Cardiopulmonary Deconditioning Rehabilitation Challenges

Susan Oates, RN. BN. MScN. APN
Rehabilitation
West Park Healthcare Centre

Rehabilitation Nursing Certification Examination
Web Cast Study Session
February 15, 2006

Learning Objectives

1. Identify types of respiratory dysfunction.

2. List obstructive disorders.

3. List non obstructive (restrictive) disorders.
Learning Objectives

4. Discuss rehabilitation strategies appropriate for the client in need of pulmonary rehabilitation.

5. Discuss the effect of co-morbid respiratory disorders may have on the rehabilitation process when another disability occurs.
**Epidemiology**

- One in five Canadians – six million adults and children – has a respiratory problem.
- 3.9% of Canadians aged 35 years or more have probable COPD (Canadian Institute for Health Information, 2001)
- Lung disease is the third leading cause of death among Canadians.
- In 2002, 17,400 Canadians will die from lung cancer, the number one leading cause of cancer death.
- Economic burden enormous!

**Anatomy**

- Upper airway
- Lower airway
- Lungs
- Circulatory system
- Nervous system
Inhalation: An active process where the phrenic nerve stimulates the diaphragm, causing it to contract. Leads to negative pressure in the thoracic cavity, causing the intercostal and abdominal muscles to expand the thoracic cavity. Air is brought into the lungs.

Exhalation: A passive process. The phrenic nerve stops stimulating the diaphragm, causing the diaphragm to expand. The intercostal and abdominal muscles relax, decreasing the size of the thoracic cavity. Carbon dioxide and other wastes are expelled.
Ventilation vs. Respiration

- **Ventilation** involves diaphragm and intercostals moving air in and out of the lungs.
- **Respiration** occurs at the cellular level.

Types of Pulmonary Diseases

- Obstructive
- Non-Obstructive (Restrictive)
- Vascular
- Ventilatory control
# Types of Pulmonary Diseases

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<td>• Parkinson's, Post polio syndrome, Amyotrophic Lateral Sclerosis (ALS), Guillian-Barre, Spinal cord injury, Diaphragm dysfunction.</td>
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## Other Chronic Lung Diseases

1. Chest Wall Diseases
   - Kyphoscoliosis
   - Spondylitis
   - Osteoporosis
   - Pulmonary hypertension
   - Pulmonary embolism
   - ARDS
3. Before and after volume reduction surgery (VRS)
4. Before and after lung transplant
5. Lung cancer
COPD Facts

- Refers to two lung diseases, **chronic bronchitis and emphysema**
- characterized by obstruction to airflow that interferes with normal breathing.
- Both of these conditions frequently co-exist, hence physicians prefer the term COPD.

**Symptoms**
- some mixture of chronic cough,
- increased sputum production,
- dyspnea,
- airflow limitation, and
- impaired gas exchange.
# COPD

**Chronic bronchitis**
- inflammation and eventual scarring of the lining of the bronchial tubes
- less air is able to flow to and from the lungs and excessive, heavy mucus is coughed up.
- The bronchial tubes then make an ideal breeding place for bacterial infections within the airways, which eventually impedes airflow.

**Symptoms:** chronic cough, increased mucus, frequent clearing of the throat and shortness of breath.

**Emphysema**
- destruction of air sacs (alveoli) in the lungs
- Damage is irreversible, walls of the air sacs become thin and fragile and permanent “holes” in the tissues of the lower lungs develop.
- Lungs also lose their elasticity, which is important to keep airways open and the patient experiences great difficulty exhaling.

**Symptoms:** cough, shortness of breath and a limited exercise tolerance.

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# Asthma

**Symptoms**
- Chronic (regular) cough.
- Shortness of breath
- Wheezing
- A feeling of tightness in the chest

**Extreme airway hyperactivity** (frequent exacerbations) or chronic airway obstruction
- Identify triggers (allergens, viral upper airway)
- Peak flow- measures how fast air can be blown out, indicates changes in airflow in the airways
- Self-management plan for exacerbations
  - focus on the reduction of this inflammatory state through environmental control measures
  - and the early use of disease-modifying agents, rather than symptomatic therapy alone.
Types of Asthma

**Intrinsic or Non-allergic**
- Triggered by factors not related to allergies.
- Cold air, dust, strong fumes, exercise, inhaled irritants, emotional upsets, smoke.

