HEMODIALYSIS

Nursing 246
Adapted from Lewis Chapter 47
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Dialysis

• Begun when patient’s uremia can no longer be adequately managed conservatively

• What is “uremia”??

• What lab test will show “uremia”??

• What about the GFR?
Dialysis

• Certain uremic complications also indicate a need
  – Encephalopathy
  – Pericarditis
  – Fluid Overload States
Dialysis

• very sick patients with sudden loss of kidney function (acute renal failure)
• or stable patients with permanent loss of kidney function (stage 5 chronic kidney disease).
Hemodialysis

Effectiveness and Adaptation

- Cannot fully replace metabolic and hormonal functions of kidneys
- Can ease many of the symptoms
- Can prevent certain complications
March 1960  Patient Clyde Shields, a Boeing Machinist, at the University of Washington Hospital in Seattle.
(He died of a MI after 11 years on dialysis)
His Physician
Belding Scribner
Inventor of the
Scribner-Quinton
Shunt....
THE Scribner-Quinton Teflon Shunt  1960
First Home Hemodialysis Machine
First Home Peritoneal Dialysis Machine
1972! Medicare ESRD Program

• Provided coverage for **all** patients with ESRD

• **Expectation:**
  – 1972: 40,000 patients
  – 2007: 450,000
Life Expectancy for Selected Diseases

USRDS 1993.
This is what dialysis tries to replace

However, not all kidney functions can be replaced with dialysis
In Renal Unit for Nursing 246
Content Outline
Compare / Contrast PD / HD

1. principles involved
2. access
3. location of dialyzing membrane
4. equipment
5. length of time involved
6. indications for use
7. advantages / disadvantages
8. complications
9. general nursing care (HD and PD)
Equipment

Hemodialysis

- Dialysis machine
- Needles / Tubing to access site
- Dialysate

Typical Hemodialysis Machine
Hemodialysis

Dialyzers

- Long plastic cartridge that contains thousands of parallel hollow tubes or fibers
- Fibers are the semipermeable membrane
For Hemodialysis this is the FILTER
Hemodialysis System

Fig. 47-16
Hemodialysis

Procedure

• Two needles placed in fistula or graft
• Needle closer to fistula or red catheter lumen pulls blood from patient and sends to dialyzer
• Blood returned from dialyzer to patient through second needle or blue catheter
Hemodialysis

Procedure

• Dialyzer/blood lines primed with saline solution to eliminate air
• Heparin added to blood as it flows to dialyzer
• Terminated by flushing dialyzer with saline to remove all blood
• Needles removed and firm pressure applied
Hemodialysis

Procedure

• Before treatment nurse should
  – Complete assessment of fluid status, condition of access, temperature, skin condition

• During treatment nurse should
  – Be alert to changes in condition
  – Perform vital signs every 30 to 60 minutes
Length of Time Involved

Hemodialysis

• 3-5 hours TIW
• Daily for 1-2 hours
Hemodialysis
Main Complications

• ESRD means a weakened immune system
  – Sepsis

• Graft Malfunction
  – Clotting / Thrombus
    • Less frequent with Fistula
  – Infected Graft
    • Less frequent with Fistula
  – Rejection of AV Graft
Hemodialysis

Complications

• Loss of blood
• Hepatitis
During Hemodialysis Serious Problems

- Hypotension
- Arrhythmias
  - Especially Atrial Fibrillation
- Air Embolus
- Irregular heart rate
During Hemodialysis Common Complaints

- Muscle Cramps
- Headaches
- Nausea and vomiting
- Feeling “washed out”
When Symptoms Appear Together

“Symptom Complex”
“Symptom Complex” during *Hemodialysis*

- Sudden N/V
- *Abdominal* cramping
- Tachycardia
- Dizziness

- IsProbablyBecause of

__________________________
“Symptom Complex” during *Hemodialysis*

- N/V
- *Muscle* cramping
- Dizziness

- Is Probably Because of ____________________
“Symptom Complex” during Hemodialysis

