NATIONAL TRANSPLANT SURGERY FELLOWSHIP CURRICULUM

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UNIT 1

IMMUNOBIOLOGY & TRANSPLANTATION RESEARCH

Unit Objectives

I. Develop an understanding of basic and clinical immunology including cellular and antibody mediated immune responses.

II. Understand the basic principles of and current techniques used to assess blood and tissue compatibility, allosensitization, and immunocompetence.

III. Explain the basic mechanisms relevant to organ transplantation including: ischemia/reperfusion, inflammation, immunologic recognition of and response to alloantigen, hyperacute, acute and chronic allograft rejection, and tolerance.

Learner Objectives

I. Develop an understanding of basic and clinical immunology including cellular and antibody mediated immune responses. Upon completion of this section the fellow will be able to:

A. Describe Basic Immunology – innate or non-specific immunity.

1) List the cells involved in non-specific immunity;

2) Describe the function of neutrophils, eosinophils and basophils;

3) Describe the function of monocytes and macrophages and differentiate one from the other;

4) Describe the mechanisms by which neutrophils and macrophages distinguish pathogens and normal host tissue;

5) List the pro-inflammatory molecules secreted by macrophages and describe their role in tissue damage;

6) Describe the roles of the classical and alternative pathways of complement activation in host defenses.

B. Describe Basic Immunology – adaptive or specific immunity.

1) Describe the relationship between antigen presenting cells and cytokines released by cells of the innate immune response;
2) Describe the types of antigen presenting cells and the changes that occur following exposure to antigen;
3) List the subsets of T cells and describe their function;
4) Describe the functions of B cells;
5) Describe the distribution of MHC Class I and Class I molecules on immune cells and commonly transplanted organs;
6) Describe the function of MHC Class I and Class II antigens;
7) Define the first, second, and third signals involved in the initiation of an effective antigen specific response;
8) Describe the steps involved in cellular injury mediated by cytotoxic T cells;
9) Describe the steps involved in cellular injury mediated by antibodies;

10) Describe the steps involved in the generation of memory T or B cells;

11) Describe the role of T regulatory cells in controlling immune responsiveness.

II. Understand the basic principles of and current techniques used to assess blood and tissue compatibility, allosensitization, and immunocompetence. Upon completion of this section, the fellow will be able to:

A. Describe blood and tissue compatibility.

1) List the blood groups that would be ABO-compatible allografts for recipients with blood groups O, A, B, and AB;

2) Define hyperacute rejection; list the possible causes, and usual measures taken to avoid it;

3) Distinguish between high- and low resolution molecular testing and serologic techniques currently in use for MHC typing (tissue typing). Identify common clinical uses for each technique;

4) Define “donor specific antibody” and explain its implication for long term allograft survival;

5) Explain the use of the crossmatch in organ allocation;

6) Explain the differences between cytotoxic, anti-kappa, and flow cytometry methods for cross matching;

7) Define “panel reactive antibody” (PRA) and explain its relevance to transplantation;

8) Define “high throughput” assays for anti-HLA antibodies.

B. Describe allosensitization.

1) Distinguish between “direct” and “indirect” pathways of antigen presentation;

2) Distinguish between allosensitization and other types of immune responses;

3) List the inflammatory factors that contribute to the efficient immune response to alloantigen in a transplant setting;

4) Explain the significance of C4d positivity on an allograft biopsy.

C. Describe immunocompetence.

1) Understand the desired balance between immune reactivity and immune suppression in transplant recipients;

2) List the problems associated with over immunosuppression;

3) List the problems associated with under immunosuppression;

4) Describe the mechanism behind tests measuring lymphocyte response to mitogen stimulation as a measure of immunocompetence;

5) Describe limitations of such testing.

III. Explain the basic mechanisms relevant to organ transplantation including: ischemia /reperfusion, inflammation, immunologic recognition of and

response to alloantigen, acute and chronic allograft rejection, and tolerance.

Upon completion of this section, the fellow will be able to:

A. Describe ischemia/reperfusion injury.

1) Define ischemia/reperfusion injury;
2) Explain the role of reactive oxygen species in ischemia/reperfusion injury;
3) Explain the role of apoptosis in ischemia/reperfusion injury;
4) Describe the role of organ preservation solution components in the prevention/modulation of ischemia/reperfusion injury;

B. Describe inflammation.

1) Describe the mechanisms by which inflammatory reactions can exacerbate donor specific immune mediated allograft damage;
2) List the inflammation-associated cytokines that can enhance the initial phases of adaptive immune responses;

C. Describe immune response to alloantigen.

1) Define alloantigen;
2) Describe the relative importance of CD4, CD8 and delayed type hypersensitivity T cells in response to allografts;
3) Describe the role and source of perforin and granzyme;
4) Define the role of donor specific antibody in relation to allograft survival;
5) Describe antibody dependent cell mediated cytotoxicity.

D. Describe acute and chronic allograft rejection.

1) Define hyperacute rejection;
2) Define acute rejection;
3) Define chronic rejection;
4) List components of the immune system involved in each type of rejection;
5) List currently accepted treatments for hyper acute rejection and state the relative efficacy of each;
6) List currently accepted treatments for acute rejection and state the relative efficacy of each;
7) List currently accepted treatments for chronic rejection and state the relative efficacy of each;
8) Describe the effect of hyperacute rejection on allograft survival;
9) Describe the effect of acute rejection on allograft survival;
10) Describe the effect of chronic rejection on allograft survival.

E. Describe tolerance.

1) Define tolerance;
2) Explain the rationale of using co-stimulation blockade to induce clinical tolerance;
3) Explain the rationale for using lymphocyte depletion followed by reconstitution with donor bone marrow or stem cells to induce clinical tolerance.

UNIT 2

PHARMACOLOGY AND IMMUNOSUPPRESSION

Unit Objectives

I. Explain the basic pharmacology (mechanisms of action, metabolism, adverse effects, potential interactions, dosing strategies, and target levels) for all immunosuppressive agents in current clinical use.

II. Understand the rationale of multi-drug immunosuppression including use of induction therapy and maintenance regimens.

III. Outline potential complications and clinical and laboratory markers of over- and under-immunosuppression and be able to develop appropriate care plans.

IV. Define the donor and recipient factors which impact the use of immunosuppressive agents including the risk of rejection, infection, wound healing and malignancy.

V. Identify the clinical and pathologic features of hyperacute, acute and chronic cellular and humoral rejection and implement appropriate pharmacologic therapy; identify short and long term ramifications of rejection episodes.

Learner Objectives

I. Explain the basic pharmacology (mechanisms of action, metabolism, adverse effects, potential interactions, dosing strategies, and target levels) for all immunosuppressive agents in current clinical use. Upon completion of this section, the fellow will be able to:

A. Discuss calcineurin-inhibitors.

1) Describe the basic chemical structure of cyclosporine (CsA) and tacrolimus;

2) Explain the mechanism of action of both agents. How are they similar and how do they differ?

3) Define calcineurin;

4) Describe target trough levels for both agents in the early and late period after renal, pancreas and liver transplantation;

5) List commonly used drugs that interfere with CsA/tacrolimus metabolism by acting as substrates, inhibitors and inducers of the cytochrome P450 enzyme CYP3A4 system;

6) List the most common clinical side effects of CsA and tacrolimus.

B. Discuss sirolimus.

1) Describe the basic chemical structure of sirolimus;

2) Explain the mechanism of action of this agent;

3) Define mTOR;

4) Describe possible target trough levels for the use of this agent when used in combination with a calcineurin inhibitor or with other antiproliferative agents;

5) List the common clinical side effects of this drug.

