(END-Stage Renal Disease)& Kidney transplantation

Definition:

Chronic renal failure, or ESRD, is a progressive, irreversible deterioration in renal function in which the body's ability to maintain metabolic and fluid and electrolyte balance fails, resulting in uremia or **azotemia** (retention of urea and other nitrogenous wastes in the blood).

Causes:

ESRD may be caused by systemic diseases, such as

- Diabetes mellitus
- Hypertension
- chronic glomerulonephritis;
- pyelonephritis; obstruction of the urinary tract
- Hereditary lesions, as in polycystic kidney disease
- Vascular disorders
- Infections
- Medications; or toxic agents.
- Environmental and occupational agents that have been implicated in chronic renal failure include lead, cadmium, mercury, and chromium.

Stages of Chronic Renal Disease

- **Stage 1**

Reduced renal reserve, characterized by a 40% to 75% loss of nephron function. The patient usually does not have symptoms because the remaining nephrons are able to carry out the normal functions of the kidney.

- **Stage 2**

Renal insufficiency occurs when 75% to 90% of nephron function is lost. At this point, the serum creatinine and blood urea nitrogen rise, the kidney loses its ability to concentrate urine and anemia develops. The patient may report polyuria and nocturia.

- **Stage 3**

End-stage renal disease (ESRD), the final stage of chronic renal failure, occurs when there is less than 10% nephron function remaining. All of the normal regulatory, excretory, and hormonal functions of the kidney are severely impaired. ESRD is evidenced by elevated creatinine and blood urea nitrogen levels as well as electrolyte imbalances. Once the patient reaches this point, dialysis is usually indicated. Many of the symptoms of uremia are reversible with dialysis.

Other classification:

Renal stages are based on glomerular filtration rate (GFR) .the normal GFR is 125ml/min .GFR is the **amount** of **plasma filtered** through the **glomeruli per** unit of time

- **Stage 1**(kidney damage with normal or increase GFR) =GFR >90ML/MIN
- **Stage 2**(Mild decrease in GFR) . GFR =60-89ML/MIN
- **Stage 3** (Moderate decrease in GFR) . GFR=30-59ML/MIN
- **Stage4** (severe decrease in GFR) . GFR=15-29ML/MIN
- **Stage5** (kidney failure) . GFR<15ML/MIN

Clinical Manifestations

The severity of these signs and symptoms depends in part on the degree of renal impairment, other underlying conditions, and the patient's age.

Because every body system is affected by the uremia of CRF patient is exhibit number of signs and symptoms

- **Neurologic:**

Weakness and fatigue; confusion; inability to concentrate; disorientation; tremors; seizures; restlessness of legs; burning of soles of feet; behavior changes

- **Integumentary:**

Gray-bronze skin color; dry skin; pruritus; ecchymosis, brittle nails; thinning hair

- **Cardiovascular:**

Hypertension; (due to Na and water retention or from activation of the rennin – angiotensin – aldosterone system),

Heart failure and pulmonary edema (due to fluid overload)

Pericarditis (due to irritation of pericardial lining by uremic toxin)

- **Pulmonary:**

Crackles; thick, tenacious sputum; cough; pleuritic- pain; shortness of breath; tachypnea; Kussmaul-type respirations; uremic pneumonitis; "uremic lung"Ammonia odor to breath ("uremic fetor"); metallic taste; mouth ulcerations and bleeding; anorexia, nausea, and vomiting; constipation or diarrhea; bleeding from gastrointestinal tract.

- **Hematologic:** Anemia; thrombocytopenia.
- **Reproductive:** Amenorrhea; testicular atrophy; infertility; decreased libido.

- **Musculoskeletal:** Muscle cramps; loss of muscle strength; bone pain; bone fractures.
- **GIT:** Anorexia; nausea; vomiting; hiccups. The patient's breath may have the odor of urine (uremic fetor)

Assessment and Diagnostic Findings

- **Glomerular Filtration Rate**

- Decreased GFR can be detected by obtaining a 24-hour urinalysis for creatinine clearance which decreased
- Serum creatinine and BUN levels increase

- **Sodium And Water Retention**

- The kidney cannot concentrate or dilute the urine normally in ESRD.
- Some patients retain sodium and water, increasing the risk for edema, heart failure, and hypertension

- **ACIDOSIS**

- metabolic acidosis occurs because the kidney cannot excrete increased loads of acid
- Decreased acid secretion primarily results from inability of the kidney tubules to excrete ammonia (NH_3^-) and to reabsorb sodium bicarbonate (HCO_3^-).

