

2020



NEPHROLOGY CURRICULUM

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Reviewed and Approved by
Members of the Scientific Committee of Nephrology

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INTRODUCTION

The clinical training experience of the nephrology fellowship program at SBOMS is designed to provide practical and academic training in almost every aspect of nephrology and prepare fellows for a productive career afterwards.

This Curriculum is a guide to what you are expected to learn in 18 months of Nephrology Fellowship. 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.

We recognise that at this point in time clinical opportunities to practice Kidney transplant and Peritoneal dialysis management are missing, and that is why the fellowship has been reduced to 18 months. Meeting the goals of introducing the fellows to these areas of practice will be attempted through online courses and case discussions .

Every year you will be tested then meet with the Program Director to review your performance and discuss any problem or areas that have been identified that require additional help or intervention.

GENERAL OBJECTIVES OF THE TRAINING PROGRAM

PROGRAM STRUCTURE

Admission requirements

To be admitted to the SBOMS Nephrology and Hypertension Fellowship Program, a candidate must:

- 1) Fulfill all the requirements as per SBOMS Admission Requirements for postgraduate Training Programs (SBOMS.org).
- 2) Possess a Specialty Certificate in Internal Medicine or its equivalent (approved by the SBOMS), or have at least successfully completed the written component of the SBOMS Specialty Certificate in Internal Medicine.
- 3) Be licensed to practice medicine.
- 4) Provide a written permission from the sponsoring institution, allowing the candidate to participate in full-time training for the entire 18 months program.
- 5) Sign an undertaking to abide by the rules and regulations of the Training Program and the SBOMS.
- 6) Successfully pass the interview for the particular subspecialty.
- 7) Register as a trainee of the SBOMS.

Rotations

- **CONSULT SERVICES:** 18 months
- **OUTPATIENT CLINIC:** 3 day a week for the duration of the program
- **DIALYSIS-HEMODIALYSIS AND PERITONEAL DIALYSIS:** 18 months
- **TRANSPLANTATION:** (If available) 3 months
- **RENAL PATHOLOGY:** 1 month

Structure of the training program

TRAINING OBJECTIVES IN FIRST YEAR

the Fellow one must be able to:

- Elicit the patient's history, past history, and the context in which the illness or symptoms occur.
- Develop verbal and nonverbal communication skills in order to facilitate communication , elicit the emotional content of the interview, and provide comfort.
- Ensure patient's understanding of nephrology and other terms used
- Perform an appropriate, technically correct physical examination
- Synthesize pertinent renal data into a differential diagnosis
- Recognize psychosocial issues that may affect patient compliance and outcome.
- Accept personal responsibility to follow-up on patient care plans and test results
- Formulate a diagnostic and therapeutic plan with supervision
- Apply appropriate preventative care for the patient with kidney disease in outpatient settings
- Develop an evidence-based therapeutic and diagnostic management
- Counsel and educate patients and families about kidney disease
- Coordinate patient care among all members of the health care team
- Develop skills for end of life and palliative care discussions and planning for the ill patient with CKD and ESRD
- Optimize discharge planning and follow-up in the nephrology clinic or dialysis unit.
- Perform procedures (urine microscopy, temporary catheters, renal biopsy) required by the ABIM
- Demonstrate knowledge of commonly encountered nephrology problems .
- Perform a thorough literature search for pertinent renal issues
- Describe basic pathophysiology for common nephrology and Hypertension related conditions.
- Follow-up on questions regarding optimal, evidence based patient care
- Develop skills for effective case presentation and discussion of optimizing medical care for all types of renal diseases.