C. Discuss antiproliferative agents (mycophenolate mofetil, mycophenolic acid, and azathioprine).

1) Explain the mechanism of action of these agents;

2) Define prodrug;

3) Describe the clinical side effect profiles and dosing strategies for these agents;

D. Discuss monoclonal antibodies (basiliximab, daclizumab, muromonab CD3).

1) Describe the difference between a depleting vs. non-depleting and a monoclonal vs. a polyclonal antibody preparation;

2) Explain the difference between a chimeric and a humanized monoclonal antibody;

3) Describe the mechanism of action, side effect profile, and appropriate dosing strategies for all 3 antibodies.

E. Discuss polyclonal antibodies (rabbit ATG, equine ATG).

1) Explain the basic steps in the preparation of xenogenic polyclonal anti-human lymphocyte sera;

2) Describe the mechanisms do polyclonal antibodies deplete peripheral lymphocytes;

3) List the known binding sites of polyclonal antibodies;

4) Describe dosing strategies for the use of polyclonal antibodies.

F. Discuss corticosteroids.

1) Describe several possible mechanisms of action of prednisone;

2) Discuss the importance of steroids in the treatment of rejection and for maintenance immunotherapy;

3) Compare the advantages and disadvantages of steroid-free immunosuppressive protocols in renal, pancreas, and liver transplantation;

4) Describe the side effect profile and dosing strategy for prednisone.

II. Understand the rationale of multi-drug immunosuppression including use of induction therapy and maintenance regimens. Upon completion of this section, the fellow will be able to:

A. Understand the rationale for use of multi-drug therapy versus single drug therapy in maintenance immunosuppression.

B. Describe the use of induction therapy followed by a maintenance immunosuppression regimen.

1) Describe common protocols used in kidney, pancreas, and liver transplantation using antibody followed by calcineurin-based immunosuppression.

III. Outline potential complications and clinical and laboratory markers of over- and under-immunosuppression and be able to develop appropriate care plans. Upon completion of this section, the fellow will be able to:

A. Describe diagnostic and treatment plans in patients with opportunistic infections.

1) List typical opportunistic infections associated with transplantation;

2) Understand at what time points post-transplantation certain types of opportunistic infections are usually observed;

3) Describe the management of immunosuppression for a transplant patient with an opportunistic infection;

4) Describe the association between cytomegalovirus (CMV) infection, acute rejection, and long-term graft outcomes;

5) Describe the alterations in immunosuppression necessary with the diagnosis of:

a. CMV disease in solid organ transplantation

b. BK virus nephropathy

c. HSV or varicella infection in solid organ transplantation

d. Fungal infection in solid organ transplantation

i. Candida species

ii. Other fungal infections

B. Describe diagnostic and treatment plans in patients with malignancy.

1) List the most common malignancies associated with transplantation;

2) Determine what percent greater risk of malignancy are transplant recipients compared with the general population;

3) Explain the association between Epstein-Barr virus (EBV) infection and Post Transplant Lymphoproliferative Disorders (PTLD);

4) Describe the management of immunosuppression for a transplant recipient diagnosed with PTLD.

C. Describe laboratory values associated with toxicity of:

1) Calcineurin-inhibitors

2) Sirolimus

3) Anti-proliferative agents

4) Antibody preparations

IV. Define the donor and recipient factors that impact the use of immunosuppressive agents, including the risk of rejection, infection, wound healing and malignancy. Upon completion of this section, the fellow will be able to:

A. Describe diagnostic and treatment plans in patients with acute rejection.

1) Describe induction protocols for deceased-donor renal grafts with immediate, slow, and delayed graft function;

2) Alternatively, describe an induction protocol for a liver transplant recipient with impaired renal function;

3) Identify recipient groups that would generally be considered at high vs. low risk for acute rejection;

4) Describe induction protocols for management of recipients at high vs. low risk for acute rejection;

5) Recommend pre-transplant immunosuppressive strategies that could be used to manage highly sensitized recipients and/or to convert renal transplant donor/recipient pairs from cross-match positive to negative.

B. Describe diagnostic and treatment plans in patients with infection/malignancy.

1) List the recipient groups at greater risk of infection post-transplantation;

2) List the recipient groups are at greater risk of PTLD;

3) Recommend strategies that could be used to reduce the risk of infection/PTLD for the above noted groups;

4) List the considerations for retransplantation in patients with PTLD or BK nephropathy.

C. Describe diagnostic and treatment plans in patients with altered wound healing.

    1) Define patients at high risk for wound complications when using sirolimus based immunosuppression regimens.

V. Identify the clinical and pathologic features of hyperacute, acute and chronic cellular and antibody-mediated rejection and implement appropriate pharmacologic therapy; identify short and long-term ramifications of rejection episodes. Upon completion of this section, the fellow will be able to:

A. Describe clinical findings associated with antibody-mediated, cellular, and chronic rejection in renal, pancreas, and/or liver transplantation.

B. Understand the pathologic grading systems used to diagnosis acute and chronic rejection for renal, pancreas, and/or liver transplantation.

C. Describe management strategies for treatment of:

    1) Antibody mediated rejection;

    2) Mild acute cellular rejection;

    3) Moderate to severe acute cellular rejection;

    4) Chronic rejection.

D. Identify the early and late adverse events associated with the treatment of rejection episodes.

UNIT 3

ORGAN PROCUREMENT

Unit Objectives

I. Understand the moral, ethical and legal issues and steps involved in determining brain death.

II. Understand the moral, ethical and legal issues and steps involved in live organ donation.

III. Describe the basic assessment of the medical, laboratory, and anatomic characteristics of a potential organ donor (live or deceased), the quality of a donor organ, and its suitability for a given recipient.

IV. Outline in detail the procedure to safely recover abdominal organs from deceased donors, including those for donation after cardiac death (DCD).

V. Understand the recovery processes for living donor organs and describe the steps necessary to perform relevant organ specific recovery (liver, kidney).

VI. Outline the basic principles and limits of organ preservation and be familiar with organ preservation techniques, including pulsatile perfusion.

Learner Objectives

I. Understand the moral, ethical and legal issues and steps involved in determining brain death. Upon completion of this section, the fellow will:

A. Be familiar with the historical development and evolution of brain death criteria in the United States.

B. Understand the moral, ethical and legal basis for declaration of brain death and the standard medical and radiologic criteria used to make this decision.

II. Understand the moral, ethical and legal issues and steps involved in live organ donation. Upon completion of this section, the fellow will:

A. Be familiar with the historical development and evolution of live donor organ donation in the United States.

B. Understand the ethical, moral and legal basis for live donor organ donation.

III. Describe the basic assessment of medical, laboratory and anatomic characteristics of a potential organ donor (live or deceased), the quality of a donor organ, and its suitability for a given recipient. Upon completion of this section, the fellow will:

A. Understand the medical and surgical issues involved with determining the suitability of an organ from a deceased donor and its suitability for a given recipient.

B. Understand the psychosocial, medical and surgical short-term and long-term issues involved with determining the suitability of an organ from a live donor and its suitability for a given recipient.

C. Understand the medical and surgical issues involved with determining the suitability of an organ from a donor after cardiac death retrieval and an extended criteria donor (ECD) and its suitability for a given recipient.

IV. Outline in detail the procedure to safely recover abdominal organs from deceased donors including those for donation after cardiac death (DCD).

Upon completion of this section, the fellow will:

A. Understand and be able to perform safe recovery of abdominal organs from deceased donors.

B. Understand and be able to perform safe recovery of abdominal organs from deceased donors who are DCD donors (Basic fellowship is not assumed to include competence in DCD donor organ recovery).

C. Be familiar with appropriate courtesy and etiquette to organ procurement personnel, operative staff and other organ procurement teams during single and multi-organ procurement.

V. Understand the recovery procedures for living donor organs and describe the steps necessary to perform relevant organ specific recovery (i.e. liver, kidney).

Upon completion of this section, the fellow will:

A. Understand and be able to perform either open or laparoscopic donor nephrectomy for the purposes of organ donation.

B. Understand the surgical procedure of live donor liver donation. (Basic fellowship is not assumed to include competence in live donor liver organ recovery.)