- **ANEMIA**

Anemia develops as a result of inadequate erythropoietin production

- **Calcium and Phosphorus Imbalance**

- increase in the serum phosphate level and corresponding decrease in the serum calcium level lead to:

- Increased secretion of parathormone from the parathyroid glands, so Calcium leaves the bone which lead to bone changes and bone disease .
- the active metabolite of vitamin D (1,25-dihydroxycholecalciferol) normally manufactured by the kidney decreases as renal failure progresses

Complications

• Hyperkalemia due to decreased excretion, metabolic acidosis, catabolism, and excessive intake (diet, medications, fluids)

• Pericarditis, pericardial effusion, and pericardial tamponade due to retention of uremic waste products and inadequate dialysis

• Hypertension due to sodium and water retention and malfunction of the renin–angiotensin–aldosterone system

• Anemia due to decreased erythropoietin production, decreased RBC life span, bleeding in the GI tract from irritating toxins, and blood loss during hemodialysis

• Bone disease and metastatic calcifications due to retention of phosphorus, low serum calcium levels, abnormal vitamin D metabolism, and elevated aluminum levels.

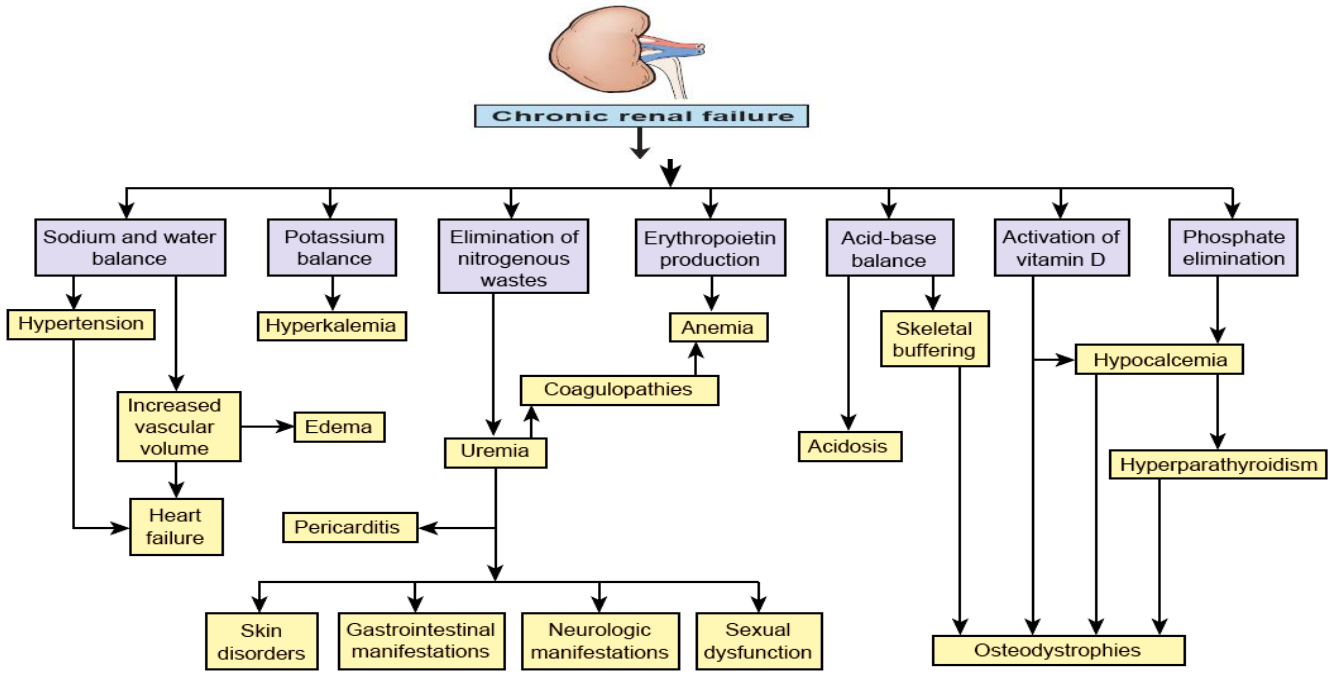


FIGURE 36-4 Manifestations of chronic renal failure.

