advantages of all modes of peritoneal dialysis

- Different methods of insertion of peritoneal dialysis catheters and their advantages and disadvantages

- Methods used to assess adequacy of peritoneal dialysis and peritoneal membrane function

- Evidence based supporting treatment targets for adequate peritoneal dialysis

- Basic principles of the modality and able prescribe an appropriate dialysis regime

- Diagnosis and management of peritoneal dialysis associated peritonitis

- Management of the catheter exit site and the prevention, diagnosis and treatment of associated infection

- Diagnosis and management of mechanical problems associated with peritoneal dialysis (including hernias, leaks, catheter malfunction)

- Methods used to recognize and manage peritoneal membrane injury, including ultrafiltration failure and encapsulating peritoneal sclerosis

**Kidney Transplantation**

Fellows must acquire knowledge and understanding of the following areas during the course of their training:

A. Immunology/lmmunogenetics

1. Normal immune response

2. Immune response to allografts

3. Inflammatory response to allografts

4. Mechanisms of tolerance

5. Immunogenetics and tissue typing, crossmatching, and surveillance for panel-reactive antibodies

B. Transplant Pharmacology

1. Basic principles of pharmacology and the mechanisms of action of immunosuppressant agents, including glucocorticoids, azathioprine, mycophenolate mofetil, cyclosporine, tacrolimus, sirolimus, and monoclonal and polyclonal antibodies

2. Basic principles of pharmacology of non-immunosuppressive medications used in transplant for the prophylaxis of infection and the treatment of concurrent illnesses, with an emphasis on anticipating and managing drug interactions

C. Organ Sharing and Allocation

1. Historical perspective

2. Pre-transplant evaluation of the recipient

3. Pre-transplant evaluation of the living donor

4. Pre-transplant evaluation of the cadaver donor/organ procurement

5. Surgical technique and surgical management

6. Physiology of the transplanted kidney

7. Pathogenesis and pathology of allograft dysfunction

8. Post-transplant care/in-hospital care

9. Post-transplant care/outpatient care short- and Iong-term

10. Expected clinical outcomes/analysis of risk factors

E. infectious diseases in transplantation/pre- and post-transplantation

F. Pregnancy and transplantation

G. Cancer and transplantation

H. Ethics of transplantation

I. Economics of transplantation

## 2.5 Specific skills for nephrologist

**Investigational and procedural competencies**:

Fellow should be able to

* minimize and manage complications of kidney/ kidney transplant biopsy
* interpret the kidney/ kidney transplant biopsy findings with the assistance of a Histopathologist
* discuss the indication, perceived benefits and potential risks of the procedure with a patient or relative in a manner that facilitates informed consent
* discuss the biopsy findings with a patient to enable shared decision making regarding treatment options
* *utilize ultrasound to localize kidneys and use ultrasound guidance to assist in renal biopsy (optional)*
* *competently perform a native kidney biopsy (optional)*
* *competently perform a renal transplant biopsy (optional)*

**Urinary abnormalities**

1. ***Hematuria***

Fellow should be able to

1. Formulate a differential diagnosis, appropriate plan of investigation and management for a patient with hematuria

2.Recognise the indication for renal biopsy in investigation of hematuria and discuss the associated risks, likely prognosis and requirement for long term review

***b. Proteinuria***

Fellow should be able to

1.Formulate a differential diagnosis, appropriate plan of investigation and management for a patient with asymptomatic proteinuria, symptomatic proteinuria or nephrotic syndrome

2.Assesse the severity of proteinuria and the risk of extra-renal complications

3. Recognize the indication for renal biopsy in investigation of proteinuria and discusses the associated risks, likely prognosis and requirement for long term review

***Fluid and Electrolytes and Acid-base disorder***

Fellow should be able to

1.Assess patients with disorders of fluid, electrolyte, and acid base homeostasis and administer appropriate management

2.Perform a thorough and accurate clinical examination which includes the assessment of the volume state

3.Interpret the results of appropriate biochemical investigations

4.Manage patients with fluid, electrolyte and acid base disorders

***Kidney Glomerular diseases***

Fellow should be able to

1.Assess clinically the patients with glomerulonephritis with or without systemic involvement