TRAINING OBJECTIVES IN SECOND YEAR

The Fellows, should be able to:

- Use the interview to identify cognitive impairment, anxiety, denial and defensiveness and be able to manage each during the interview.
- Independently perform the procedures (urine microscopy, temporary catheters, renal biopsy) required by the ABIM
- Efficiently evaluate and manage patients in the inpatient and outpatient setting at the level of the nephrology sub-specialist
- Function competently as an nephrology consultant
- Coordinate patient care among all members of the healthcare team and demonstrate leadership skills to promote multidisciplinary management
- Demonstrate effective ability to lead end of life and palliative care discussions and planning for the ill patient with CKD and ESRD
- Demonstrate improvement in performance on objective knowledge assessment (NephSAP)
- 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
- Direct other subspecialty, surgical, nutritional, podiatric and social services consultations for patients with kidney disease

CORE COMPETENCIES FOR NEPHROLOGY

The nephrology training program provides an in-depth exposure to the broad spectrum of renal diseases and electrolyte abnormalities encountered in clinical nephrology. The Nephrology service evaluates these problems on a consultation basis for all covered hospitals. The consultation service consists of an attending from the renal division, the clinical fellow, and one to two medical residents. The fellow's role is primarily that of directing the management of the consultations while providing maximal educational benefits to the service and the general medical House staff. The training program has a full-time Nephrologist attending on site in addition to multiple board-certified nephrologists in the US providing teaching in the form of didactic lectures in various areas.

The Nephrology-Cardiac service is a unique concept where fellows are exposed to the renal problems encountered in cardiac patients. This includes acute renal failure in the ICU. The dialysis units are an integral part of the renal training program. The in-center dialysis facilities consist of an extremely dynamic 6 station unit providing acute and chronic dialysis training. The CAPD and transplant programs are not in operation at this point in time.

Specific Program Content

The fellow is expected to gain experience in a wide variety of renal disease. The specific entities are detailed below:

1. Glomerular diseases
2. Diabetes mellitus and diabetic nephropathy
3. Hypertension
4. Acute renal failure and intensive care unit nephrology
5. Chronic renal failure
7. Acid-base disorders
8. Fluid and electrolyte disorders
9. Cystic and inherited diseases of the kidney
10. Tubulointerstitial disease and urinary tract infection
11. Disorders of mineral and bone metabolism
12. Principles of transplantation

13. Renal disease in pregnancy
14. Renal function testing
15. Pharmacology of drugs in renal disease

Glomerular Diseases

I. PROGRAM CONTENT

- A. Trainees 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

- B. Trainees should be familiar with and develop an in-depth knowledge of:
 1. The causes, clinical decision making, and treatment of common and uncommon causes of hematuria and proteinuria
 2. Etiology and clinical findings of glomerular syndromes, including nephrosis, nephritis, and rapidly progressive glomerulonephritis manifesting as renal-limited processes or associated with systemic disease

- C. Trainees 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. Membranoproliferative glomerulonephritis, including types I, II, and III, and the clinical and pathological features of this disorder in association with hepatitis C and cryoglobulinemia
3. Focal segmental glomerulosclerosis (FSGS), including its various pathological and clinical syndromes and the association with conditions of reduced renal mass. The demographics, clinical course, and outcome of the clinicopathologic syndromes of "primary" focal sclerosis, including collapsing FSGS, glomerular tip lesion, and perihilar FSGS
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
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

D. Trainees 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:

1. Necrotizing and crescentic glomerulonephritis
 - a. Anti-glomerular basement membrane disease
 - b. Immune complex diseases, including lupus nephritis, postinfectious glomerulonephritis, and Henoch-Schonlein purpura
 - c. Pauci-immune glomerulonephritis and small vessel vasculitis
2. Renal manifestations of other rheumatic disorders, including systemic sclerosis, Sjogren's syndrome, mixed connective tissue disease, rheumatoid arthritis, Bechet's syndrome, relapsing polychondritis, and familial Mediterranean fever
3. Renal disease in the dysproteinemias, including multiple myeloma, amyloidosis, fibrillary glomerulopathy/immunotactoid glomerulopathy, and mixed cryoglobulinemia