**Extrinsic or allergic**
- Characterized by symptoms that are triggered by an allergic reaction
- Pollen (grasses, trees and weeds), animal secretions (cats and horses tend to be to the most allergen causing), molds, house dust mites.
Interventions for Asthma

- Identify and manage precipitating factors
- Encourage smoking cessation
- Encourage early treatment of infections
- Control environment and emotional triggers
- Medications, including emotional triggers
- Medications, including vaccinations
- Use peak flow

Education - Inhalers

Types of inhalers

- Hand-held portable devices, deliver medication directly to the lungs.

Metered-dose inhalers.

- Use a chemical propellant to push the medication out of the inhaler.
- Squeezing the canister or by direct inhalation.

Dry powder inhalers.

- Medication is released by inhaling more rapidly than you would with a traditional metered-dose inhaler.

Medications

- Bronchodilators
- Beta 2 Agonists
- Anticholinergics
- Methylxanthines
- Corticosteroids
- Antibiotics
- Oxygen
- Opioids (Palliative)
The asthma treatment algorithm above illustrates:
- the timeline for the introduction of treatment as severity increases, beginning with environmental control and education at the onset of symptoms;
- followed by the introduction of beta agonist, inhaled steroid and prednisone therapies.

Obstructive Lung disease

Alpha 1 antitrypsin deficiency (a1AT) - 5% of emphysema

- **(AAT) emphysema**, caused by the inherited deficiency of a protein called alpha1-antitrypsin (AAT) or alpha1-protease inhibitor.
- AAT, produced by the liver, is a "lung protector."
- Blood screening and a DNA-based cheek swab are used to diagnose whether a person is a carrier or AAT-deficient.
- Children diagnosed, they may undergo a liver transplant.

**Symptoms**
- SOB, decreased exercise capacity
- mild but constant cough
- Later stages, a struggle for air even when sitting quietly or lying down.
Inherited, Chromosome #7, damages lungs and digestive problems.

One in every 2,500 children born in Canada have CF, 3,400 attend CF clinics (Canadian Cystic Fibrosis Foundation, 2005).

Diagnosed earlier and treated more effectively, people live into their 30s, 40s and beyond.

Affects the cells that produce mucus, sweat, saliva and digestive juices.

Secretions are thick and sticky, and they plug up tubes, ducts and passageways, especially in the lungs and pancreas.

Respiratory infections/failure. Bronchiectasis (bronchial tubes become enlarged and distended forming pockets where infection may gather).

**Interventions for Cystic Fibrosis**

- Rehabilitation is tailored to individual needs and depend upon the stage of the disease and which organs are affected.

- Usually at home:
  - tapping or "clapping" the chest and the back vigorously (percussion) or PEP (positive expiratory pressure) Mask Therapy to help loosen the mucus which clogs the lungs;
  - taking pancreatic enzymes with all meals, to aid digestion;
  - taking nutritional supplements and vitamins to promote good nutrition;
  - taking antibiotics in pill, intravenous (IV), and or inhaled forms, to ease congestion and protect against and fight lung infection;
  - exercise.

60% of patients are diagnosed in the first year of life, and 90% by 10 years of age (Canadian Cystic Fibrosis Foundation, 2005).
Interventions for Cystic Fibrosis

- Psychological, genetic and occupational counseling
- Chest Physio
- Medications, including vaccinations
- O2 therapy

Interstitial Lung Disease Sarcoidosis

- Disease in which abnormal collections of inflammatory cells (granulomas) form in many organs of the body.
- Most often found in the lungs, but granulomas may also form in the lymph nodes, lungs, liver, eyes and skin.
- Rarely, in the spleen, bones, joints, skeletal muscles, kidneys, heart and nervous system.
- Eventually, the granulomas may disappear completely or become scars.

**Symptoms**
- Shortness of breath
- A dry cough that doesn't bring up mucous
- Wheezing
- Pain in the middle of your chest that gets worse when you breathe deeply or cough (rare).
Interstitial Lung Disease

Pulmonary Fibrosis

- tissue between the air sacs of the lungs is called the interstitium and this tissue is affected by fibrosis (scarring).

1. Lung tissue is damaged in some known or unknown way.
2. The walls of the air sacs in the lung become inflamed.
3. Scarring (or fibrosis) begins in the interstitium (or tissue between the air sacs), and the lung becomes stiff.

**Symptoms** - Shortness of breath, particularly with exertion
- Chronic dry, hacking cough.
- Fatigue and weakness.
- Discomfort in the chest.
- Loss of appetite.
- Rapid weight loss.

**Causes** - Occupational and environmental exposures -
- mining, exposure to asbestos or metal dusts.
- agricultural workers, organic substance.
- moldy hay, cause an allergic reaction in the lung (Farmer’s Lung).