2. Investigate patient with suspected glomerulonephritis appropriately including laboratory tests, imaging and kidney biopsy

3. Interpret the results of laboratory investigations and kidney biopsy findings

4.Make appropriate decisions about urgency of treatment

5.Dermine the place for immunosuppression, balances risks and benefits, and monitors long term use

6. Make an accurate and focused clinical assessment of patients who may have diabetic nephropathy

***Kidney Tubulointerstitial diseases and urinary infection***

Fellow should be able to

**1.**Assess clinically the of patients with interstitial nephritis, and takes a full drug and environmental history

2.Investigate patients appropriately including use of laboratory tests, imaging and renal biopsy

Interprets the results of appropriate laboratory investigations and renal biopsy findings

3.Make decisions about urgency of treatment and the place of steroids or other immunosuppression

4.Investigate and manage all forms of urinary tract infection including recurrent urinary tract infection

5.Explain the familial nature of urinary tract infection when appropriate

***Inherited and Rarer Diseases***

Fellow should be able to

1.Assess patients with inherited diseases, take a full history, and aware of systemic features found in these diseases

2. Initiate investigations including laboratory tests, imaging and renal biopsy (when appropriate).

3.Interpret the results investigations (including renal biopsy) and initiates specific treatment appropriately

4.Explain to patients the long term and progressive nature of these diseases and acts to minimize complications

5.Determine when screening is required and interprets results of screening tests

**Kidney stone disease**

Fellow should be able to

1.Assess the patient with renal stones and appropriately investigates patients with recurrent renal stones

2.Discuss with a patient suitable simple and dietary measures to reduce risk of renal stone formation

3.Recognise the limitation of medical treatment and appropriately refers patients for surgical assessment

4.Recognise the need to appropriately involve other clinicians including dieticians, urologists, radiologists

**Hypertension**

Fellow should be able to

1.Assess a patient with hypertension (including use of home and ambulatory blood pressure monitoring) and appropriately investigates to exclude underlying secondary causes

Identifies the patient with secondary hypertension who is suitable for definitive treatment; recognise and be able to counsel patient about the limitations of such intervention

2.Agree with the patient lifestyle measures and a suitable antihypertensive drug regime

3.Prescrib antihypertensive medication to achieve targeted blood pressure levels

4. Review effectiveness of blood pressure control over time with patient and primary care team

5.Assess patients who may have renovascular disease and determines if further investigation and intervention are required

6. Prevent the risks of acute kidney injury after angiographic procedures

7.Be able to counsel a patient about risks and benefits of investigations and interventions such as angiography and angioplasty/stent

8. Be able to provide long term care of blood pressure and cardiovascular risk for the patient with renovascular disease

**Acute kidney Injury**

Fellow should be able to

1.Identify patients at high risk of AKI and institutes preventative measures

2.Differentiate pre-renal failure, renal failure and post-renal (urinary tract obstruction) AKI

3.Grade the severity of AKI

4.Order, interpret and act upon investigations appropriately including: biochemistry, hematology, microbiology, immunology and imaging

5.Initiate appropriate specialist management of AKI and the underlying cause (including kidney replacement therapy, immunosuppressant treatment, plasma exchange etc.)

**Acute Dialysis and plasma exchange**

Fellow should be able to

1**.**Assess the suitability of a patient for hemodialysis or hemofiltration

2.Prescribe hemodialysis and hemofiltration safely, adjust prescriptions appropriately and monitor response to treatment

3.Prescribe medication safely and appropriate to patients with acute kidney injury

4.Assesse the suitability of a patient for plasmapheresis

5.Prescribe plasmapheresis safely and assesses response to treatment

6.Manage the patient with acute renal injury requiring both plasmapheresis and acute renal replacement therapy

**Chronic kidney disease**

Fellow should be able to

1.Take an accurate clinical history in the assessment of chronic kidney disease including drug history, family, social and environmental history

2.Manage the patient with chronic kidney disease to ensure that reversible causes are identified and treated

3.Manage the non-renal complications of chronic kidney disease

4.Discuss treatment options with patients appropriately and in liaison with the multi-disciplinary team to support the patient’s decision-making processes