- N/V
- Restlessness
- HA
- Blurred vision
- Muscle twitching
- Altered LOC

*If occurs, happens usually after first dialysis*

*Is Probably Because of*
Access for Dialysis

Hemodialysis
Hemodialysis

Vascular Access Sites

• Obtaining vascular access is one of most difficult problems

• Types of access include
  • Temporary vascular access
    – External
  • Arteriovenous fistulas and grafts
    – Internal
Access

Hemodialysis

– External Access
  • Permcath or similar
– Internal Access
  • AV Fistula
  • AV Graft
Right Internal Jugular Preferred Site Will be Tunneled If expected to Remain in place For > 3 weeks
PERMCATH

Usually inserted by a radiologist
Into the large central veins of the chest or upper arm
Can provide access *for as long as a year*
Catheter Used for Dialysis

An *internal jugular catheter*, *because it is the easiest on the blood vessels*
PermCath

- Easily identified from other Central Lines as have red and blue ports
- **Red** = Access Lumen
  - What does access lumen mean?
- **Blue** = Return Site
  - What does return site mean?
- Always assume the catheter contains **Heparin**
  - *(usually 5,000 – 10,000 U / ml and 1-2 ml is used)*
Can an IV be run into a PermCath?

• ONLY with an order from the nephrologist
  – Permacath is always heparinized when not in use
  – Withdraw 5 ml and discard before using if for emergency IV Access
  – Any Heparin not aspirated places patient at risk for bleeding post-dialysis

• A minimum IV Requirement
  – Keep Open Rate of 30 ml/hr
  – on an infusion pump
Internal Vascular Access for Hemodialysis

Fig. 47-13
Why a Fistula?

• A Fistula is a connection between two parts of the body that are not normally connected at that point

• AV fistula: an artery and a vein are joined
Why an Artery and a Vein?

- Veins have lower blood flow, weak walls and collapse
- Arteries have high speed blood flow and strong walls
- The vein then becomes larger and stronger
Figure 2 - Brachiocephalic arteriovenous fistula. Note the terminolateral anastomosis of the vein to the artery.
Mature Arteriovenous Fistula

Photo courtesy of J. Rowland
Figure 3 - Patent radiocephalic arteriovenous fistula in a girl weighing 15 kg.
An AV fistula may take six weeks or longer to heal, but it can last for many years. An AV fistula is less likely than other types of access points to form clots or become infected.
What about AVG?

- Arteriovenous Graft
- Synthetic Tube surgically placed to connect the vein and artery
- Location
  - Usually upper or lower arm
  - Or thigh
  - Or could be in chest
- There is risk of rejection
Arteriovenous Graft

Photo courtesy of J. Rowland
An AV graft often heals within two to three weeks.

With proper care, an AV graft may last several years — but it's more likely to form clots and become infected than is an AV fistula.
Nursing Fistula & AV Graft Care

• Routine checks are done during dialysis
  – Fistulogram or doppler studies can be done
• Avoid BP and other IV access in the affected extremity
• Check blood flow
  – Look for signs of infection, temperature or color changes
  – Listen for “bruit” / palpate “thrill”
What are the “Bruit” and “Thrill”

- the physical signs of blood flow through the access
  - i.e., it is not clotted
Care of AV Grafts & Fistulas
Patient Instructions

• Keep the access area clean.
• Don't lift heavy objects or put pressure on the arm with the access point.
• Don't cover the access point with tight clothing or jewelry.
• Check for the thrill at the access site every day
• Don't sleep with the access arm under your head or body.
“Cannulating” a Fistula

• The formal description of the process of inserting needles into a vascular access

Graphic courtesy of Medisystems HemoDYNAMIC Devices™
Vital Signs are checked before and throughout