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Neuromuscular & Neurological Conditions

- **Parkinson’s**
- **Post-polio syndrome**
- **Amyotrophic Lateral sclerosis**
- **Multiple sclerosis**
- **Guillain-Barre syndrome**
- **Myasthenia gravis**
- **Duchenne’s muscular dystrophy**
- **Spinal cord injuries**

**Conditions**
- Diaphragm dysfunction - muscle weakness.
- Increased oxygen consumption r/t peripheral muscle weakness.
- Retained secretions due to a weak cough.
- Laryngeal dysfunction.
- Aspiration pneumonia.
Chest Wall Diseases

- **Kyphoscoliosis**

- **Spondylitis** of inflammatory arthritis that primarily affect the spine

- **Osteoporosis**
  - 10 million women
  - 18 million at risk
  - Degenerative joint / cartilage

Vascular Lung Disease

**Pulmonary Hypertension**

- High blood pressure in the large and small arteries of the lung damages walls of the arteries in the lungs.
- Walls thicken and are less able to transfer oxygen and carbon dioxide to and from the blood resulting in pulmonary arteries become narrower.
- Damage to the heart occurs, muscles of the right ventricle become thicker and larger - *cor pulmonale* and this leads to heart failure.
- Compensation for the lower oxygen it is getting by producing more red blood cells in the bone marrow, making the blood thicker, stickier and even harder for the heart to pump, increasing the risk of pulmonary embolism.

**Symptoms**

- shortness of breath upon exertion,
- lightheadedness, fatigue and chest pain.
- heart failure, such as swelling (edema) in the legs and progressively worse shortness of breath, develop.

**Primary pulmonary hypertension** muscles that line the walls of the pulmonary arteries go into spasms (contractions).

**Secondary pulmonary hypertension** blood does not receive enough oxygen - COPD, CF or occupational lung diseases.
## Vascular Lung Disease

### Pulmonary Embolism
- An artery in your lung becomes blocked.
- Blockage is caused by one or more blood clots which usually originate in the legs.

**Signs and symptoms include:**
- Sudden S.O.B., active / rest
- Chest pain that often mimics a heart attack, sweating.
- Pain may radiate to your shoulder, arm, neck, or jaw.
- Sharp and stabbing or aching and dull.
- Worse when breathe deeply, cough, eat, bend or stoop, and with exertion.
- Cough, bloody or blood-streaked sputum.
- Lightheadedness or fainting (syncope), Wheezing

### Adult Respiratory Distress Syndrome (ARDS)
- Life-threatening condition in which inflammation of the lungs and accumulation of fluid in the air sacs (alveoli) leads to low blood oxygen levels.
- **Cause:** Major lung inflammation or injury.
  - Pneumonia, septic shock, trauma, aspiration of vomit, or chemical inhalation.

**Signs and symptoms include:**
- Pulmonary edema
- Severe respiratory distress
- Hypoxemia, refractory to O2
- Decreased lung compliance

## Non-Obstructive Lung Disease

### Lung volume reduction surgery (LVRS)
- New treatment for certain patients with moderate to severe emphysema.
- Parts of the lung are removed allowing the remaining lung tissue to work more effectively.
- LVRS is the first treatment to demonstrate actual improvement in lung function, quality of life, exercise tolerance and survival.
Hypoxia / Hypoxemia

Hypoxemia is low oxygen in the blood.
- Measured by a blood test or pulse oximeter.
- Hypoxemia is a sign of an underlying problem. If severe, it can be life-threatening.

Causes -
1. High altitudes
2. Lung diseases, such as chronic obstructive lung disease, pulmonary fibrosis, pulmonary embolism, severe pneumonia and fluid in the lungs (pulmonary edema)

Symptoms -
1. Shortness of breath.

Treatment
1. Depends on the underlying cause.

Non-Obstructive Lung Disease

Lung transplant
Advanced stages of such lung diseases as:
- Emphysema
- Bronchiectasis
- Pulmonary hypertension
- Rejection - foreign to the body, risk that the body’s immune system will attack and reject it. Immunosuppressive (anti-rejection) medication lowers immunity to prevent rejection, but also increases the risk of infection and other diseases.
- Rejection most often occurs the first three months after transplantation.

A team of pulmonologists, surgeons, immunologists, social workers, nurses and technicians evaluate to physical and psychological health to establish who is a good candidate for a lung transplant.
Non-Obstructive Lung Disease

Cancer

Symptoms
- A cough that doesn’t go away and gets worse over time
- Constant chest pain
- Coughing up blood
- Shortness of breath, wheezing, or hoarseness
- Repeated problems with pneumonia or bronchitis
- Swelling of the neck and face
- Loss of appetite or weight loss
- Fatigue

Tuberculosis

- infectious disease caused by bacteria, Mycobacterium tuberculosis.
- most commonly affects the lungs but also can involve most any organ of the body.
- tuberculosi usually can be treated successfully with antibiotics.