5.Make timely and appropriate plans for renal replacement therapy where necessary

6.Interpret the results of biochemical, radiological and histological investigations in patients with disorders of bone and mineral metabolism

7.Prevent, diagnose and manage renal bone disease in patients with chronic kidney disease before the initiation of kidney replacement therapy

8.Manage the renal bone disease in patients on peritoneal dialysis, hemodialysis and with a kidney transplant

9.Explain available treatment options to patients

10.Describe the pathophysiology of renal anemia and the hematological and biochemical methods to diagnose, assess and monitors treatment in renal anemia

11.Distinguishes between anemia secondary to chronic kidney disease and other causes

12.Defins the indications for and the use of erythropoietic stimulating agents (ESAs) and their complications

13.Define the indications for and use of oral and parenteral iron therapy and its complications

14.List the causes of resistance to ESA therapy and its investigation

15.Assess a patient who may have cardiovascular disease including identification and treatment of cardiovascular risk factors

16.Interpret guidelines for treatment of cardiovascular risk factors including hyperlipidemia and obesity

17.Discuss self-management strategies and dietary modifications with patient and when necessary prescribe and monitor drug therapy

18.Recognise patients who need referral for specialist cardiology review (including potential kidney transplant recipients)

19.Consider a patient’s nutritional status and provides appropriate nutritional advice with the support of dieticians

20.Manage the nutritional needs of patients with acute kidney injury and other complex multisystem disorders

**Management of advanced chronic kidney disease**

**Conservative care**

Fellow should be able to

1.Identifiy patients requiring active support management or end of life care

2.Counsel patients and caregivers about active supportive care (conservative - non dialysis, non transplant) management of advanced chronic kidney disease

3.Recognise and manage the symptoms of end-stage renal disease including prescription of effective analgesia for patients requiring pain relief and initial management of depression

4.Identifies the patient who is deteriorating despite dialysis; counsels patients and caregivers about withdrawal of dialysis with the support of the multidisciplinary team

**Kidney Replacement Therapy**

**a. Hemodialysis**

Fellow should be able to

1.Adjust the prescription of hemodialysis and monitor change

2.Advise on ultrafiltration, sodium profiling and the use of different dialysate solutions

3. Assess the suitability of different methods of vascular access

4.Organise the day-to-day management of a hemodialysis unit

5.Identify and manage the complications of vascular access involving, when necessary, surgeons and radiologists

6.Manage dialysis-related sepsis and develop protocols with microbiologists

7.Develop protocols to deal with acute dialysis emergencies

8.Be able to discuss the indications, benefits and adverse events of the procedure to patients, 9.Relatives and caregivers in a manner that will allow informed consent

10.Be able to perform insertion of temporary hemodialysis catheters using the Seldinger technique and ultrasound guidance for bilateral internal jugular and femoral veins

11. Be able to perform insertion of tunneled hemodialysis catheters using (elective)

12. Explain the use of the catheter and its management to the patient, relatives and caregivers

1. **Peritoneal dialysis**

Fellow should be able to

1.Assess the suitability of a patient for peritoneal dialysis in the context of other methods of kidney replacement therapy

2.Adjust the prescription of peritoneal dialysis and monitor change

3.Manage the nutrition of peritoneal dialysis patients.

4.Organise the day-to-day management of a peritoneal dialysis service

5. Adjust the prescription of peritoneal dialysis required following complications and these monitor changes

6.Manage the prevention and treatment of peritoneal dialysis associated infections (peritonitis and exit-site) and their complications

7.Manage peritoneal dialysis technique failure and transfer to hemodialysis, if needed

**c. Kidney transplantation**

**Pre-transplant evaluation**

Fellow should be able to

1.Assess suitability of patients with end-stage renal disease for renal transplantation

2.Discusses the issues around living donor transplantation and pre-dialysis transplantation

3.Counsel patients and relatives in all aspects of renal transplantation including living kidney donation

4.Assess the suitability of a person as a living kidney donor in accordance with national guidelines

5.Develop and carries out protocols for pre-transplant assessment of recipients and living donors