VI. Outline the basic principles and limits of organ preservation and be familiar with organ preservation techniques, including pulsatile perfusion. Upon completion of this section, the fellow will:

A. Be familiar with basic principles of organ preservation and organ preservation fluids.

B. Understand the limits of organ preservation and the attendant risk of organ dysfunction over time.

C. Understand the basic principles of pulsatile kidney perfusion. (Basic fellowship is not assumed to include competence in pulsatile organ preservation.)

UNIT 4

MEDICAL COMPLICATIONS OF TRANSPLANTATION

Unit Objectives

I. Define short and long term medical complications found in transplant patient.

II. Diagnose and manage medical complications that occur as a direct consequence of immunosuppression.

III. Recognize and treat the infectious complications of organ transplantation.

IV. Identify the components of appropriate health maintenance in the post transplant period.

V. Explain the impact transplantation on psychosocial well-being.

Learner Objectives

I. Define short and long term medical complications found in transplant patients.

Upon completion of this section, the fellow will be able to:

A. Identify the cardiac complications in recipients of abdominal transplant.

1) Describe the evaluation and management of cardiac ischemia in the immediate post-operative period;

2) Determine the need for cardiovascular support in patients in the post-operative period including the need for vasopressors, intra-aortic balloon pump, and cardiac catheterization;

3) Understand the impact of myocardial infarction and poor perfusion on the outcome of organ transplants including the risk for delayed graft function and primary non function;
4) Identify appropriate strategies for primary and secondary prevention of ischemic heart disease in transplant recipients;
    a. Appreciate the impact of chronic immunosuppression on the development of cardiac disease;
    b. Determine the relative consequences of immunosuppression regiments on the development of coronary artery disease;
5) Understand the management of hypertension and the general options of treatment in the post-transplant patient;
    a. Understand the effects of certain anti-hypertensive agents on the metabolism of common immunosuppressive agents;
6) Assess the impact of pre-existing cardiac disease on post-transplant outcome;

B. Describe the management of pulmonary complications in the immediate and late post transplant period.
    1) Understand the need for and management of mechanical ventilation;
    2) Determine the timing of extubation and need for re-intubation;

3) Identify and treat noscomial pneumonia in the post-transplant patient;
4) Determine the impact of pre-morbid pulmonary disease (chronic obstructive pulmonary disease, obstructive sleep apnea) on post transplant outcome;
5) Appreciate the management of specific organ related pulmonary complications
    a. Explain the diagnosis and management of hepato-pulmonary syndrome and portopulmonary hypertension in liver transplant patients;
    b. Evaluate and treat primary pulmonary hypertension in liver and kidney transplant candidates and recipients;
    c. Describe the diagnosis and treatment of pleural effusion in the post-liver transplant recipient;
    d. Assessment and management of lung involvement in renal patients with Wegener's Granulomatosis.

C. Assess and manage renal dysfunction in both renal and extra-renal organ transplant recipients.
    1) Define delayed graft function in patients undergoing renal transplant;
    2) Determine the need for renal replacement therapy in the immediate post-operative period;

a. Understand the physiological and technical differences between renal replacement options (hemodialysis, continuous venovenous hemofiltration, peritoneal dialysis);

3) Describe the physiology and management of hepato-renal syndrome;

4) Appreciate the impact of immunosuppressive therapy on kidney function in kidney and extra-renal organ transplant recipients;

5) Assess the need for renal transplantation in conjunction with (liver-kidney, heart-kidney) or following extra-renal transplant.

D. Identify the risk of liver disease in non-liver transplant patients.

1) Explain the increased risk of hepatic decompensation in kidney transplant patients who have chronic viral hepatitis infection;

2) Assess the impact of systemic amyloid deposition in patients following heart or kidney transplantation and the indications for liver transplantation;

3) Identify the effects on hepatic metabolism of commonly used agents in transplantation:

a. Calcineurin inhibitors,

b. Azathioprine,

c. Azole anti-fungal treatments,

E. List and explain the metabolic complications following transplantation.

1) Describe the risk factors for and management of post-transplant diabetes;
2) Appreciate the need for glucose management in transplant patients who are inpatients, particularly in the ICU;
3) Diagnose and treat basic electrolyte abnormalities in the post-operative period:
    a. Hypo/Hyperkalemia
    b. Hypo/Hypermagnesemia
    c. Hypo/Hyperphosphotemia
    d. Hypo/Hypercalcemia
4) Evaluate and treat chronic hyperparathyroidism in the post-renal transplant patient.

F. Identify and treat hematology/oncology issues following transplantation.
    1) Assess and treat coagulopathy in the immediate post-operative period:
        a. Understand how to interpret coagulation parameters;
        b. Assess the impact of uremia on coagulopathy;
        c. Determine the type of blood and factor replacement to administer.
    2) Assess the production of epogen in the post-renal transplant patient and the need for supplementation;
    3) Demonstrate knowledge of the tumor types which are found most commonly in post transplant patients:

a. Skin cancers

b. Lymphoproliferative disorders

i. Initial therapies

ii. Indications for chemotherapy and antiviral therapy

iii. Outcomes and implications for patient and graft survival

c. Carcinoma (lung, uterus, kidney, colon, breast etc.)

G. Assess the gastrointestinal changes which occur following transplant.

1) Appreciate the need for stress ulcer prophylaxis with certain medication regiments;

2) Understand the causes of diarrhea after transplant;

a. Anatomic: e.g. pancreas transplant

b. Medications including immunosuppression (mycophenolate mofetil)

c. Infection: cytomegalovirus, clostridium. difficile, giardia

3) Describe the risk of medication/nutritional malabsorption issues;

4) Detail the indications for colonic surveillance for malignancy follow transplantation;

H. Identify the reproductive health ramifications of transplantation.

1) Need for birth control in the post-transplant period;

2) Management of immunosuppression during pregnancy;

3) Incidence and consequences of rejection in the pregnant patient.

II. Diagnose and manage medical complications that occur as a direct consequence of immunosuppression. Upon completion of this section, the fellow will be able to:

A. Identify neurological changes which may be caused by immunosuppression:

1) Calcineurin inhibitor neurotoxicity;

2) Corticosteroid induced changes.

B. Appreciate the impact of immunosuppression on cardiac function.

1) Acceleration of coronary artery disease;

2) Sirolimus and its effect on lipid metabolism.

C. Describe the impact of immunosuppression on renal function.

1) Summarize the mechanism by which calcineurin inhibitors damage, allograft and native renal function;

2) Identify strategies to limit the impact of immunosuppression on renal function including calcineurin inhibitor free and sparing regiments, delayed introduction of CNIs, and monitoring strategies;

3) Estimate the incidence of chronic renal insufficiency and end stage renal disease in extra-renal transplant recipients;

D. Assess the metabolic effects of immunosuppressive agents including the propensity to cause post-transplant diabetes mellitus.

E. Understand the relationship between hepatic allograft function and cyclosporine absorption.

F. Describe the relationship between the intensity of immunosuppression and the development of post-transplant malignancy.

1) Appreciate the relationship between the use of antibody induction agents and the development of PTLD;
2) Describe the risk factors for basal cell carcinoma and melanoma in post transplant patients;

G. Evaluate and treat immunosuppression related bone marrow suppression.
H. Consider the implications of immunosuppression and other transplant related medications on pregnancy.
    1) Incidence of birth defects
    2) Teratogenic effects of anti-viral agents
    3) Impact on blood levels of immunosuppressive agents
    4) Describe the impact of immunosuppression on fertility

III. Recognize and treat the infectious complications of organ transplantation. Upon completion of this section, the fellow will be able to:
    A. Understand the necessary procedures to evaluate a potential transplant recipient.
        1) Interpret viral serology (CMV, HIV, EBV, and Hepatitis B & C);
        2) Screen for tuberculosis;
        3) Determine the need for pre-transplant treatment (Hepatitis B & C);
    B. Appreciate the potential for transplant organs to transmit common and uncommon infection.
        1) Risk of HIV, CMV,EBV, Hepatitis B & C;
        2) Rare: rabies, West Nile virus, T gondii, trypansoma cruzi, leishmania, acthamoeba, naegleria, etc.