Symptoms
- generalized tiredness or weakness
- weight loss,
- fever, and
- night sweats
- coughing,
- chest pain,
- coughing up of sputum (material from the lungs) and/or blood, and
- shortness of breath.

If the infection spreads beyond the lungs, the symptoms will depend upon the organs involved.
Chest X-ray

- A chest x-ray is ordered when a person's symptoms include a persistent cough, coughing up blood, chest pain, a chest injury, or difficulty in breathing. The test is also used when tuberculosis, lung cancer, or other chest or lung disease is suspected.

- A = lung hyperinflated
- B = asthma

Ventilatory Control
Mechanical Ventilator

- A ventilator (also known as a respirator) is used to mechanically assist breathing by delivering air to the lungs.
- Used to optimize a patient's breathing until they recover from their respiratory problem.
- Keep the patient breathing long-term if they can no longer breathe on their own.
- To measure quality of breathing and assess need for ventilation, check the oxygen saturation level.
- Average between 97-98%.
- Arterial oxygen saturation levels below 88% indicate respiratory distress, making MV necessary.
- MV is usually delivered by an endotracheal tube connected to a ventilator.
- Long-term MV caused by spinal cord injuries, neck fractures, or neuromuscular diseases such as polio or ALS (commonly known as Lou Gehrig's disease).
- Damage to involuntary and voluntary muscles, including those used to breathe.
- Spinal cord injuries affecting neck vertebrae C3, C4, or C5, interrupted for life.
- Christopher Reeve, (spinal cord injury), was dependent on mechanical ventilation.
- High quality rehabilitation, including maintenance of ventilation machines in a fully supportive medical environment, extremely important.

Weaning-Ventilator Dependent

Pretraining Optimization:
- Trendelenburg Position - 15°
- Suction - 2-3 cc saline
- Aerosolize - bronchodilators
- Hyperinflate - increase volume by 200 cc, decrease rate by 2 breaths
- Trach. Inner cannula was removed to reduce resistance
- Rest for 10 minutes
- Inspiratory/Expiratory Resistance Training - trach tube cuffs deflated and were removed from the ventilator. A red decannulation cap (Portex REF 519000) was placed on the trach tube, and nose clips were applied
- Rest for 10 minutes
- Inspiratory/expiratory trainer

On-Vent Endurance Training
Synchronized intermittent mandatory ventilation (SIMV) rate of 1-2 ventilator for on-vent endurance training, SIMV of 1 to 2 breaths per minute, positive end-expiratory pressure (PEEP) of 5 cm H2O, and PSV of 5 to 10 cm H2O.

Pressure support ventilation (PSV) to maintain ~400 cc
- Progress to off-vent training when patient maintains a tidal volume (Vt) = 400 ml on continuous positive airway pressure (CPAP) 5 cm H2O and PSV 5 for 2 continuous hours per day for 1 week

Off-Vent Endurance Training
- Gas injection nebulizer (GIN)
- Tracheal gas insufflation (TGI)
- Red cap to trach tube as tolerated
- Tracheal decannulation unless contraindicated
Intermittent, Continuous or Nocturnal Ventilation

Significant atrophy of peripheral skeletal muscles

**Goal:**
- Strength training - free weights, elastic bands
- Nutritional support

Respiratory Acidosis / Hypercapnia

*Respiratory acidosis describes a condition in which the amount of acid in the body is increased, caused by not breathing well or fast enough.*

What is going on in the body?
- The kidneys and lungs work to keep the level of acid in the body at a constant level.

What are the causes and risks of the condition?
- There are many possible causes of respiratory acidosis, including: lung disease, such as severe emphysema, asthma, pneumonia, or chronic bronchitis.
- Blockage of the windpipe, opioid overdose, or brain damage (stroke, ABI), paralysis of the chest muscles, sleep apnea.

**Symptoms of severe acidosis** S.O.B., anxiety, confusion, psychosis, personality change, headache, drowsiness, fatigue, tremors, LOC or death.

**Diagnostic tests**
ABGs, chest x-ray
Cyanosis / Clubbing

Bluish colour (cyanosis) can be observed on the skin and mucous membranes.

Central cyanosis is caused by insufficient oxygen saturation of haemoglobin in pulmonary diseases and congenital heart defects (left-right short cut).

It is commonly found together with clubbed fingers. (Oxygen inhalation reduces cyanosis of pulmonary origin.)