II. PATIENT CARE EXPERIENCE

A. Trainees should be familiar with and have experience in:

1. Diagnosis and management of patients with isolated proteinuria, hematuria, nephrotic syndrome, and acute glomerulonephritis
2. Serological evaluation of glomerulonephritis, including the diagnostic value and limitations of antiglomerular basement membrane (anti-GBM), ANCA, antinuclear and anti-microbial antibodies, hypocomplementemia, and cryoglobulinemia
3. Indications for and complications of renal biopsy, as well as the morphological and immunohistological features of the major glomerular diseases
4. Treatment of patients with nephrotic syndrome and acute glomerulonephritis, both renal-limited and secondary to systemic diseases, including the indications, complications, and value of various immunosuppressive protocols

Diabetes Mellitus and Diabetic Nephropathy

I. PROGRAM CONTENT

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

1. Epidemiology and course of nephropathy in insulin-independent 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. Therapy of established DN
5. Modalities of therapy for end-stage renal disease (ESRD) in DN, including hemodialysis

and peritoneal dialysis, kidney transplantation, and kidney pancreas transplantation

B. Trainees should develop an in-depth knowledge of:

1. Various ways in which diabetes mellitus (DM) may affect the kidneys and urinary tract
2. Cardinal clinical and histological features, as well as the epidemiology and course of DGS in patients with IDDM and NIDDM
3. Results of clinical trials designed to prevent DN or slow its progression
4. Relative merits of different modalities of therapy for ESRD in diabetic patients, including hemo- and peritoneal dialysis, kidney transplantation, and kidney-pancreas transplantation

C. Trainees should be familiar with:

1. Definition, interpretation, prognostic value, and clinical use of "microalbuminuria"
2. Unique medical and surgical problems facing patients with advanced DN as well as their management

II. PATIENT CARE EXPERIENCE

A. Trainees must have experience in the evaluation and management of patients with progressive diabetic nephropathy, both insulin-dependent and non-insulin-dependent. Experience with treatment of blood pressure, fluid-electrolyte disorders, glycemia, and non-renal diabetic complication is needed.

B. Trainees must have experience in the evaluation and management of patients with end-stage diabetic nephropathy who are receiving hemodialysis and peritoneal dialysis.

Hypertension

I. PROGRAM CONTENT

A. Trainees 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

II. PATIENT CARE EXPERIENCE

A. Trainees should be familiar with and have experience in the following areas in both the outpatient and inpatient setting:

1. Trainees must be able to assess the severity of hypertension and end-organ damage. They should be familiar with the role of ambulatory blood pressure monitoring in the evaluation of the hypertensive patient.

2. Trainees must be able to define goals of treatment, be familiar with the nonpharmacologic modalities as well as the use and side-effects of antihypertensive agents, and be able to make appropriate therapeutic choices in the context of comorbid conditions.

3. Trainees must be familiar with the management of hypertension in renal parenchymal disease during chronic dialysis and after renal transplantation.

4. Trainees must be able to identify symptoms and signs suggestive of secondary causes of hypertension and be familiar with the various screening and diagnostic tests as well as the

management of these disorders.

5. Trainees must become familiar with the management of the various hypertensive emergencies and urgencies.

Acute Renal Failure and Intensive Care Unit Nephrology

I. PROGRAM CONTENT

A. Trainees 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 renal failure
3. Mechanisms of acute renal failure (ARF) in the postoperative patient
4. Mechanisms of ARF in patients with hepatobiliary disease
5. Causes of ARF in patients with cancer and immunosuppression
6. Causes of ARF in patients with AIDS
7. Metabolic consequences of ARF
 - a. Hormonal
 - b. Nutritional
 - c. Electrolyte
 - d. Acid-base
 - e. Volume
8. Evaluation and management of ARF
 - a. Radiologic techniques in ARF
 - b. Biochemical evaluation of ARF
 - c. Role of the renal biopsy in ARF
 - d. Nondialytic therapy
 - e. Dialytic therapies
 - i. Role of hemodialysis
 - ii. Role of peritoneal dialysis
 - iii. 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