C. Diagnosis and treat infection in the transplant recipient.
    1) Immediate post-operative period (0-30 days): wound infection, urinary tract infection, nosocomial pneumonia;
    2) Opportunistic infections:
        a. Viral: HSV, CMV, EBV
        b. Bacterial: nocardia, listeria
        c. Fungal: pneumocystis, aspergilllus, cryptococcus
        d. Parasitic
        e. PCP
    3) Late infections:
        a. Community acquire pneumonia
        b. EBV related disease
        c. BK virus

D. Understand strategies to for prophylaxis and treatment of post-transplant infectious disease.
    1) Hepatitis C
    2) Hepatitis B
    3) CMV
    4) EBV
    5) PCP

E. Describe the potential interaction of medical therapy of infection disease (antibiotics, antiviral, antifungal agents) and immunosuppression.

F. Appreciate the importance of early imaging, tissue sampling, and surgical debridement of infected tissues.

G. Evaluate and treat potential CNS infections in transplant patients:

1) Acute meningitis- listeria

2) Subacute or chronic meningitis- cryptococcus, TB, listeria, histoplasma, nocardia, coccidiodes, HSV

3) Focal brain infection- invasive fungus e.g. aspergillus

4) Progressive dementia- JC virus, viral infections

IV. Upon completion of this section, the fellow will be able to identify the components of appropriate health maintenance in the post transplant period, including:

A. Mammogram and pap smear.

B. Colonoscopy.

C. Cardiac assessment and evaluation.

D. Cancer surveillance in patients with pre-existing malignant states (i.e. hepatocellular carcinoma at transplant, ulcerative colitis, cholangiocarcinoma).

E. Diabetes management.

V. Explain the impact transplantation on psychosocial well-being. Upon completion of this section, the fellow will be able to identify:

A. Signs and symptoms of depression and anxiety.

B. Indications for referral to medical psychology/psychiatry.

C. Implications of transplantation on patient's finances.

1) Impact of insurance;
2) Cost of medications;
3) Implications of insurance on return to work.

D. Assess transplant impact on the patient's role in his or her family and the impact on relationships within the family.

E. Know common objective assessment tools for well-being and their limitations in certain patient groups.

F. Understand signs and symptoms of recurrent substance abuse.

G. Understand the common issues in transitioning patients from pediatrics to adults and incidence and impact of noncompliance in pediatric and adolescent recipients.

UNIT 5

KIDNEY TRANSPLANTATION

Unit Objectives

I. List the indications for kidney transplantation, explain the different disease processes resulting in end-stage renal disease, and describe the treatment options.

II. Outline the basic of principles of donor and recipient selection and deceased donor organ allocation.

III. Describe and perform living and deceased donor kidney transplant procedures; identify strategies for the high complexity recipient (re-transplant, pediatric, complex urinary reconstruction).

IV. Explain the rationale for immunosuppressive strategies used in kidney transplantation, including induction therapy and minimization protocols.

V. Recognize and diagnose renal transplant rejection including performing diagnostic biopsy and interpreting basic pathological findings.

VI. Describe appropriate long term follow-up and be able to identify and treat short and long term complications of kidney transplantation.

VII. Describe the short and long term outcomes of kidney transplantation.

Learner Objectives

I. List the indications for kidney transplantation, explain the different disease processes resulting in end-stage renal disease, and describe the treatment options. Upon completion of this section, the fellow will be able to:

   A. Understand the process that result in end stage kidney disease in adults and children including the pathophysiology, rate of progression, incidence of recurrent disease, and impact on transplantation for the following diseases:

      1) Hypertensive nephropathy
      2) Diabetic nephropathy
      3) Glomerulonephritis
      4) Reflux disease
      5) Autoimmune kidney disease (e.g. Lupus, Wegners)
      6) Inherited cystic diseases

   B. Define the evaluation process for patients considering kidney transplantation. Including the following components:

      1) Minimal pre-operative testing
      2) Cancer screening and period of waiting following diagnosis
      3) Cardiac evaluation
      4) Serologic evaluation and importance of viral testing (CMV, EBV, Hepatitis B and C, HIV)

   C. Understand when patients should be listed for transplant.

      1) Minimal listing criteria (CrCl < 20);

2) Pre-emptive vs. following the initiation of dialysis;
3) Properly and completely consent the patient and family and explain the risks and benefits of renal transplantation compared with dialysis;
4) Compare life expectancy on dialysis vs. transplant for a variety of patient populations;
5) Define the risk of peri- and post-operative complications.

II. Outline the basic of principles of donor and recipient selection and deceased donor organ allocation. Upon completion of this section, the fellow will be able to:

A. Describe criteria used to assess the suitability of a deceased donor for organ transplant:

1) Demographic factors (age, race, sex);
2) Cause of death;
3) High risk behaviors;
4) Presence of malignancy (central nervous system vs. others);
5) Viral status (Hepatitis B, Hepatitis C, HTLV-1);
6) Infection in donor;
7) Hemodynamic status, vasopressor requirements;
8) Length of cold ischemic time in all donors and warm ischemic time for donation after cardiac death;
9) Anatomic considerations (multiple arteries, ureters, surgical damage);
10) Interpretation of renal biopsy and pulsatile perfusion parameters.

B. Describe criteria used to assess the suitability of a living donor for organ transplant.

1) Demographic factors (age, size, gender);
2) Evaluation of renal function including protein excretion;
3) Presence of illnesses that may predispose the donor to renal insufficiency ;
4) Anatomic evaluation and considerations:
    a. Multiple arteries
    b. Duplicated collecting systems
    c. Left vs. right kidney
5) Crossmatching and incompatible donors;
6) Psychological and psychosocial evaluation;
7) Understand and perform the consent process for living donation including risks and benefits of laparoscopic and open nephrectomy, risk of short and long term complications, potential for transplant failure;
8) Appreciate the ethical issues involved in living donor transplantation, the role of independent donor advocates, and the potential for coercion;

III. Describe and perform living and deceased donor kidney transplant procedures; identify strategies for the highly complex recipient (re-transplant, pediatric, complex urinary reconstruction). Upon completion of this section the fellow will be able to:

A. Prepare the kidney for transplantation.
    1) Strategies to deal with common anatomic features including multiple arteries and veins;
    2) Prepare venous extension grafts for right kidney;
    3) Identify and repair surgical damage.
B. Understand possible surgical approaches for kidney transplant including extraperitoneal and intraperitoneal location.
C. Describe the technique for isolating the iliac vessels and performing vascular anastomoses including strategies to deal with complex anatomy.
D. Detail the procedure for implanting the ureter and importance of the blood supply to the ureter:
    1) Creation of anti-reflux tunnel;
    2) Indications for stent placement;
    3) Difficult bladder;
    4) Understand technique for ureteroureterostomy, implantation into urinary conduit;
E. Use of intra-operative adjunctive medications.
F. Detail the post-operative care of renal transplant patients. Including:
    1) Fluid and electrolyte management;
    2) Antibiotic use;
    3) Recognition and treatment of cardiac complications.
G. Identify and treat surgical complications:
    1) Bleeding

2) Ureteral leak

3) Lymphocoele

4) Vascular thrombosis

5) Wound complications

H. Describe and interpret relevant radiological evaluations:

1) Ultrasound

2) CT scanning

3) Lasix-renogram

4) Interventional diagnostics (angiogram, percutaneous nephrostogram)

I. Identify and manage delayed graft function.

1) Determine the need for post-operative dialysis;

2) Determine when a biopsy be performed.