Peripheral cyanosis is caused by prolonged tissue-blood contact caused by insufficient blood circulation. It accompanies heart failure; it can appear in cold.

The tongue is rosy.

Tracheotomy

- prolonged intubation
- subglottic stenosis from trauma
- obstruction from obesity for sleep apnea
- congenital (inherited) abnormality of the larynx or trachea
- severe neck or mouth injuries
- inhalation of corrosive material, smoke or steam
- presence of a large foreign body that occludes the airway
- Paralysis, weak muscles that affect swallowing, mucous expectoration
- causing a danger of aspiration
- long term unconsciousness or coma
Pulmonary Rehabilitation

Chronic lung disease is permanent

Will worsen over time

Persons become embodied in disease process

Pulmonary Rehabilitation (PR)

Individually tailored respiratory program is formulated through:
- accurate diagnosis, therapy, emotional support and education;
- stabilizes and/or reverses both the physio- and psychopathology of pulmonary disease;
- attempts to return the patient to the highest possible functional capacity allowed by his/her pulmonary handicap and overall life situation.

(American Association of Pulmonary and Cardiovascular and Pulmonary Rehabilitation, 1993; American College of Chest Physicians and American Association of Pulmonary and Cardiovascular and Pulmonary Rehabilitation Guidelines Panel, 1997).

4 major components of PR
1. Assessment
2. Education - Prevention
3. exercise training,
4. psychosocial and behavioral intervention, and
5. outcome assessment.
Individualized rehabilitation program meets the specific needs of the patient, not every health discipline will be involved.

An essential component of pulmonary rehab. Is health promotion and disease prevention, which is accomplished when prevention is integrated into every component.

Training or exercise alone does not constitute a pulmonary rehab. program.

Criteria for Admission Pulmonary Rehabilitation

1. *Respiratory* disorder as a primary diagnosis.
2. Needs are complex, thus requiring an inpatient program.
3. Potential to further increase their functional independence through therapeutic intervention.
4. Pre-existing medical conditions must be controlled and not be a major barrier to their active participation.
5. Emotionally and psychologically stable.
6. Willing and motivated to actively participate in all aspects of the program.
7. Abstained from smoking prior to admission.
8. Not be actively abusing any substance, i.e. Alcohol...
9. Disruptive/aggressive behaviour will not be eligible for admission.
10. Patients must be 18 years or older.
Respiratory Rehabilitation Protocol

* Clients who have COPD, Bronchiectasis, Pulmonary Fibrosis, and other lung related diseases.

**The Rehabilitation Program consists of:**
- an individualized exercise program,
- energy conservation training,
- education,
- relaxation and breathing classes,
- leisure counseling,
- recreational programs and
- individual or group psychosocial support.

The average length of attendance is approximately four months with clients attending two to three times per week.

West Park Healthcare Centre (2002)

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Discharge and Follow-up Guidelines

**Discharge:**
- maximum potential is reached in all areas of therapies.
- when the client may benefit from a more intensive therapy program (i.e. referral to the in-patient respiratory program).
- physically impossible for the client to continue with the program.
- discharge is requested by the client.
- client no longer meets the criteria for the Respiratory Rehabilitation Program.

2. When a discharge date is set, an appointment with the West Park Hospital Respiriologist is made at or near the discharge date.

**Follow-up Guidelines:**
1. Graduated Follow Up appointments are booked by the Physiotherapist.

2. An appointment is made with the Respiriologist approximately 3 months following discharge.

West Park Healthcare Centre (2002)
Model: Essential Components of Pulmonary Rehabilitation

Assessment Goals

**Patient Goals – realistic & achievable:**
- include improved respiratory symptom control/"breathe better",
- muscle function, exercise tolerance/ "travel",
- quality of life, and reduced hospitalizations/"return to work”.

**Emotional barriers:**
- anxiety, depression, and fear of dyspnea.

**Rehabilitation Team Goals:**
- Maximize breathing
- Integrate PREVENTION into Tx. Plan
- Individual plan i.e. smoking cessation, nutrition
- Improve Quality of Life,
- Control symptoms and complications
- Increase exercise tolerance, functional skills
- Maintain or improve nutritional status
- Decrease psychological symptoms as anxiety or depression
- Increase compliance with health care goals
- Educate, motivate, increase efficacy, include significant other
- Return to work.
Nursing Assessment

- **Level of Dyspnea – subjective symptom**
  - Present level, using a quantitative scale – visual analogue scale
  - Usual level, using a quantitative scale – visual analogue scale

1. Level of dyspnea – use a quantitative scale
2. Vital signs
3. Pulse oximetry
4. Chest auscultation
5. Chest wall movement and shape
6. Presence of peripheral edema
7. Accessory muscle use
8. Presence of cough and/or sputum
9. Ability to complete a sentence
10. Level of Consciousness / orientation

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**Gift, A. & Narsavage, G. (1998).** Validity of the numeric rating scale as a measure of dyspnea. American Journal of Critical Care, 7(#), 200-204. - RNAO, BPG - Nursing Care in Dyspnea

**Appendix D: Numeric Rating Scale As A Measure of Clinical Dyspnea**

On a scale from 0 to 10

Indicate how much shortness of breath you are having right now.