Medical Management

The goal of management is to maintain kidney function and homeostasis for as long as possible.

Management is accomplished primarily with medications and diet therapy, although dialysis

➢ Pharmacologic Therapy

Complications can be prevented or delayed by administering prescribed antihypertensive, erythropoietin (Epogen), iron supplements, phosphate-binding agents, and calcium supplements

- **Calcium and phosphorus binders**

Hyperphosphatemia and hypocalcemia are treated with medications that bind dietary phosphorus in the GIT. All binding agents must be administered with food to be effective.

- **Antihypertensive and Cardiovascular Agents.**

Heart failure and pulmonary edema may also require treatment with fluid restriction, low-sodium diets, diuretic agents, inotropic agents such as digitalis or dobutamine, and dialysis

- **Antiseizure Agents.**

- If seizures occur Intravenous diazepam (Valium) or phenytoin (Dilantin) is usually administered to control seizures.
- The side rails of the bed should be padded to protect the patient.

- **Erythropoietin.**

- Anemia associated with chronic renal failure is treated with recombinant human erythropoietin (Epogen).
- The patient receiving Epogen may experience influenza-like symptoms with initiation of therapy; these tend to subside with repeated doses.
- Erythropoietin is administered I.V or S.C .

➢ Nutritional Therapy

- Diet restricted of potassium
- adequate caloric intake and vitamin supplementation
- Protein is restricted because urea, uric acid, and organic acids
- Calories are supplied by carbohydrates and fat to prevent wasting.

➢ DIALYSIS:

Dialysis is a process used to remove fluid and waste products from the body when the kidneys unable to do on their own. Before dialysis was available, total kidney failure meant death. Today, people with kidney failure can live because of treatments such as dialysis and kidney transplant.

There are two kinds of dialysis. Hemodialysis, blood is pumped out of patient body to an artificial kidney machine, and returned to his body by tubes that connect him to the machine. Peritoneal dialysis, the inside lining of patient own belly acts as a natural filter. Wastes are taken out by means of a cleansing fluid called dialysate, which is washed in and out of his belly in cycles.

Physiologic principles of dialysis:

Dialysis involves the movement of fluid and particles across semipermeable membrane to restore fluid and electrolyte balance, control acid-base balance, and

remove waste and toxic material from the body. Three principles underlie the action of hemodialysis: diffusion, osmosis, and ultrafiltration.

✓ Diffusion:

- Means movement of particles from an area of greater to an area of lesser concentration.
- It results in the movement of urea, creatinine, and uric acid from the patient's blood into the dialysate.
- Solution contains fewer particles of substances to be removed from the bloodstream and high concentration of particles of substances to be added to the blood.
- Dialysate is composed of the entire important electrolyte in their ideal extracellular concentration (by controlling and adjusting the dialysate bath).
- The body's buffer system is maintained by the addition of acetate which diffuses from the dialysate to the patient's blood and is metabolized to form bicarbonate.

NB: small pores in the semipermeable membrane do not allow the loss of red blood cells and proteins.

✓ Osmosis:

Involves the movement of water across a semipermeable membrane from an area of lesser to an area of greater concentration. Or removal of water from an area of higher pressure (patient) to lower pressure (dialysate).

✓ Ultrafiltration:

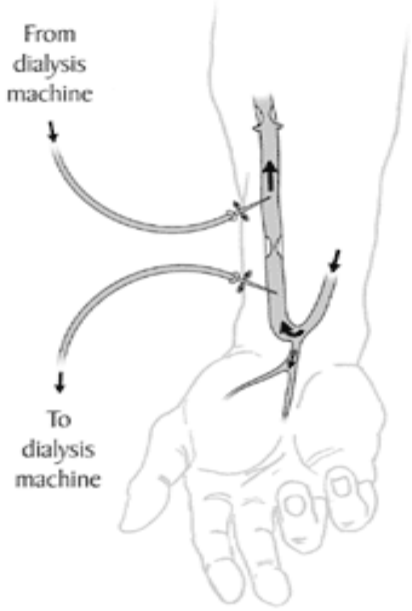
It is more efficient than osmosis for removal a fluid. In the machine, negative pressure is an actual suctioning force applied to the membrane and facilitates removal of water to achieve isovolemia.