**Post-transplant management**

Fellow should be able to

1.Optimise the graft and patient outcome in the first 3 months after kidney transplantation

2.Assess the significance of changes in kidney transplant function

3.Investigate kidney transplant patients with acute transplant dysfunction and interpret the results of investigations

4.Evaluate patients with surgical and medical complications of kidney transplantation

5.Plan and modify immunosuppressive therapy regimens

6.Counsel patients and relatives in all aspects of kidney transplantation

**Long-term care of the kidney transplant patient**

Fellow should be able to

1.Identify declining transplant function, assesses significance of changes, investigates appropriately, and makes appropriate changes to management

2.Utilise strategies that optimizes long term graft and patient outcomes

3. Identify and manage cardiovascular, malignant and infectious problems in renal transplant recipients

4.Modify long term immunosuppressive therapy regimens and tailor to an individual patient considering other comorbid conditions and changing circumstances

5.Minimizes and manage the medical complications of a failing kidney transplant

6.Counsel patients and relatives in all aspects of kidenyl transplantation, including graft failure and preparation for dialysis or re-transplantation

# 3.CURRICULUM FOR EACH ROTATION

In addition to the overall education and clinical requirements in the previous section, a description of the educational requirements for each rotation is outlined. Fellows are expected to integrate medical problems with preventive practices, cultural, socioeconomic, ethical, occupational environmental and behavioral issues in each rotation.

**Teaching methods**

Introductory (Core) Conferences given during the first 6 months of Fellowship

Attending rounds, multidisciplinary conference

Didactic Lectures during the remainder of the year

Case-based conferences

Multidisciplinary meetings held monthly

Case Conferences and Morbidity/Mortality meetings

Quality improvement projects/presentations

Review Topics for discussion, literature search on topics pertinent to the care of patients.

Training in research

## 3.1 Job description

Fellow Duty Hours and the Working Environment

1. Supervision of Fellows

a. All patient care must be supervised by qualified faculty. The program director must

ensure, direct, and document adequate supervision of fellows at all times. Fellows

must be provided with rapid, reliable systems for communicating with supervising

faculty.

b. Faculty schedules must be structured to provide residents with continuous supervision

and consultation.

c. Faculty and fellows must be educated to recognize the signs of fatigue and adopt and

apply policies to prevent and counteract the potential negative effects.

2. Duty Hours

a. Duty hours are defined as all clinical and academic activities related to the residency

program, i.e., patient care (both inpatient and out-patient), administrative duties related to

patient care, the provision for transfer of patient care, time spent in-house during call

activities, and scheduled academic activities such as conferences. Duty hours do not

include reading and preparation time spent away from the duty site.

b. Duty hours must be limited to 48 hours per week, averaged over a four-week period,

inclusive of all in-house call activities.

c. Fellows must be provided with 1 day in 7 free from all educational and clinical

responsibilities, averaged over a four week period, inclusive of call. One day is defined as

one continuous 24- hour period free from all clinical, educational, and administrative

activities.

3. Oversight

Each program must have written policies and procedures consistent with the

Institutional and Program Requirements for fellow duty hours and the working

environment.

Teaching attendings are expected to provide oral evaluations to fellows throughout the course of the rotation as well as formal oral feedback at the end of each rotation. Each fellow meets twice a year with the Program Director, to review his or her performance.

***1st year (11 months) nephrology rotations***

**Rotation (module)1.1**: **Assessment of Kidney disease**

Required number of months: 1

Fellows should be able to should longitudinally manage the lab data and investigations of at least 40 patients; observe at least 8-10 kidney biopsy procedure; one presentation on update kidney disease diagnostics

**Rotation (module) 1.2 Primary and secondary glomerulopathies**

Required number of months: 4

Fellows should longitudinally manage at least 50 patients including taking history and clinical examination, participate in kidney biopsy procedure (at least 20), participating in nephrology-pathology round table (at least 2); oral presentation of at least 6 cases

**Rotation 1.3 Tubulo-interstitial kidney disease; inherited kidney diseases**

Required number of months: 1

Fellows should longitudinally manage at least 18-20 patients including taking history and clinical examination, oral presentation of at least 2 cases