J. Be familiar with the technique of transplant nephrectomy in the early and late post-transplant periods.

IV. Explain the rationale for immunosuppressive strategies used in kidney transplantation, including induction therapy and minimization protocols. Upon completion of this section, the fellow will:

A. Understand induction immunosuppression.

1) Identify patients population which will require induction:

a. Immunologically high risk;

b. Marginal donors (ECD, DCD);

c. Steroid minimization protocols.

2) Risks and benefits of available agents:

a. IL-2 vs. depleting agents;

b. Length of treatment.

B. Be able to determine appropriate maintenance immunosuppressive regimen.

1) Rationale for choice of CNI, anti-proliferative, and/or steroids;

2) Appreciate issues of timing (e.g. delayed CNI for DGF);

3) Describe appropriate monitoring intervals, dosing levels, and complications;

4) Review and understand the medical literature related to minimization trials.

C. Be able to counsel patients regarding the need for compliance, potential side effects and important drug interactions, and strategies to minimize side effects.

D. Be able to describe the rationale, current treatment regimens, and results for positive crossmatch and ABO incompatible kidney transplantation.

V. Recognize and diagnose renal transplant rejection including performing diagnostic biopsy and interpreting basic pathological findings. Upon completion of this section, the fellow will be able to:

A. Participate in the care of post-transplant patients.

B. Review and evaluate pertinent laboratory data to identify potential for rejection or other etiologies of graft dysfunction.

C. Determine the need for a percutaneous biopsy, ultrasound examination, or other diagnostic procedure.

D. Understand renal biopsy.

1) Provide appropriate consent discussion for patients;

2) Utilize ultrasound for location of graft;

3) Perform needle biopsy;

4) Send specimen for appropriate diagnostic studies (H and E evaluation, C4D staining);

5) In cooperation with renal pathologist, review biopsy results and identify and grade rejection of renal allografts.

E. Describe in detail treatment approaches for mild, moderate, and severe allograft rejection based on the Banff criteria.

1) Understand the difference in treatment for cellular and humoral rejection.

F. Understand the impact on long term outcome from acute rejection episodes.

VI. Describe appropriate long term follow-up and be able to identify and treat short and long term complications of kidney transplantation. Upon completion of this section, the fellow will be able to:

A. Participate in and understand the process of long term follow-up of transplant patients.

B. Appreciate the health maintenance needs of transplant patients.

C. Describe techniques to preserve long term graft function.

D. Discuss calcineurin inhibitor minimization strategies or conversion to TORs.

E. Understand the impact of cardiac disease on the long term outcome of renal transplant patients.

F. Determine the indications for transplant Nephrectomy.

VII. Describe the short and long term outcomes of kidney transplantation. Upon completion of this section, the fellow will be able to:

A. Review and critically evaluate the literature describing the short and long term outcome of kidney recipients.

B. Appreciate the role of transplant surgeons in improving both long and short term outcomes.

C. Describe the impact of graft type (living donor, SCD, DCD, ECD), delayed graft function, and acute and chronic rejection on long term graft survival.

UNIT 6

LIVER TRANSPLANTATION

Unit Objectives

I. Outline the basic principles of liver transplantation, donor and recipient selection and donor allocation.

II. Describe the types of immunosuppressive therapy utilized in liver transplantation.

III. List the different disease processes which may require liver transplantation; manage the complications of liver disease including end stage liver disease and the care of patients with fulminant hepatic failure.

IV. Recognize and diagnose liver transplant rejection including performing diagnostic biopsy and interpreting basic pathological findings.

V. Describe and perform liver allograft recovery from deceased donors and deceased donor liver transplant; identify strategies for transplantation of the difficult recipient (re-transplant, pediatric, arterial and venous conduit, use of veno-venous bypass).

VI. Diagnose and implement treatment approaches for both short and long term medical and surgical complications following liver transplantation; describe appropriate long term follow-up for the liver transplant recipient.

VII. Appreciate the evaluation of potential living donors, describe the surgical options for living donors, and identify the principles of living donor liver transplantation. (Basic fellowship training is not assumed to include competence in living donor liver graft recovery or transplantation).

Learner Objectives

I. Outline the basic principles of liver transplantation, donor and recipient selection and donor allocation. Upon completion of this section, the fellow will:
    A. Be familiar with the historical development and evolution of liver. transplantation from experimental procedure to accepted clinical procedure.
    B. Understand the evaluation and management of prospective liver transplant recipients.
    C. Understand the evaluation and management of prospective liver transplant donors:
        1) Deceased donor;
        2) Live donor;
        3) Pediatric donor including split-liver, reduced-size, and size-matched grafts.
    D. Understand the OPTN/UNOS liver donor allocation system (MELD score).

II. Describe the types of immunosuppressive therapy utilized in liver transplantation. Upon completion of this section, the fellow will:
    A. Be familiar with the basic historical development and evolution of immunosuppression for liver transplantation including familiarity with the following immunosuppressive agents and their use in multi-drug regimens:

1) Cyclosporine,
2) Tacrolimus,
3) Induction therapy.

III. List the different disease processes which may require liver transplantation; manage the complications of liver disease including end stage liver disease and the care of patients with fulminant hepatic failure. Upon completion of this section, the fellow will:

A. Be familiar with the common indications for liver transplantation including:

1) End-stage liver disease:
   a. Alcoholic liver disease;
   b. Viral hepatitis (HBV, HCV);
   c. Autoimmune hepatitis;
   d. Cholestatic liver disease (PBC, PSC);
   e. Non-alcoholic steatohepatitis (NASH).
2) Metabolic disease:
   a. Alpha 1 antitrypsin disease;
   b. Hemochromatosis;
   c. Amyloidosis;
   d. Oxaluria;
   e. Other.
3) Acquired disease:
   a. Budd-Chiari syndrome;

b. Pulmonary disease (Portopulmonary hypertension/hepatopulmonary syndrome).

4) Neoplasia:

a. Hepatocellular carcinoma.

5) Acute fulminant hepatic failure.

6) Pediatric disease:

a. Cholestatic disease (biliary atresia, Allagille's syndrome)

b. Neoplasia (hepatoblastoma)

c. Metabolic disease (ornithine transcarbamylase deficiency, ά 1 antitrypsin disease)

B. Be able to manage the common complications of chronic end-stage liver disease.

1) Portal hypertension:

a. Ascites

b. Variceal bleeding

c. Hepatorenal syndrome

d. Subacute bacterial peritonitis

e. Chronic hepatic encephalopathy

2) Coagulopathy.

C. Be able to manage the common complications of acute hepatic failure.

1) Acute hepatic encephalopathy;

2) Cerebral edema;

3) Coagulopathy;

4) Other.

IV. Recognize and diagnose liver transplant rejection including performing diagnostic biopsy and interpreting basic pathological findings. Upon completion of this section, the fellow will:

A. Be familiar with the clinical, laboratory and histologic presentation of acute rejection of the liver allograft.

B. Be familiar with the technique of percutaneous liver biopsy including management of complications.

V. Describe and perform liver allograft recovery from deceased donors and deceased donor liver transplant, identify strategies for use in the difficult recipient (re-transplant, pediatric, arterial and venous conduit, use of veno-venous bypass). Upon completion of this section, the fellow will:

A. Be familiar with the technique of multi-organ and liver allograft alone deceased donor recovery for routine and difficult recipients.

VI. Diagnose and implement treatment approaches for both short and long term medical and surgical complications following liver transplantation; describe appropriate long term follow-up for the liver transplant recipient. Upon completion of this section, the fellow will:

A. Understand the short-term medical and surgical complications of liver transplantation:

1) Bleeding;

2) Infection;

3) Primary or delayed liver allograft function;

4) Multi-organ failure including heart, lung, kidney, other;

5) Neurologic;

6) Other.

B. Understand the long-term medical and surgical complications of liver transplantation:

1) Recurrent disease;

2) Renal insufficiency;

3) Infection;

4) Malignancy;

5) Endocrine;

6) Other.