II. PATIENT CARE EXPERIENCE

- A. Trainees must have experience in the evaluation and management of acute renal failure.
- B. Trainees must have experience in the evaluation and management of fluid-electrolyte and acid-base disturbances in the critically ill patient.
- C. Trainees should have experience in the evaluation of hemodynamics and the proper use of fluids and vasoactive drugs in critically ill patients.
- D. Trainees should have experience in the use of various dialytic techniques, including hemodialysis, peritoneal dialysis, and continuous venovenous hemodialysis.
- E. Trainees should have experience in the use of extracorporeal therapy to remove specific toxins.
- F. Trainees should have experience in the placement of central lines.

Chronic Renal Failure

1. PROGRAM CONTENT

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

1. Various etiologies of chronic renal failure (CRF)
2. Evaluation, diagnosis, and treatment of CRF 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 CRF, specifically:
 - i. Diabetes mellitus
 - ii. Hypertension
 - iii. 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. Predialysis management of CRF with particular regard to diet, anemia, metabolic bone diseases, and drug dose adjustments
5. Role of anemia in the management of patients with CRF
 - 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 CRF

II. PATIENT CARE EXPERIENCE

- A. Trainees must have at least one year of continuous outpatient clinic experience in the management of patients with CRF.
- B. Trainees must have a sufficient number of patients to evaluate and manage so that they acquire expertise in the management of patients with glomerular, interstitial, and obstructive renal processes. In addition, trainees should have a sufficient number of patients to work with to be competent in the management of hypertension, anemia, and diabetes mellitus.
- C. Trainees must be competent to interpret intravenous pyelograms, radiopharmaceutical studies, renal arteriography, and renal ultrasound in the diagnosis of patients with CRF.
- D. Trainees must be competent to perform - and must have performed a sufficient number of - percutaneous renal biopsies.
- E. Trainees must have interpreted an appropriate number of renal biopsies so that they are comfortable in reviewing histologic features and assigning appropriate diagnoses.

Dialysis

1. PROGRAM CONTENT

- A. Types, advantages, disadvantages, complications, and management of acute and chronic hemodialysis and peritoneal dialysis access
- B. Available water treatment and dialysis delivery machines for hemodialysis and connection and cycling systems for peritoneal dialysis
- C. Currently available hemodialyzers and their advantages and disadvantages, with emphasis on differences in membrane composition, biocompatibility, and solute and water flux
- D. Importance of and correct method of determining the dialysis prescription for hemodialysis and of monitoring the actual delivered dose of dialysis
- E. Most common complications of hemodialysis, including hypotension, cramps, arrhythmias, hemolysis, and air embolism

- F. Most common complications of peritoneal dialysis, including peritonitis, hypotension, hernias, dialysate leaks, and inadequate dialysis
- G. Continuous dialytic therapies, including continuous arteriovenous hemodiafiltration and continuous venovenous hemodiafiltration
- H. Nutritional considerations and management of ESRD patients
- I. Evaluation and management of complications of ESRD, including anemia, renal osteodystrophy, dialysis amyloidosis, hypertension, hyperlipidemia, and acquired cystic disease
- J. Appropriate use of drugs, including dose modifications for dialysis patients

II. PATIENT CARE EXPERIENCE

- A. Trainees must manage patients with acute renal failure requiring dialysis treatment including intermittent hemodialysis, continuous peritoneal dialysis, and the extracorporeal continuous renal replacement therapies.
- B. Trainees must manage patients with chronic renal failure on maintenance hemodialysis longitudinally for a sufficient time to allow participation in the prescription of and monitoring of the dose of delivered dialysis. assessment and adjustment of the need for and dose of erythropoietin, evaluation and treatment of renal osteodystrophy, and Ongoing evaluation of the dialysis access