With 0 = no shortness of breath
And 10 = shortness of breath as bad as can be

Circle the number:

0 1 2 3 4 5 6 7 8 9 10
Nursing Interventions

**Stable Dyspnea**
- Risk factors – smoking, alcohol
- Complicating factors – depression, malnutrition, muscles deconditioning, anemia, co-morbidities
- Review inhaler technique
- Review understanding of medications
- Assess understanding of COPD & disease process
- Assess self-management strategies: exercise, stress management, nutrition, sleeping patterns
- Review early signs of exacerbation
- Breathing and coughing exercises
- ? Referral to Pulmonary rehab.?

**Unstable Dyspnea**
- Ongoing monitoring of vital signs, pulse oximetry, level of consciousness & respiratory
- Administrate meds as prescribed:
  - Bronchodilators
  - Beta 2 Agonists
  - Anticholinergics
  - Methylxanthines
  - Corticosteroids
  - Antibiotics
  - Oxygen
  - Opioids (Palliative)
- Preparation for non-invasive mechanical ventilation for severe acute exacerbations

### Accessory Muscles of Respiration

- Trapezius
- Scalene
- Sternomastoid
Pulmonary Function Tests

Gas diffusion tests
- Gas diffusion tests measure the amount of oxygen and other gases that cross the lungs' air sacs (alveoli) per minute, i.e. Arterial blood gases
-Spirometry

Body plethysmography
- measures the total amount of air your lungs can hold (total lung capacity, or TLC). Sit inside an airtight booth called a plethysmograph and breathe through a mouthpiece while pressure and air flow measurements are collected.

Inhalation challenge tests
- done to identify substances (allergens) that may be causing severe respiratory allergies or asthma. These tests are also called provocation studies.

Laboratory Values

(ABG) test measures the levels of oxygen and carbon dioxide in the blood,
- Partial pressure of oxygen (PaO2) & partial pressure of carbon dioxide (PaCO2).
- pH is a measure of hydrogen ion (H+) in blood which indicates the acid or base (alkaline) nature of blood. A pH of less than 7 is acidic, and a pH greater than 7 is called basic (alkaline). The pH of blood is usually close to 7.4.
- Bicarbonate (HCO3). Buffers are chemical substances that keep the pH of blood within a normal range. Bicarbonate is the most important buffer in the blood.

Normal ABG values
- PaO2: 70-100 mm Hg
- PaCO2: 35-45 mm Hg
- pH: 7.35-7.44
- Bicarbonate (HCO3): 21-28 milliequivalents per liter (mEq/L)
- Oxygen saturation: 95-100%
- Concentration of O2 being breathed, fraction of inhaled FiO2

Abnormal values:
- Lung function.
- Heart and circulation function.
- Kidney function.
- The ability of the body to use food for energy (metabolism).
- The use of some medications.
Case study

- pH - 7.55
- pO2 - 99
- HCO3 - 31

This ABG represents:
- Respiratory acidosis / alkalosis
- Metabolic acidosis

Is the pH normal?
Is the CO2 normal?
Is the HCO3 normal?
Does the CO2 or the HCO3 match the pH?
Does the CO2 or the HCO3 go the opposite direction of the pH?
Is the pO2 and the SaO2 normal?

The correct answer is Metabolic Acidosis:
This ABG represents a fully-compensated metabolic acidosis.
It is a metabolic acidosis, because the HCO3 matches the pH, and the pH is acidotic. There is compensation because the CO2 goes the opposite direction of the pH (it is alkalotic). The compensation is full because the pH gets back into the normal range.