VII. Appreciate the evaluation of potential living donors, describe the surgical options for living donors, and identify the principals of living donor liver transplantation. (Basic fellowship training is not assumed to include competence in living donor liver graft recovery nor transplantation). Upon completion of this section, the fellow will:

A. Understand the evaluation, surgical options and management of living liver donors.

B. Describe the basic surgical technique of living donor liver transplantation.

UNIT 7

PANCREAS TRANSPLANTATION

Unit Objectives

I. Outline the basic principles of donor and recipient selection and deceased donor allocation in pancreas transplantation.

II. Describe the different immunosuppressive strategies currently utilized in pancreas transplantation.

III. Understand and perform pancreas recovery from deceased donors and simultaneous and isolated pancreas transplant procedures; identify strategies which can be employed in the high risk recipient.

IV. Understand the rationale for and advantages/disadvantages of exocrine (bladder versus enteric) and venous (systemic versus portal) drainage of the transplanted pancreas.

V. Recognize and diagnose pancreas transplant rejection including performing diagnostic biopsy and interpreting basic pathological findings.

VI. Outline the outcomes associated with pancreas transplantation alone, simultaneous kidney/pancreas transplantation and pancreas after kidney transplantation.

VII. Describe appropriate long term follow-up and be able to identify and treat short and long term complications of pancreas transplantation.

VIII. Outline the basic principles and outcomes of islet transplantation.

Learner Objectives

I. Outline the basic principles of donor and recipient selection and deceased donor allocation in pancreas transplantation. Upon completion of this section, the fellow will:

   A. Know the indications for pancreas transplant alone (PTA) in the nonuremic diabetic.

      1) State the difference between Type I and Type II diabetes and associated factors including age at onset, obesity/BMI, and C-peptide levels/insulin resistance;
      2) Outline factors that favor the candidacy of a recipient:
         a. Hypoglycemic unawareness;
         b. Extreme lability with oscillating episodes of ketoacidosis and hypoglycemia;
         c. Inability to hold a job, attend school, or live independently;
         d. Extreme frequency of blood sugar checks;
         e. Failure of insulin pump or requirement for extraordinary measures;
      3) Know the meaning of glycosylated hemoglobin levels and measures of adequacy of diabetic control;
      4) Properly and completely consent the patient and explain the risks and benefits of pancreas transplantation:

a. Risks of surgery, immunosuppression, and postoperative complications versus benefits of being insulin free;
b. Define the risk of peri- and post-operative complications of PTA.

B. Outline the considerations unique to the pancreas transplant candidate with renal failure.
    1) Understand that insulin requirements may decrease in the setting of renal failure;
    2) Delineate the advantages and disadvantages of simultaneous pancreas/kidney transplantation (SPK) versus pancreas after live-donor kidney transplantation (PAK) and what may affect the choice between them:
        a. Single versus sequential procedure;
        b. Pancreas allocation algorithm and waiting time for PTA versus SPK versus PAK transplant;
        c. Advantages of single versus repeated courses of induction;
        d. Monitoring for rejection in the pancreas transplant;
        e. Long-term survival of the kidney and pancreas grafts.

C. Understand the pre-transplant evaluation of the pancreas transplant recipient.
    1) Particular attention to the cardiovascular system;
    2) Use of invasive diagnostic and therapeutic cardiologic procedures;

3) Potential need for neurologic, ophthalmologic, metabolic, and renal functional testing.

D. Outline the basic principles of donor selection and deceased donor organ allocation.

1) List criteria used to assess the suitability of a deceased donor for pancreas transplant:

a. Age;

b. Cause of death;

c. BMI;

d. Splenic injury;

e. Previous gastric or splenic surgery;

f. Hemodynamic status, vasopressor requirements;

g. Length of cold ischemic time;

h. Visualization and palpation of the gland at the time of procurement;

i. Amylase, lipase, glucose levels;

j. Injury during the procurement.

2) Understand that allocation of pancreata with regard to PTA versus SPK is determined locally;

3) Know the geographic differences in pancreas utilization.

II. Describe the different immunosuppressive strategies currently utilized in pancreas transplantation. Upon completion of this section, the fellow will:

A. Understand Induction Immunosuppression.

1) Risks and benefits of available agents;
    a. IL-2R blockers vs. ant-lymphocyte depleting agents.
2) Length of treatment.

B. Determine appropriate maintenance immunosuppressive regimen.
    1) Rationale for choice of CNI, anti-proliferative, and/or steroids;
    2) Describe appropriate monitoring intervals, dosing levels, and complications.

C. Counsel patients regarding the need for compliance, potential side effects and important drug interactions, and strategies to minimize side effects.

III. Understand and perform pancreas recovery from deceased donors and simultaneous and isolated pancreas transplant procedures; identify strategies which can be employed in the high risk recipient. Upon completion of this section, the fellow will:

A. Know the surgical techniques of pancreas recovery:
    1) Organ procurement;
    2) Use spleen as a handle to prevent over-manipulation of the gland;
    3) Use of pancreas when right hepatic artery arises from superior mesenteric artery;
    4) University of Wisconsin versus HTK preservation solution.

B. Back table preparation:
    1) Removal of spleen;
    2) Role for shortening of duodenum;
    3) Control of mesenteric vessels;

4) Y-graft or use of alternative arterial reconstruction;

5) Role for portal vein extension graft.

C. Know the surgical techniques of the pancreas transplant procedure:

1) Intraperitoneal versus retroperitoneal placement of the pancreas graft;

2) Describe the technique for isolating the iliac vessels and performing vascular anastomoses, including strategies to deal with complex anatomy;

3) Use of intra-operative adjunctive medications.

D. Describe segmental pancreas transplantation:

1) Rationale;

2) Surgical procedure;

3) Preoperative testing to minimize chance of developing diabetes in the live donor.

IV. Understand the rationale for and advantages/disadvantages of exocrine (bladder versus enteric) and venous (systemic versus portal) drainage of the transplanted pancreas. Upon completion of this section, the fellow will understand:

A. Urinary/bladder drainage of exocrine secretions.

1) Historical evolution of technique;

2) Hand-sewn versus stapled;

3) Advantages, including utility of urinary amylase monitoring;

4) Disadvantages and indications for postoperative duodenal-enteric conversion.

B. Enteric drainage of exocrine secretions:
    1) Historical evolution of technique;
    2) Hand-sewn versus stapled;
    3) Use of Roux-en-Y limb and advantages/disadvantages.
C. Systemic venous versus portal venous drainage: advantages/disadvantages.

V. Recognize and diagnose pancreas transplant rejection including performing diagnostic biopsy and interpreting basic pathological findings. Upon completion of this section, the fellow will be able to:
    A. Review and evaluate pertinent laboratory data (serum and urine amylase, serum lipase) to identify potential for rejection or other etiologies of graft dysfunction.
    B. Determine the need for a percutaneous biopsy, ultrasound examination, or other diagnostic procedure.
    C. Perform pancreas biopsy.
        1) Provide appropriate consent discussion for patients;
        2) Role for protocol biopsy in solitary grafts;
        3) Utilize ultrasound or CT for location of graft;
        4) Perform needle biopsy;
        5) Send specimen for appropriate diagnostic studies (H and E evaluation, EM);
        6) Alternative biopsy techniques.

D. Describe in detail treatment approaches for acute allograft rejection based on the Drachenberg criteria.

E. Understand the impact of acute rejection episodes on long-term outcome.

VI. Outline the patient and graft outcomes associated with PTA, SPK and PAK transplantation. Upon completion of this section, the fellow will be able to:

A. Describe the effect of pancreas transplantation on the metabolic and secondary complications of diabetes:

1) Glucose metabolism;

2) Cholesterol and lipid metabolism;

3) Retinopathy;

4) Neuropathy;

5) Nephropathy;

6) Microangiopathy.

B. Describe the impact of pancreas transplantation on the quality of life of diabetic patients.

C. Contrast short- and long-term graft survival for the three different types of pancreas transplants, and potential reasons for the differences.