Acid-Base Disorders

1. PROGRAM CONTENT

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

II. PATIENT CARE EXPERIENCE

- A. Trainees should be familiar with and have experience in the following areas in both the outpatient and inpatient setting:
 1. Trainees must assess the accuracy of the acid-base parameters and interpret serum and urine acid-base data, including the anion gap.
 2. Trainees must determine from the patient's history, physical findings, and laboratory data the nature of the prevailing acid-base disorder and whether a simple or mixed acid-base disorder is present.
 3. Trainees must have experience in managing renal tubular acidosis, uremic acidosis, and acid-base homeostasis in end-stage renal disease.
 4. Trainees must have experience managing all other types of metabolic acidosis.
 5. Trainees must have experience in the management of metabolic alkalosis.
 6. Trainees must have experience in the management of respiratory acidosis and alkalosis.
 7. Trainees must have experience in the management of mixed acid-base disorders.

Fluid and Electrolyte Disorders

1. PROGRAM CONTENT

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

1. Physiology of sodium balance, including sensors of extracellular volume, effector 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, effector 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

II. PATIENT CARE EXPERIENCE

A. Trainees should be familiar with and have experience in the following areas in both the outpatient and inpatient setting:

1. Trainees must be able to assess the validity and relevance of serum and urine electrolyte measurements for patient management.
2. Trainees must be able to assess volume status (including the interpretation of central venous pressure and Swan-Ganz measurements) and recognize and manage hypovolemic and edematous disorders.
3. Trainees must be familiar with the use and complications of diuretic therapy.
4. Trainees must be able to evaluate and manage hyponatremia in the acute and chronic setting.
5. Trainees must be able to evaluate and manage hypernatremia in the acute and chronic setting.
6. Trainees must be able to evaluate and manage the polyuric patient.
7. Trainees must be able to evaluate and manage the patient with hypokalemia and hyperkalemia. They must be familiar with the acute as well as the long term management of these disorders.
8. Trainees must be able to evaluate and manage disorders of sodium, water, and potassium in patients with ESRD.

Cystic and Inherited Diseases of the Kidney

1. PROGRAM CONTENT

A. Trainees should acquire knowledge of the following areas:

1. Genetics of inherited diseases
 - a. Understanding of Mendelian genetics
 - b. Understanding of gene linkage analysis
 - c. brief knowledge of chromosomal localization and characteristics of the gene responsible for the more common inherited renal disorders
2. Clinical, diagnostic and epidemiologic differences between simple, acquired, and inherited cystic disorders and their potential for renal malignancies
3. Diagnosis of inherited and cystic disease

- a. Use of gene link analysis and mutational analysis in the screening
- b. Role of urinalysis, renal function testing, and radiologic testing
- c. Possibilities of prenatal diagnosis and pretest counseling
- 4. Approach to the symptomatic patient
 - a. Familiarity with the natural history of inherited cystic and non-cystic disease
 - b. Knowledge of clinical presentations
 - c. Familiarity with extrarenal manifestations
- 5. Treatment
 - a. Knowledge of strategies to manage progression of renal failure, proteinuria, and hypertension in non-cystic inherited disease
 - b. Knowledge of management of pain, hypertension, renal stone, hematuria, infection, and progressive renal failure in patients with cystic disease
 - c. Familiarity with management of extrarenal manifestation of ADPKD, including mitral valve prolapse diverticular disease, intracranial aneurysm, and hepatic cystic disease

II. PATIENT CARE EXPERIENCE

- A. Trainees should have experience in the diagnosis and management of various forms of cystic renal disease, with particular emphasis on autosomal dominant polycystic kidney disease (ADPKD) and its various renal and extrarenal complications.
- B. Trainees should have experiences in the diagnosis and management of patients with non-cystic inherited diseases, with emphasis on Alport's syndrome and its renal and extrarenal complications.
- C. Trainees should be familiar with the principles of genetic counseling of patients with inherited renal disorders.

