Treatment of Cardiac Failure

Cardiotonic Drugs

- **Heart failure (HF)** is the most frequent cause of hospitalization for individuals older than 65 years. HF is a complex clinical syndrome results from the inability of the heart muscle to pump enough blood to supply the whole body.
- **Several drugs are used to treat HF**. Combinations of drugs are commonly used in efforts to improve circulation, alter the compensatory mechanisms, and reverse heart damage.

- **Cardiotonic Drugs**
- Diuretics
- Vasodilators
    - ✶Drugs affecting the renin – angiotensin system
    - ✶Nitrate
- Beta-adrenergic blockers: (used in caution because it can worsen HF)

E.g. Metoprolol, Carvedilol.

- Most of the drugs used to treat HF are also used in other disorders and are discussed in other lectures.

Cardiotonic or Inotropic Drugs (Myocardial Stimulants)

- ✶Cardiac glycosides (Digoxin)
- ✶Phosphodiesterase inhibitors

- Cardiotonic drugs decrease hearts workload and help to relieve congestive HF by the following effects:

– Increase the force and efficiency of myocardial contraction that improves the heart's effectiveness as a pump, improving stroke volume and cardiac output

– Slower heart rate and gives the ventricles more time to fill with blood coming from the atria, which leads to increased stroke volume and cardiac output

– Slower conduction through the AV node

- **Mechanism of action:**
- These drugs exert a cardiotonic or positive inotropic action = increased force of myocardial contraction, by inhibition of Na, K -Adenosine TriphosPhatase – Na, K-ATPase, (an enzyme in cardiac cell membranes that decreases the movement of sodium out of myocardial cells after contraction). As a result, increases the movement of sodium out of myocardial cells, and more calcium enters the cell in exchange for sodium → increase intracellular Ca^{+2}, causing increase myocardial contractility → which leads to improved blood flow to all tissues of the body.

Cardiac glycosides – Digoxin

✶✶Digoxin has a very rapid onset of action and has a very narrow margin of safety (meaning that the therapeutic dose is very close to the toxic dose).

Uses:

1. Congestive HF 2. Dysrhythmias (atrial fibrillation)

Pharmacokinetic

- Digoxin is usually administered by mouth (is available for parenteral and enteral use), rapidly absorbed, widely distributed throughout the body. Primarily excreted unchanged in urine - 85% & remaining is metabolized by liver.
- Digoxin improves symptoms but it does not reduce mortality from HF. With presence of safe and more effective drugs such as ACE inhibitors, cardiac glycosides are now primarily used for more advanced stages of HF.

Adverse effects: usually associated with excessive dose

1. Abnormal cardiac rhythm. Ventricular arrhythmia & heart block.
2. GI effects anorexia, nausea, vomiting, and abdominal pain, diarrhea may occur.
3. Visual effects: blurring, disturbance of color vision especially yellow color (yellow halos around object)
4. Mental effects: confusion, restlessness, drowsiness, dizziness, & depression.

Contraindications/Precautions:

- Hypersensitivity.
- Pregnant (Pregnancy Risk Category C) and lactating patient
- Acute myocardial infarction – increase in force of contraction could cause more muscle damage & infarction.
- Renal insufficiency.
- Electrolyte abnormalities (↑ Ca^{+2}, ↓ $K^{+}$and Mg^{+}) → (increase the side effect of the digoxin)
- Thyrotoxicosis → digitalis arrhythmia.

Nursing consideration:

- Prior to beginning therapy with digoxin evaluate the pt for any history of allergy to drug and for ventricular arrhythmia not causing by HF.
- Monitor ECG for rate & rhythm changes. Assess the vital signs – monitor pulse for any change in quality & rhythms to detect arrhythmia or sign of toxicity (dose of digoxin should be hold & notified the physician, if the pulse is below 60 or over 110 beat/min).
- Assess the pts renal function – drug excreted by the kidney
- Determine the potential nursing diagnoses related to drug therapy and health problems that the drug might cause.
- Planning: patient goals and expected outcomes including specific interventions directed to solving or preventing the problem

Nursing consideration:

- Intervention with continues observation to ensuring therapeutic effects and minimizing adverse effects
- Advise patients to limit salt intake to 2 mg /day, to avoid excessive fluids, loss wt. for obese patients, and establish mild exercise.
- Monitor the patient for adverse effects & educate the patient about these effects – anorexia is the earliest sign of digoxin toxicity in older pt.
- Monitor K^+ level because hypokalemia, usually induced by diuretics, predisposes the pt to serious digoxin toxicity or dysrhythmias. Severe vomiting &diarrhea can increase K^+-loss. Teach pts to recognized early sign of hypokalemia e.g. muscle weakness.

- IV doses administered very slowly over at least 5 min. to avoid cardiac arrhythmia & side effects. Avoid IM inj. that is painful.
- Advise the pt to take his drug at the same time every day to avoid over dose. Do not skip or double dose if missed.
- Monitor input & output. Weight the pt at the same time each day – to monitor for fluid retention (worsening of HF).
- Do not stop taking this drug without consulting your physician.
- Avoid taking the oral drug with food or drugs, which reduce absorption. (for 2 hrs)

✓ Diuretics – may lead to hypokalemia, which increases the risk of developing dysrhythmias

✓ ACE inhibitors and ARBs – increase the risk of hyperkalemia, which can lead to decreased therapeutic effects of digoxin.

✓ Verapamil – increases plasma levels of digoxin

✓ Evaluate the effectiveness of drug therapy by confirming that the patient goals and expected outcomes have been met