D. Explain the survival benefit of pancreas transplantation and the pivotal studies addressing the topic.

VII. Describe appropriate long term follow-up and be able to identify and treat short and long term complications of pancreas transplantation. Upon completion of this section, the fellow will be able to:

A. Detail the postoperative care of pancreas transplant patients:
    1) Fluid and electrolyte management;
    2) Insulin infusion;
    3) Anticoagulation;
    4) Role for octreotide use;
    5) Antibiotic use;
    6) Recognition and treatment of cardiac complications.
B. Identify and treat surgical complications:
    1) Thrombosis;
    2) Bleeding;
    3) Pancreatitis, and its various etiologies;
    4) Duodenal leak;
    5) Fluid collections, pseudocysts, abscesses;
    6) Wound complications.
C. Describe and interpret relevant radiological evaluations:
    1) Ultrasound;
    2) CT scanning;
    3) Percutaneous drainage.
D. Appreciate the health maintenance needs of pancreas transplant patients.
E. Understand the impact of cardiac disease on the long-term outcome of pancreas transplant patients.
F. Determine the indications for bladder to enteric conversion (e.g. dehydration, electrolyte imbalance, renal injury).

G. Determine the indications and technique of transplant pancreatectomy.

H. Appreciate the role of transplant surgeons in improving both long- and short-term outcomes of pancreas transplantation.

VIII. Outline the basic principles and outcomes of islet transplantation. Upon completion of this section, the fellow will be able to:

A. Describe recipient selection criteria for islet transplantation.

1) State how they differ from whole pancreas transplantation;

2) Know how to determine whether one is a candidate for islet or whole pancreas transplantation.

B. Know donor selection and recovery.

1) List how donor selection criteria for islet transplantation differ from whole pancreas transplantation;

2) Describe how pancreas recovery requirements/techniques differ from that for whole pancreas transplantation;

3) Discuss pancreas preservation modalities.

C. Understand where islet transplantation fits into the pancreas allocation algorithm.

D. Know the islet isolation and transplantation process.

1) Describe the pancreas digestion process;

2) Describe islet purification methodology;

3) Delineate criteria that determine a transplantable islet preparation;

4) Describe operative and percutaneous transplant techniques.

E. List the short- and long-term complications of islet transplantation.

F. State the outcomes of islet transplantation:

1) Graft function;

2) Insulin independence;

3) Euglycemia;

G. Discuss islet transplantation, finance and reimbursement.

UNIT 8

ACCESS FOR RENAL REPLACEMENT THERAPY

Unit Objectives

I. Outline the basic principles of vascular access for hemodialysis and the most common surgical techniques for establishing access.
II. Outline potential complications and describe the expected outcomes of vascular access for hemodialysis.
III. Outline the basic principles of peritoneal dialysis and the accompanying surgical techniques for establishing peritoneal access.

Learner Objectives

I. Outline the basic principles of vascular access for hemodialysis and the most common surgical techniques for establishing access. Upon completion of this section, the fellow will be able to:

    A. Identify the necessary prerequisites for successful vascular access.

        1) Desired flow rate;

        2) Desired Urea Reduction Ration (URR) and Kt/V to assess adequacy of dialysis;

        3) Ability to cannulate.

B. Describe the preferred progression of vascular access types and locations for hemodialysis and the rationale for their ranking.

    1) Autogenous AV fistulas vs. non-autogenous grafts vs. vascular catheters;

    2) Lower arm vs. upper arm vs. lower extremity vs. central access.

C. Describe the preoperative evaluation of a patient needing vascular access.

    1) General medical considerations:

        a. Effect of chronic kidney failure on perioperative physiology;

        b. Hypercoaguability;

        c. Arm preservation.

    2) Operative site evaluation:

        a. History and physical:

            i. Previous history of relevant interventions, sensory motor evaluation of extremities, Allen's test;

        b. Role of ultrasound mapping:

            i. Vein size;

            ii. Arterial size and waveform;

    3) Potential anesthetic approaches.

D. Describe the surgical techniques for:

1) Autogenous radiocephalic fistula;

2) Autogenous brachiocephalic fistula;

3) Autogenous brachio-basilic transposition;

4) Non-autogenous loop graft;

5) "Exotic" vascular access (leg grafts, chest grafts, etc).

II. Outline potential complications and the expected outcomes of vascular access for hemodialysis. Upon completion of this section, the fellow will be able to:

A. Describe the Kidney Disease Outcomes Quality Initiative (KDOQI.)

B. Explain the physiology, workup and treatment of steal syndrome including:

1) Physical exam and non-invasive testing,

2) Role of angiography,

3) Banding and the Distal Reconstruction Interval Ligation (DRIL) procedure.

C. Describe the treatment and workup of access thrombosis. Be able to discuss in this context:

1) Differences in graft and fistula thrombosis;

2) Hypercoaguability;

3) "Early" thrombosis vs. "late" thrombosis;

4) Venous neointimal hyperplasia.

D. Describe potential etiologies, workup and treatment of failure of maturation including:

1) Physiology of maturation;

2) Access stenosis;

3) Parasitizing branches;

4) Secondary procedures to assist maturation (fistulography, transpositions, vein ligation).

E. Describe the expected patencies of different types of vascular access.

1) Definitions of different types of patency (primary unassisted, cumulative, etc).

III. Outline the basic principles of peritoneal dialysis and describe the surgical techniques of peritoneal access. Upon completion of this section, the fellow will be able to:

A. Explain the physiology of the peritoneal membrane.

B. Describe the preoperative evaluation of a patient needing peritoneal access for dialysis.

1) General medical considerations:

a. Effect of chronic kidney failure on perioperative physiology;

b. Dexterity, vision, ability to comply with sterile technique.

2) Operative site evaluation:

    a. History and physical- previous history of abdominal procedures.

C. Describe surgical technique for placement of catheters:

    1) Laparoscopic;

    2) Open.

D. Outline the potential complications, workup of those complications and subsequent complication management of peritoneal catheters both perioperatively and longer term including:

    1) Bleeding;

    2) Infection:

        a. Bacterial

        b. Fungal

    3) Malplacement;

    4) Loss of abdominal domain.

UNIT 9

PUBLIC POLICY AND ORGAN ALLOCATION

Unit Objectives

I. Identify the key organizations governing the conduct of transplant practice (OPTN/UNOS, ASTS, AST, and CMS).
II. Understand the key provisions of the National Organ Transplant Act and the medical-legal ramifications for transplant professionals.
III. Describe the basic concepts underlying the various systems of deceased organ allocation for each organ.
IV. Describe the organ allocation process.
V. Appreciate current efforts to identify and reduce the disparity in access to care.

Learner Objectives

I. Identify the key organizations governing the conduct of transplant practice (OPTN/UNOS, ASTS, AST, CMS, HHS, and HRSA). Upon completion of this section, the fellow will be able to:
    A. Understand the relationship between the Organ Procurement and Transplantation Network (OPTN) and transplant centers.
        1) Outline the organizational structure of the OPTN;
        2) List the various classes of data that are collected from the transplant centers by the OPTN and at what stages in the transplant process;

3) Define the role of the OPTN in transplant center and transplant surgeon certification;
4) State how the OPTN oversees transplant center performance through Membership and Professional Standards Committee.

B. List the activities of the United Network of Organ Sharing (UNOS) in its role as the contractor for the OPTN.
C. Understand the purpose of the Scientific Registry of Transplant Recipients (SRTR), its activities, and its relationship with OPTN.
    1) List the elements of Center-Specific Reports (CSRs);
    2) State the methods by which the OPTN uses CSRs in transplant center oversight;
    3) Understand the methodology by which the SRTR collects the data and performs its analyses;
D. Know how the American Society of Transplant Surgeons and the American Society of Transplantation performs accreditation of Transplant Surgery and Transplant Nephrology fellowships.
E. Define the oversight role of the Centers for Medicaid and Medicare Services (CMS) and the (JCAHO) in transplantation.
F. State the function of the Department of Health and Human Services (HHS), the Division of Transplantation (DOT) and the Health Resources Services Administration (HRSA) in transplant oversight.