Tubulointerstitial Disease and Urinary Tract Infections

1. PROGRAM CONTENT

- A. Trainees should acquire a general understanding of:
 - 1. Structure and function of the normal renal tubules and interstitium
 - 2. Pathophysiological mechanisms of acute and chronic interstitial diseases
 - a. Immunologically mediated interstitial nephritides
 - b. Interstitial scarring as a consequence of primary c. Reflux nephropathy
 - d. Obstructive nephropathy
 - 3. Pathophysiology of interstitial disease
 - a. Immunopathogenetic and non-immune mechanisms
 - b. Relationship to glomerular function
 - c. Association with major tubular defects, including diabetes insipidus, acidification, and potassium excretion
 - d. Effects of acute and chronic urinary obstruction
 - 4. Diagnostic procedures
 - a. Assessment of tubular defects
 - b. Evaluation of obstruction
 - c. Definition of acute and chronic interstitial nephritis
 - 5. Pathogenesis and treatment of bacterial urinary tract infections
 - a. Major pathogenetic species, routes, and course of infection
 - b. Appropriate antibiotic choices
 - c. Appropriate workup of the patient with multiple or resistance infections

II. PATIENT CARE EXPERIENCE

- A. Trainees should develop an in-depth knowledge of:
 - 1. Clinical features, causes, course, and treatment of acute allergic interstitial nephritis
 - 2. Clinical features, predisposing factors, complications, and treatment of acute pyelonephritis
 - 3. Management of patients with symptomatic and asymptomatic bacteriuria, including familiarity with
 - a. Major pathogenic species, routes, and course of infection
 - b. Appropriate antibiotic choices

- c. Appropriate workup and treatment of patients with recurrent or resistant infections
 - d. Related syndromes, such as nonspecific urethritis, prostatitis, and hemorrhagic cystitis
4. Clinical and radiological features, course, and treatment of reflux nephropathy (chronic pyelonephritis) and analgesic nephropathy, and the differential diagnosis of papillary necrosis

B. Trainees should be familiar with:

- 1. Pathological features of acute and chronic interstitial nephritides
- 2. Clinical laboratory tests to evaluate aspects of tubular function, concentrating ability, urine acidification, potassium handling, and various reabsorptive functions

C. Trainees should be aware of unusual syndromes affecting the renal interstitium, such as xanthogranulomatous pyelonephritis, lymphomatous infiltration, and various granulomatous diseases

Disorders of Mineral and Bone Metabolism

I. PROGRAM CONTENT

A. Trainees 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 calcitropic 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

II. PATIENT CARE EXPERIENCE

A. Trainees should also be familiar with, and preferably have experience in, the direct diagnosis and management of the following areas, in both an outpatient and inpatient setting:

- 1. Different types of renal osteodystrophy
- 2. Hyper- and hypocalcemia, hyper- and hypophosphatemia, and hypo- and hypermagnesemia
- 3. Various forms of nephrolithiasis (significant exposure)
- 4. Interpretation of bone biopsies

Transplantation

1. PROGRAM CONTENT

A. Immunology/Immunogenetics

- 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 nonimmunosuppressive medications used in transplant for the prophylaxis of infection and the treatment of concurrent illnesses, with an emphasis on

Anticipating and managing drug interactions and familiarity with

- A. infectious diseases in transplantation/pre- and posttransplantation
- B. Pregnancy and transplantation
- C. Cancer and transplantation
- D. Ethics of transplantation

Renal Disease in Pregnancy

I. PROGRAM CONTENT

A. Trainees 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 blood 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 of 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 renal 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

II. PATIENT CARE EXPERIENCE

A. Trainees must diagnose and manage women whose pregnancies are complicated by acute or chronic renal dysfunction as well as gestations complicated by hypertension. They should have exposure to the presentation and management of gravidas experiencing acute hypertensive crises, especially those crises complicated by systemic manifestations such as liver dysfunction, thrombocytopenia, and microangiopathic hemolytic anemia.