**Rotation 1.4 Kidney disease in pregnant women and onconephrology**

Required number of months: 1

Fellows should longitudinally manage at least 5 pregnant women and at least 10 patients with various oncology diseases, including taking history and clinical examination; oral presentation of at least 3 cases

**Rotation 1.5 Acid base and water-electrolytes disorders**

Required number of months: 1month

Fellows should longitudinally manage at least 18-20 patients including taking history and clinical examination, oral presentation of at least 5 cases with various acid base and water-electrolytes disorders

**Rotation 1.6 Acute Kidney Injury**

Required number of months: 1

Fellows should longitudinally manage at least 15 patients including taking history and clinical examination, oral presentation of at least 5 cases

**Rotation 1.7 CKD**

Required number of months: 2

Fellows should longitudinally manage at least 40 patients including taking history and clinical examination, oral presentation of 5 cases

2***nd year (11 months) nephrology rotations – Kidney Replacement Therapy***

**Rotation 2.1 – Hemodialysis**

Required number of months: 4

Fellows should longitudinally manage 80-100 HD patients; work independently with the HD machines during the rotations period, prescribe HD session schedule

**Rotation 2.2 Peritoneal dialysis**

Required number of months: 3 months

Fellows should longitudinally manage 20 PD patients

**Rotation 2.3 Kidney Transplantation**

Required number of months: 4

Fellows should longitudinally manage at lease 50-60 kidney transplant patients

Assessment Methods:

Formative evaluations of the fellow at the end of each month are completed by the Nephrology

Attending. Verbal feedback is also given to the fellow by the Nephrology Attending. After each rotation The fellow sat the end of the each module (rotation) should be evaluated as

|  |  |  |
| --- | --- | --- |
| Excellent | Good | Satisfactory |
| Independent work | Works under supervision | Observer |

# 4. Academic staff

Irma Tchokhonelidze: Fellowship post-graduate program director in Nephrology; Professor of Internal Medicine, TSMU

Tamar Kasradze: Assistant fellowship director, Nephrologist

Lela Beglarishvili: Assistant fellowship director, Nephrologist

Avtandil Tataradze: Assistant fellowship director, Nephrologist

# 5. Training hospitals

The fellowship postgraduate program in nephrology has in-patient and out-patient rotations at two hospitals:

1. Tbilisi State Medical University and Ingorokva High Technology Medical Center (Tsinandali st.9, Tbilisi) for Internal Medicine and Nephrology rotations
2. National Center of Urology and Nephrology (Tsinandali st.9, Tbilisi) Nephrology rotations

# 6. Final evaluation form

Fellow Name -----------------------------------

Examiner Name ---------------------------------

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Points | 1 - acceptable | 2 - satisfactory | 3 - good | 4 – very good | 5 -excellent |
| History taking skills |  |  |  |  |  |
| Kidney patients’ examination skills |  |  |  |  |  |
| Professionalism and consulting skills |  |  |  |  |  |
| Kidney replacement therapy skills |  |  |  |  |  |
| Transplant patient management skills |  |  |  |  |  |
| Patient presentation skills |  |  |  |  |  |

Additional comments:----------------------------------------------------------------------

------------------------------------------------------------------------------------------------

Examiner signature: ----------------

Fellow signature:-----------------

Date: ------------------------

The training requirements must be successfully completed before the eligibility to apply for specialty (nephrology) certificate examination for the next 3 years.

# 7. Recommended literature:

1. Jurgen Floege, Richard J.Johnson, John Feehally. Comprehensive Clinical Nephrology, 2019.
2. Robert W. Schrier. Renal and electrolyte disorder; 8th edition, 2018
3. Dieanne B. McKay, Steven M.Steinberg. Kidney Transplantation, 2010.
4. R. Khanna, R.T. Krediet. Nolph and Gokal’s Textbook of Peritoneal Dialysis, 2009.
5. Gabriel M. Danovitch. Handbook of Kidney Transplantation, 6th edition, 2017
6. J.Larry Jameson, Harrison’s Principles of Internal Medicine, 20th edition, 2018