PREPARING FOR HEMODIALYSIS

Preparations for hemodialysis should be made at least several months before it will be needed. In particular, easy access to a patient's blood stream must be established so that the access is available when dialysis begins. One important step before starting regular hemodialysis sessions is preparing a Vascular access (usually referred to as an access or shunt), which is the site on patient body where blood will be removed and returned during dialysis.There are three basic kinds of vascular accesses for hemodialysis: an Arteriovenous (AV) fistula, an AV graft, and a venous catheter.

Arteriovenous Fistula

- Permanent fistula is created surgically in operating room (usually in forearm).
- The artery and vein anatomized.
- Arterial blood diverted into the vein.
- Increase the blood flow through the vein lead to intimal hyperplasia, vein grows larger and stronger making repeated insertion for hemodialysis easier.
- The vein "matures" over 6:12 weeks, then able to be canulated by the dialysis needles.



Forearm arteriovenous fistula.

Canulation before proper maturation lead to infiltration of the dialysis needle may occur, pain, edema or hematoma.

Contraindication:

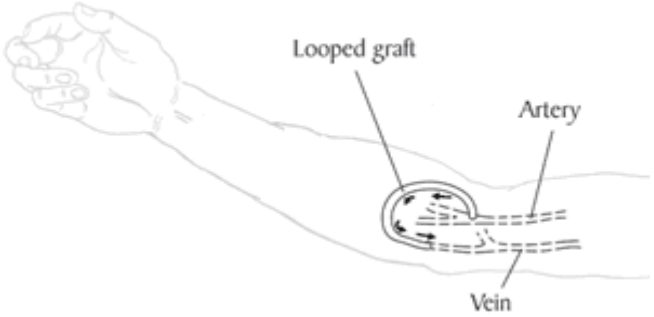
1. Patient with vascular disease.
2. Patient with diabetes mellitus.
3. Long term hypertension.
4. Advanced age.

NB:

A fistula usually needs two to four months to heal before it can be used for dialysis.

Arteriovenous Graft

- It was done when patient have small vein.
- Using a synthetic flexible tube implanted under the skin in the arm to create a path between an artery and vein.
- The tube becomes an artificial vein that can be used repeatedly for needle replacement and blood access during hemodialysis.
- Grafts heal more quickly than fistulas and can often be used about two weeks after they are created.
- However, complications such as narrowing of the blood vessels, clotting or infection are more common with grafts than with AV fistulas.
- A well-caring for graft can last it for several years.



One kind of AV graft

Venous Catheter for Temporary Access

- If patient kidney disease has progressed quickly, he may not have time to get a permanent vascular access before he start hemodialysis treatments.
- A catheter is inserted into a vein in neck, chest, or leg near the groin.
- It has two chambers to allow two-way flow of blood.
- Catheters are not ideal for permanent access.
- They can clog, become infected, or cause narrowing of the veins in which they are placed.
- After finishing hemodialysis, high dose heparin should be inserted in each port of catheter-----to prevent thrombosis.
- Catheters that will be needed for more than about 3 weeks are designed to be tunneled under the skin to increase comfort and reduce complications.

Complications during dialysis

Most complications that occur during dialysis can be prevented or easily managed if you are monitored carefully during each dialysis session. Possible complications may include:

- Low blood pressure (hypotension). This is the most common complication of hemodialysis. It is seen more often in women and in people older than 60.
- Muscle cramps. If cramps occur, they usually happen in the last half of a dialysis session.
- Irregular heartbeat (arrhythmia).
- Nausea, vomiting, headache, or confusion (dialysis disequilibrium).
- Infection, especially if a central venous access catheter is used for hemodialysis.
- Blood clot (thrombus) formation in the venous access catheter.

- Technical complications, such as trapped air (embolus) in the dialysis tube.

Nursing Management

Nursing care is directed toward assessing fluid status and identifying potential sources of imbalance, implementing a dietary program to ensure proper nutritional intake within the limits of the treatment regimen, and promoting positive feelings by encouraging increased self-care and greater independence. It is extremely important to provide explanations and information to the patient and family concerning ESRD, treatment options, and potential complications. A great deal of emotional support is needed by the patient and family because of the numerous changes experienced.