Renal Function Testing

I. PROGRAM CONTENT

A. Trainees 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 and calculation of its clearance rate
3. Measurement of renal 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)

II. PATIENT CARE EXPERIENCE

A. Trainees must be given sufficient direct experience to develop expertise in their performance and interpretation of:

1. Urinalysis
2. Accurate and timed complete collection of urine for renal function testing, proteinuria, and microalbuminuria
3. Fractional excretion of electrolytes
4. Renal function clearance studies

Pharmacology of Drugs in Renal Disease

I. PROGRAM CONTENT

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

1. Principles of drug pharmacokinetics
2. Renal handling of drugs and chemicals
3. Mechanisms of drug metabolism
4. Drug prescribing in disease states and during dial
5. Relevant drug-drug interactions
6. Mechanisms of drug nephrotoxicity
7. Management of drug-induced renal diseases
8. Therapeutic drug monitoring
9. Renal transplant immunosuppression

II. PATIENT CARE EXPERIENCE

A. Trainees should also be familiar with, and preferably have experience in, the following areas, in both an outpatient and inpatient setting:

1. Trainees must diagnose and manage patients with different drug-induced renal syndromes.
2. Trainees should be able to prescribe for and adjust drug dosage in patients with renal dysfunction.
3. Trainees should understand indications of therapeutic drug monitoring.
4. Trainees should be able to access drug and poison information.
5. Trainees should be familiar with common overdoses and the need for extracorporeal therapy.
6. Trainees should prescribe and manage immunosuppression for renal transplantation.

Essential Procedures (minimum 5 each for credentialing)

- Percutaneous renal biopsy: All renal biopsy procedures are performed under personal supervision of an Attending Physician.
 - o Native kidney under ultrasound guidance
 - o Transplant kidney under ultrasound guidance
- Placement of temporary vascular access for hemodialysis and related procedures: Placement of vascular access lines is performed by the Fellow on the Clinical Service. The first 5 lines are placed under personal supervision by an Attending physician after this, lines are placed under direct supervision.
- Acute hemodialysis: Orders for acute peritoneal dialysis are written by the Fellow on the Clinical Service. These orders are written under direct supervision of an Attending physician for the Fellow's first 10 procedures.

Elective Procedures (No minimum requirement)

- Renal and transplant ultrasound
- Thrombolysis of tunneled catheters
- Thrombolysis of permanent AV grafts and fistulae
- Placement of acute peritoneal dialysis (Cook's) catheter

Ultrasound guided biopsy:

To perform ultrasound-guided biopsies independently attending physicians should complete the "Ultrasound For Nephrologists" course and perform 20 renal biopsies under visual supervision.

Educational activities

Teaching and learning activities in Adult Nephrology

The trainee should have extensive exposure to other academic activities, including:

- Self-education by reading current textbooks and relevant scientific literature;
- Attend Nephrology Journal Club
- Presentation of Nephrology clinical cases or topics;
- Departmental Educational Activities:
 - The trainee is expected to attend morning reports, bedside rounds, grand rounds, diagnostic and therapeutic rounds, pathology, and radiology rounds related to Nephrology
 - Teaching experiences: The trainee must participate actively in teaching medical students, medical residents
 - Mortality and Morbidity Rounds: Objectives: The mortality review is intended to identify and examine medical errors. The process allows improvement of patient care by implementing preventative strategies for further errors. A review of medical literature related to medical errors and medico-legal issues is mandatory.
 - Format: Trainees are required to present a case-based theme review during the academic year. Using PowerPoint, a short case presentation is followed by identification and description of the medical error.
 - Contributing factors, preventative strategies, and any relevant medico-legal issues should be discussed, followed by one or two slides describing an idea or design for a quality improvement project. These rounds are not intended to be punitive in any way.
- Journal Club:
 - Objectives: This activity will enable the trainee to critically appraise the literature and develop an approach to analyzing the various types of articles (harm, diagnosis, prognosis, and treatment). It will enable the trainee to understand the basis of hypothesis testing (Type I and II errors, p values, 95% confidence intervals, sample size) and to understand the basis of diagnostic testing (prevalence, sensitivity, specificity, positive and negative predictive values, likelihood ratios). The trainee will become familiar with sources of bias and understand how study results can be used in clinical Practice.
- Academic half-day: Trainees are entitled to a protected academic half-day (three hours). Time will be divided as follows:
 - 40 minutes: Mortality and Morbidity Rounds
 - 40 minutes: Journal Club
 - 40 minutes each : Pathology/Radiology