Medications - Bronchodilator

Inhaled or Oral - relief of bronchoconstriction, combination
- Beta2 agonists - 1st line med.
stimulation of B2-adrenergic receptors thus relaxing smooth muscle.
- Short and long acting
  Side-effects - tremor, tachycardia, headache, nervousness, palpitations & insomnia

2. Anticholinergics - Avoid contact with eyes, - use a holding chamber - administer same time each day - capsules sensitive to light
- Acts in 5 - 30 minutes, lasts up to 5 hrs., some, 24-hrs.
  Side-effects - dry mouth, bad taste, tremor, constipation, urinary retention, blurred vision, glaucoma

3. Methylxanthines - oral, take with food or after meals, monitor blood serum
- Relaxes smooth muscles, some anti-inflammatory effect
  Side-effects - nausea, diarrhea, headaches, nervousness, tachy, seizures
**Corticosteroids / Antibiotics**

*Corticosteroids* – not recommended for acute exacerbations only because of side-effects. *Inhaled / oral steroids* – rinse, gargle to minimize side-effects, spacer.

*Side-effects* – Adrenal, immune suppressant, osteoporosis, hyperglycemia, weight gain, cataracts, glaucoma, peptic ulcer, ecchymosis, avascular necrosis of the hip.

- dentures – fit (thrush), rinse before putting back in, good dental hygiene, assess baseline bone density, dietary education, glucose level, skin care – bruising, adhesive bandages, Vit E lotion.

*Antibiotics – Macrolides / Anti-infectives* – Increased sputum volume and purulence – Bacterial infections Streptococcus pneumonia, haemophilus influenza, Pseudomonas aeruginosa, and catarrhalis.

- Prescribed to alleviate and treat cough and increase purulent sputum production
- Inhibits protein synthesis by binding to 50S ribosomal subunits
- with or without food? Sensitivity?

*Opioid Analgesics – use in nebulized form for end-stage* – depress pain impulse transmission at the spinal cord level by interacting with opioids receptors, CNS.

*Vaccination* – given when NOT contraindicated (egg allergy, thimerosal sensitivity)

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**Controlled Oxygen Therapy**

**Benefits for COPD with PaO2 60 mmHg or less**

- cor pulmonale, enhanced cardiac function, increased body weight, improved neuropsychological functions, improved skeletal metabolism, reduced pulmonary hypertension
- Based on ABGs and six minute walk test results

**Goal**

- Maintain O2 sat @ 89-90% and O2 arterial tension PaO2 @ 60 mmHg or greater
- Consider sleep clinic referral

- NOT recommended isolated nocturnal desaturation, but considered for persons with significant co-morbidities as cardiovascular disease and obstructive sleep apnea
- NOT recommended during exercise except if become hypoxemic only during exercise

**Palliative comfort measures, nasal cannula, 4-5 L/min.**
Secretion Clearance

*Chest physiotherapy*

1. Deep breathing
   - 4 - 5 times a day
   - Breathe in through nose, out mouth
   - Blow air out through pursed-lips.

2. Controlled coughing
   - 4 - 5 times a day
   - Breathe in through nose, out mouth
   - Blow air out through pursed-lips.

3. Huffing - if its hard to cough
   - Take a medium breath in
   - Make a sound like ‘ha’ to push air out very fast with your mouth open
   - Do this 3 - 4 times, then cough.

Non-invasive and Invasive Ventilation Modalities

- **Non-invasive positive pressure ventilation (NIPPV)**
  - Respiratory muscle failure & increased airway resistance
  - Alternating levels of airway pressure by keeping airway open and reduces work of exhalation.
    - Bi-level positive airway pressure via nasal oral, oronasal, full and total face mask.

- **Invasive positive pressure ventilation**
  - Cannot tolerate NIPPV or cannot sustain NIPPV effort.
Energy Conservation

**Pacing**
- Balance activities and rest
- Steady work = decreasing efficiency = Periodic breaks
- Rest following meals
- Use slow rhythmic movements

**Planning**
- Time management, Develop a healthy schedule

**Prioritizing**
- Set priorities, eliminate unnecessary tasks

**Posture**
- Correct use of body
- Keep work within easy range, change positions frequently
- Make sure your work is at proper height

**Proficiency**
- Organization essential
- Use equipment best suited to job and which requires the least amount of work

Breathing Techniques

**Control Breathing - 1. Purse-lip, 2. Diaphragmatic, 3. Lateral-costal (Inspiratory muscle training)**
- Pursed lip breathing
  - Slowly through nose for 1 count
  - Purse lips (whistle), breathe out gently through pursed lips for 2 slow counts (let air escape naturally)
  - Keep it up until no longer S.O.B.

**Positions to Reduce Shortness of Breath (S.O.B.)**
- Sit in chair, back against chair, head and shoulder relaxed forward, hand on thighs palms upward
- Sit, pillow on table, arms folded, resting on pillow
- Stand, back against wall, feet slightly apart, head and shoulders relaxed.