Nursing diagnoses for these patients include the following:

• Excess fluid volume related to decreased urine output, dietary excesses, and retention of sodium and water

• Imbalanced nutrition: less than body requirements related to anorexia, nausea and vomiting, dietary restrictions, and altered oral mucous membranes

• Deficient knowledge regarding condition and treatment regimen

• Activity intolerance related to fatigue, anemia, retention of waste products, and dialysis procedure

• Low self-esteem related to dependency, role changes, changes in body image, and sexual dysfunction

Nursing intervention

o Diet and fluid considerations:

➢ Restriction of protein will reduce nitrogenous wastes and decrease symptoms.

- Protein must be of high biologic quality composed of essential amino acid to maintain positive nitrogen balance as eggs, meat and fish.
- A diet that is low in sodium, potassium, and phosphorus may be recommended.
- Amount of fluids (in drinks and foods) may be limited, fluid accumulation can lead to congestive heart failure and pulmonary edema.
- A dietitian can help patients to choose foods that are compatible with hemodialysis treatment.

o **Medication consideration**:

Medications are excreted wholly or in part by the kidneys. Patients requiring different medications. So, they should be monitored closely. For example: if antihypertensive drugs are taken on dialysis day, a hypertensive effect may occur during dialysis causing dangerously low blood pressure.

o **Psychosocial consideration:**

Person requiring long-term hemodialysis are often have:-

- Financial problems.
- Difficulty in holding a job.
- Depression from being chronically ill.
- Impaired sexual desires and impotence.
- Fear of dying.
- Younger persons worry about marriage.

The patient should be given the opportunity to express any feeling of anger and concern over the limitations imposed by the disease and treatment.

- **Patient education**

  - Purpose of treatment.
  - Medications.
  - Side effect of treatment.
  - Care of vascular access.
  - Diet and fluid restrictions.
  - Fluid over load.
  - Prevention and management of complications.
  - Psychological concerns.
  - Financial consideration.

Kidney Transplantation

Definition:-

Kidney transplantation is a surgical procedure to remove a healthy, functioning kidney from a living or brain - dead donor and implant it into ft patient with non - functioning kidneys.

Indication:-

Kidney transplantation is performed on patients with chronic kidney failure, or end - stage renal disease (ESRD). (ESRD) occurs when the kidney can no longer perform its many functions. Common diseases that cause kidney failure and require kidney transplantation include:-

Acquired diseases: glomerulonephritis, diabetic nephropathy, hypertension.

Congenital disorder:, polycystic kidney disease.

Other disorders: Wilms' tumor or other tumors, renal vein thrombosis, multiple myeloma.

Contra indications:-

- Seropositivity for the human immunodeficiency virus (HIV).
- Active infection.
- Severe coronary artery disease with left ventricular dysfunction.
- Malignancy.
- Severe peripheral vascular disease.
- Severe carotid artery disease.
- Chronic active hepatitis.

Organ procurement

Organs and tissues come from 2 primary sources:-

I- Cadaver donors (heart beating and non heart beating)

II- Living related and living –non related donors.

1-Cadaver donors

NB In cadaver donor, death is irreversible cessation of all functions of the brain and brainstem.

A. Heart beating cadaver:

Are persons with confirmed brain death in whom the vital organs can be preserved in vivo. Brain death has resulted from severe neurologic trauma (head or spinal cord injury), hemorrhage or anoxia. Death must occur In a location in which cardio vascular support system b immediately available (i.e. emergency deportment, O.R. or other

critical Care unit) to prevent ischemic damage to the vital organs by maintaining individual who is brain dead on mechanical ventilation and to fulfill the following criteria:-

- Systolic blood pressure above 90 mmHg.
- CVP of 5 to 10 mmHg.
- Hydration with crystalloids and colloids.
- Urine out put minimum 100 ml/hr.
- Ventilation with 100% oxygen.
- Core body temperature of 37c.

B. Non heart beating donors:

Are not suitable for the procurement of parenchymal organs because major organs have suffered thrombosed vascular structures and ischemia; but skin, bone, heart valves, blood vessels and corneas may be acceptable for procurement.

II- **Living Donor:-**

A growing number of studies demonstrate that transplantation of organs from unrelated living donors can be successful when combined with donor specific immunosuppressive drugs.

Transplants using kidney from living related donors offer the best long term patient survival because living donors genetically related to recipients rather than from cadaver or living unrelated donors.

Advantages of living related donor

• Donor - recipient matches are usually good.