ACTIVITY	OBJECTIVES
Morning report and case presentation	<ul style="list-style-type: none"> • To monitor patient care and management decisions, along with their outcomes • To develop competence in presenting cases in a concise and an informative manner • To develop the ability to perform appropriate differential diagnoses and proper management plans • To develop appropriate presentation skills
Morbidity and mortality report	<ul style="list-style-type: none"> • To identify areas that can be improved in regard to clinical care • To prevent future medical errors by learning from previous incidents • To recognize system issues, such as outdated policies and patient-identification procedures • To understand the confidentiality of cases discussed and colleagues involved
Grand rounds	<ul style="list-style-type: none"> • To increase medical knowledge and skills • To learn about the latest advances in medical research • To identify and discuss controversial topics in the medical field
Journal clubs, critical appraisal	<ul style="list-style-type: none"> • To promote continuing professional development • To remain abreast of current medical research • To disseminate information and debate good practice • To learn and practice efficient searching strategies and critical appraisal skills • To implement and apply acquired knowledge and skills in clinical practice

Examinations

Final Adult Nephrology Board Examination (Syria Board Examination)

Eligibility

- 1) Successful completion of the required period of fellowship training
- 2) Possession of a training completion certificate issued by the local supervisory committee and based on a satisfactory FITER report, in addition to the local supervising committee's approval of the completion of the clinical requirements (via the fellow's logbook, etc.).
- 3) Registered for the examination at least one month before the exam date.

Examination format

The final Syria board examination consists of two parts, a written and a clinical exam:

Written examination (accounting for 60% of the final score)

- 1) This examination assesses trainees' theoretical knowledge base (including recent advances) and problem-solving capabilities in the adult Nephrology specialty.
- 2) The examination consists of two parts:
 - 1- **Paper-1:** 100-120 MCQs/2.5 hours (choose a single correct answer from four options). This covers all Nephrology-related topics, as shown in the last blueprint outlines
 - 2- **Paper-2:** Data interpretations/3 hours. This will be distributed as shown in the last blueprint outlines

These covers all Nephrology-related topics, as shown in the blueprint outlines

TOPICS	#	%
Sodium and Water Abnormalities	10	10%
Acid-Base and Potassium Disorders	10	10%
Calcium, Phosphorus, and Magnesium Disorders and Stones	5	5%
Chronic Kidney Disease	25	25%
Hypertension	10	10%
Tubular, Interstitial, and Cystic Disorders	5	5%
Glomerular and Vascular Disorders	15	15%
Kidney Transplantation	2	2%
Pharmacology	3	3%
Acute Kidney Injury and Intensive Care Unit Nephrology	15	15%
Total	100	100%

Suggested References for the Syria Board's Final Written Examination of Nephrology

1. COMPREHENSIVE CLINICAL NEPHROLOGY 6
2. National Kidney Foundation's PRIMER ON KIDNEY DISEASES
3. MKSAP 18 NEPHROLOGY

Clinical examination (accounting for 40% of the final score)

The final clinical examination may include all of the following:

- Long case: structured oral format.
- Objective structured clinical examination (OSCE) including stations of dialysis and ICU.
-

Passing score

The passing score is 60%

THE END