Mostly time to relax
Watch TV
Read
Pay Bills???????
Question One

A vascular access is:

a) A birth defect that can cause kidney failure

b) An unusual pattern of blood vessels on the skin

c) A passageway to the blood created for hemodialysis

d) A hole in the blood vessel
Question 2

Vascular access is called the *dialysis lifeline* because:

a) You use it to lower yourself into the dialysis chair

b) You use it to get dialysis and have only a few possible sites

c) You get all your food and medications through it

d) You need it to go swimming when you are on dialysis
Question 3

Why is a fistula the best type of access?

a) It can last longest and is least likely to get infected or clotted

b) It looks the best and allows you to wear short sleeves

c) It can be used for dialysis the same day it is created

d) It can be easily moved from one arm to the other
Question 4

The biggest problem with a graft for dialysis is:

a) A graft can fall out if it becomes infected
b) A graft is hard to put dialysis needles into
c) A graft gets bigger and bigger over time
d) A graft is prone to infection and clotting
Question 5

A catheter is the last choice for permanent access, because:

a) It dissolves in water, and is very inconvenient

b) It has poor blood flow, and is easily infected and clotted

c) It must be placed under special conditions that are hard to find

d) It can only be used by specially-trained dialysis staff
Question 6

Which type of dialysis catheter is recommended for kidney patients?

a) A femoral catheter, because it is the most convenient

b) A subclavian catheter, because it is the easiest to use

c) An internal jugular catheter, because it is the easiest on the blood vessels

d) An external jugular catheter, because it is the most comfortable
Question 7

Which of the following are signs of possible access infection?

a) Warmth, redness, tenderness, swelling

b) Sneezing, sniffling, coughing, sore throat

c) Cramps, nausea, vomiting, diarrhea

d) Headaches, blurred vision, shortness of breath
Question 8

You can check your *bruit* each day by monitoring its ________________:

a) Color

b) Smell

c) Sound

d) Feel
Question 9

You can check your *thrill* each day by monitoring its __________________:

a) Color

b) Smell

c) Sound

d) Feel
Question 10

Why should you *never* compress a fistula or graft with a tight watch or bracelet, or by sleeping on your access arm?

a) Because the chaffing can increase the risk of an infection

b) Because the buzzing will damage your jewelry and keep you awake

c) Because your sleep will be disturbed, which can hurt your access

d) Because squeezing the access slows blood flow and makes clots more likely
Fact

• Fistula First initiated in early 2003
• At that time use of AVFs were:
  – 80% of prevalent hemodialysis patients in Europe
  – 30% of prevalent hemodialysis patients in the United States

Benefits of Arteriovenous Fistula (AVF)

• Benefits of Arteriovenous Fistula (AVF)
  – Lowest rate of failures and complications
  – Longevity
  – Lowest costs

Complications
Stenosis

• Most common complication

• Causes:
  – IV, CVC, PICC lines
  – Surgery to create AVF
  – Aneurysms
    • May be caused by the back pressure associated with stenosis
  – Needle-stick injury
Distended, Obstructed Left Shoulder Veins Indicative of Central-vein Stenosis

Photo courtesy of J. Holland
Bleeding

- Bleeding during treatment (oozing around needle or infiltration)
- Bleeding post–needle removal
- Improper pressure with needle withdrawal = vessel damage
Post-Cannulation Bruising and Hematoma

- the surface skin site has sealed but the needle hole in the vessel wall has not
Infiltration = Hematoma

Photo courtesy of D. Brouwer
Aneurysm

Photo courtesy of P. Cade
Thrombosis

- Surgical/technical problems
- Preexisting anatomic lesions
  - eg, old IV injury
- Premature use
- Poor blood flow
- Hypotension
- Hypercoagulation
- Fistula compression
Infection

- AV fistulas have lowest risk of infection of any vascular access type.
“Claw Hand” Contracture From Steal Syndrome

Photo courtesy of J. Holland