• Waiting time is reduced.

• Procedure is planned and performed under controlled circumstances.

Criteria for using living donors

- Adult donors must be able to give informed consent voluntarily.
- If the donor is a minor, court (legal) and parental or guardian consents are required to avoid bias.
- The donor must fully comprehend the sacrifice (having one kidney). The donor must be in excellent health, He or she undergo a complete medical history and physical examination to evaluate their suitability for donation.
- Renal arteriograms are performed to confirm the presence of bilateral kidneys and to identify the renal vasculature.
- The donor should have no psychiatric complications (intelligence testing may be also done)

Before transplantation, Cross matching , the recipient undergoes ABO typing, Rh typing, HLA tissue typing.

A positive result on cross- matching means 'the antibodies are present

⇨ Rejection,

A negative result on cross- matching means no antibodies ore present

⇨ Decrease risk of rejection.

NB. A human kidney has a set of six antigens.

Immunosuppressive Therapy

The dominant factor for success in organ transplantation, it is used for suppressing the Immune response to prevent organ rejection. This medication regimen is individualized for each patient and dose should be kept within the therapeutic range because long term out comes for using are:

- Increased risk of infection.
- Liver or kidney insufficiency.
- Joint necrosis.
- Cataracts , Malignancies.

Types of Rejection

Type	Characteristics	Outcome
Hyper acute	- Occurs within hours after transplantation and results in immediate graft failure - It includes thrombosis and extensive Destruction of allograft vasculature - Hyper acute prevented by selecting donors with compatible RBC types.	- Irreversible and unbeatable -Transplanted kidney must be removed.
Accelerated	- The graft may function for up 5 days then rapid loss of renal function.	-Immediate removal of the transplant.
Acute	- Occurs within weeks to 4 months after Transplant. - systemic and local symptoms as well as reduced urinary output and abnormal laboratory findings are present.	- Treatable and Reversible.
Chronic	- Develops slowly over months to years - Chronic inflammation results in scaring tissue	-Unbeatable -Eventually

	and stenosis of vasculature of organ.	leading to graft loss.

Clinical manifestation of graft rejections includes:--

- ⇩Urine out put.
- Graft tenderness or pain.
- Rising serum creatinine level
- Rising blood urea nitrogen level.
- Fever.
- Weight gain.

Complication of renal transplantation:-

Renal as: rejection, acute tubular necrosis and technical failure from vascular problems.

Extra renal as: infection and malignancy, gastrointestinal bleeding, and psychologic problems from fears of rejection.

These complication are usually caused by immunosuppressive or corticosteroid therapy.

I- Assessment

* Assessment of renal function by determination of :-

- Blood urea nitrogen (BUN).
- Serum creatinine.
- Glomerular filtratration rate (GFR).

- Fluid intake and output.
- Weight.
- Serum electrolyte.

* Nurse should prepare patient for renal scan or ultrasound to detect complication or prognosis.

* Follow assessment for post-operative patient with nephrectomy surgery.

II- Nursing diagnosis

1. Pain related to transplantation surgery.
2. Knowledge deficit related to management of therapeutic regimen.
3. Altered nutrition: High risk for:

- Less than body requirement related to increased caloric needs after transplantation.

- More than body requirements related to side effects of immunosuppressant agents.

4. Altered protection and risk for infection related to immunosuppressive therapy.
5. High risk for ineffective Individual coping after transplantation related to increased stress / anxiety / fear and lifestyle changes.
6. High risk for; rejection of transplanted kidney related to unpaired immunocompetence.
7. High risk for malignancy / diabetes / hypertension related to Immunosuppression.

III- Goals

- Maintaining hydration.
- Promoting diuresis.
- Avoiding fluid overload
- Preventing infection.
- Assessing for manifestation of rejection.
- Preventing complications as organ dysfunction.

IV- Nursing intervention

Post operative management is similar to that of other urologic surgical patients, with emphasis on the:-

* Initial adequacy of renal function.

* Prevention of the hazardous effects of immunosuppressive therapy.

* Observation for allograft rejection.

Patient and Family Education

Before discharge from the hospital, pertinent information is discussed with the patient and family members. Postoperative education after transplantation can be quite challenging, because many patients are discharged between 1&2 weeks after surgery, whereas other patients reside close to the transplantation center for 2 to 8 weeks before going home.