II. Understand the key provisions of the National Organ Transplant Act (NOTA) and the medical-legal ramifications for transplant professionals. Define how NOTA has

influenced the environment regarding. Upon completion of this section, the fellow will understand:

A. Valuable consideration;

B. Organ sales;

C. Living donor paired exchanges.

III. Describe the basic concepts underlying the various systems of deceased organ allocation. Upon completion of this section, the fellow will be able to:

A. List and define basic principles of allocation.

1) Utility;

2) Urgency;

3) Equity.

B. Compare the advantages and disadvantages of emphasizing various components of allocation systems: urgency, benefit, waiting time, matching, prioritizing pediatric candidates.

C. Specific allocation systems.

1) Kidney – list the elements of the current system and the proposed inclusion of net benefit;

2) Pancreas – state the various mechanisms by which local pancreata are allocated ;

3) Islet cells-understand the process by which pancreata can be utilized for islet cell transplantation;

4) Liver – explain allocation by MELD, standard exceptions, and the share 15 rule;

5) Pediatrics – what are the special allocation rules designed to increase liver and kidney transplantation to pediatric candidates?

D. Define the determinants of by which the efficacy of allocation systems may be evaluated:

1) Waiting time;
2) Transplant rate;
3) Death rates on waiting list;
4) Discards;
5) Acceptance measures.

IV. Describe the allocation process. Upon completion of this section, the fellow will:

A. Understand regions and OPOs.

1) State what a match run is and its importance;
2) Define regional and national sharing, and identify situations in which sharing is mandatory;
3) Know what is meant by expedited placement;
4) Delineate the process of electronic offer and acceptance.

B. Understand how allocation policy is made.

1) Describe the role of local, regional, and national committees, the OPTN Board of Directors and the public comment process;
2) Define what is meant by a variance and state the significance;
3) Describe standardized and non-standardized exceptions;
4) Understand the role of the regional review processes;
5) Alternative systems (e.g. ECD).

V. Appreciate current efforts to identify and reduce the disparity in access to care (waiting list and transplant). Upon completion of this section, the fellow will understand the issues relevant to disparity in access to care in the following settings:

A. Geographic.

B. Socioeconomic.

C. Racial.

D. Transplant program practices.

UNIT 10

ETHICS

Unit Objectives

I. Understand the general principles underling biomedical ethics and their specific application to transplantation.

II. Understand and be able to characterize some of the continuing and emerging ethical challenges specifically related to deceased donor organ allocation and access to transplantation.

III. Understand and be able to characterize some of the continuing and emerging ethical challenges related to live donor organ transplantation.

IV. Discuss and carry out various strategies designed to address some of the common ethical challenges encountered in live donor organ transplantation.

Learner Objectives

I. Understand the general principles underlying biomedical ethics and their specific application to solid organ transplantation. Upon completion of this section, the fellow will understand:

    A. Beneficence/non-malfeasance.

        1) The Hippocratic Oath.

    B. Respect for the person and patient autonomy.

        1) The Hippocratic tradition and paternalism;

        2) The practice of informed consent.

C. Justice.

II. Understand and be able to characterize some of the continuing and emerging ethical challenges specifically related to deceased donor organ allocation and access to transplantation. Upon completion of this section, the fellow will understand:

A. Supply, demand, and maintenance: Getting listed and gaming the list (i.e. multiple listing).

B. Poverty as a contraindication for organ transplantation.

C. Equal access to transplantation.

1) Impact of race;

2) Impact of religion;

3) The case of the Jehovah's witness.

D. Transplant tourism and implications for post transplant care.

E. Issues of presumed consent.

1) Regulated sales of organs;

2) Incentivisation for organ donation.

F. Ethical issues surrounding standard brain death donors (DBD) vs. deceased cardiac death (DCD) donors.

G. The ethical issues emerging from the current kidney transplant allocation debate.

1) Utility vs. urgency;

2) The principal of net lifetime saved benefit.

III. Understand and be able to characterize some of the continuing and emerging ethical challenges related to live donor organ transplantation. Upon completion of this section, the fellow will understand:

A. "First Do No harm."

1) The moral permissibility of living organ donor transplantation:

a. The "Unacceptable Risks" argument;

2) Obligation as a threshold for acceptable risk :

a. Donors, recipients, and the relations between them.

B. Informed consent:

1) The Gold Standard: reasoned, intellectual decisions:

a. The Donor Acts: emotion, speed, and other departures from "Informed Consent".

2) Autonomy and its limits in living organ donor transplantation:

a. Altruism, duty, and the possibility of autonomy;

b. The trouble with "coercion".

3) The role of emotion in living organ donor decision-making.

C. Arguments for and against regulated sales of organs.

1) Arguments against regulated sales of organs;

2) Arguments against prohibitions on regulated sales of organs.

IV. Discuss and carry out various strategies designed to address some of the common ethical challenges encountered in live donor organ transplantation. Upon completion of this section, the fellow will understand:

A. New York state guidelines for organ donation:

B. The “cooling off period”.

C. The case of the “Blameless” excuse.

UNIT 11

ECONOMICS OF TRANSPLANTATION

Unit Objectives

I. Understand the basic economic issues in transplantation.

II. Describe the basic reimbursement methodology of Medicare.

III. Attain a basic understanding of private payer contracting arrangements.

IV. Describe the relationship between organ procurement organizations, transplant centers, and donor hospitals including a basic understanding of the Standard Acquisition Cost for deceased donors.

Learner Objectives

I. Understand the basic economic issues in transplantation. Upon the completion of this section, the fellow will:

   A. Be able to define key economic terms.

      1) Cost;

      2) Effectiveness;

      3) Cost-effectiveness analysis;

      4) Perspective of analysis (payer, provider, society).

   B. Understand basic financial terminology.

      1) Cost:

         a. Total, direct, indirect;

         b. Fixed cost;

c. Variable cost.

2) Charges;

3) Reimbursement;

4) Margin:

a. Gross margin;

b. Contribution margin;

c. Allocation of overhead costs.

5) Overhead:

a. Allocation of overhead costs.

II. Describe the basic reimbursement methodology of Medicare. Upon completion of this section, the fellow will:

A. Appreciate the components of hospital payment- Part A.

1) DRG – Diagnosis Related Group:

a. Definition;

b. Outlier threshold;

c. Covered services.

2) Medicare Cost Report:

a. Direct medical expenses;

b. Indirect medical expenses.

3) Organ acquisition cost center:

a. Allowable costs;

b. Transplant center responsibilities:

i. Negotiate for lowest available cost;

ii. Allocate coordinator/staff time between pre/post transplant costs.

c. Appreciate the role of the Office of the Inspector General.

B. Understand key components which determine professional payment:

1) Medicare part B;

2) Relative Value Units (RVU) and conversion factors;

3) Current Procedural Terminology (CPT) codes;

4) Impact of sustainable growth rate provisions on physician payments.

III. Attain a basic understanding of private payer contracting arrangements. Upon completion of this section, the fellow will:

A. Understand the basic types of transplant contracts:

1) Full charges;

2) Discounted charges;

3) Fixed rate contracts:

i. Outlier protection;

ii. Global period;

iii. Assumption of risk.

B. Define the issues regarding payment for organ acquisition costs.

C. Appreciate the importance of Center of Excellence networks.

D. Explain the concept of transplant coverage carve-outs.

IV. Describe the relationship between organ procurement organizations, transplant centers, and donor hospitals including a basic understanding of the Standard Acquisition Cost for deceased donors. Upon completion of this section, the fellow will:

A. Understand the role of the Organ Procurement Organization.

B. Define standard acquisition cost.

C. Appreciate the differences in OPO costs with SCD, DCD, and ECD donors.