**S.O.S. for S.O.B.**
- Stop and rest
- Head and shoulders down
- Breathe in through mouth, blow out fast as necessary
- Start to blow out longer, (pursed lips)
- Slow breathing, start breathing out through nose
- Diaphragmatic breathing
- Stay in position 5 minutes longer.
Outcomes of Pulmonary Rehabilitation

- Reduced hospitalization and use of medical resources
- Improved quality of life
- Reduced respiratory symptoms (e.g., dyspnea)
- Improved psychosocial symptoms (decreased anxiety, depression, improved self-efficacy)
- Increased knowledge (secondary)
- Increased exercise tolerance and performance
- Enhanced ability to perform ADL
- Increased survival
- Return to work

Relaxation Techniques

- **Progressive Muscle Relaxation**
  - Reduce psychological stress and dyspnea
- **Positive Thinking and Visualization**
  - Little evidence to support
- **Music**
  - Proof - music used as distraction method such as during music exercise
- **Yoga**
  - One study, breathing exercises and posture
- **Positioning**
  - Leaning forward, improve overall muscle strength
- **Use of Fresh Air Fan**
  - Cold facial stimulation reduce breathlessness
  - Qualitative studies - with patients reports
Nutrition Strategies

- **Consider impact of:**
  - Dyspnea, dysphasia, dyspepsia, depression, anxiety, physical limitations, social/financial considerations, food allergies, and drug and alcohol consumption.

- **Increased caloric needs**
  - Increased catabolism and muscle proteolysis
  - Use of corticosteroid therapy

- **Protein depletion**
  - May be normal weight, underweight or depletion
  - Screening by a Registered Dietitian - protein supplements

- **Low Body Mass Index (BMI)**
  - Associated with an increased risk of death

- **Corticosteroid therapy**
  - Osteoporosis, important to have calcium and vitamin D in diet.

Disease self-management

- **Develop action plan** - Nurse play an important role!
  - Aware of baseline symptoms and activity level
    - Severity of illness, individual motivation, understanding, self-efficacy
  - Recognition of symptoms that worsen symptoms
    - Consistent education, ongoing, requiring repetition and reinforcement
  - Early symptom recognition of acute exacerbation / infection
    - Education based on behavioural changes that influence self-management and control

- **End of life decision-making / advanced directives**
  - Often not given opportunity to discuss
  - Identify perspectives on quality of end of life care
Exercise Training

- Incorporating exercise into daily routine has been known to improve: dyspnea, energy levels, muscle strength, activity levels, psychological well-being
- Advanced stages have sever muscle wasting as a result of physical de-conditioning
- Bone loss r/t corticosteroid use
- Evidence supports weight bearing exercise to minimize rate of bone loss.

Exercise for 6-minute walk

ANAEROBIC VERSUS AEROBIC CAPABILITIES:

1. For aerobic training to be done, the patient must be able to walk approximately 5 minutes continuously.

2. If the patient cannot perform in this manner, and the therapist has assessed that it is not due to anxiety, incorrect breathing control or hypoxia, then that patient will begin with the Modified Interval Training (M.I.T.) Program.

3. Patients who walk for more than 5 minutes continuously begin with an aerobic endurance program. The usual choice is treadmill, as training is known to be specific for an activity. Cycle ergometer programs are done if the patient already has a cycle for home use.

- Check HR - check to see if patient is on Digoxin, or any other medication (or has a pacemaker) which might mask cardiac response.

- The therapist should assess the patient on the treadmill and make any adjustments to speed or grade prior to starting patient on T/M exercise program.

West Park Healthcare Centre (2002)
Summary - Education

- **Recognize importance if self-report of dyspnea**
- **Patient education**
  - Smoking cessation strategies
  - Pulmonary rehab/exercise training
  - Breathing retraining strategies
  - Energy conservation
  - Relaxation techniques
  - Nutritional strategies
  - Role/rationale for oxygen therapy
  - Role/rationale for medications
  - Inhaler device techniques
  - Disease self-management and action plans
  - End-of-life issues

- *Appropriate referrals to physician and community resources.*

Learning Objectives

- **Identify cardiac problems for which cardiac rehabilitation may be prescribed**
- **Describe the major components of cardiac rehabilitation**
- **Discuss the implications of cardiac events on persons with concurrent disabilities**
Epidemiology

- Cardiovascular disease - 37% of all deaths, ischemic heart disease (IHD) at 21%, of which half are attributable to acute myocardial infarction (AMI)
- Decrease mortality - with beta-blocking agents, aspirin, and thrombolytic therapy, a significant decline coincides with the increased use of thrombolytic therapy.
- Canada ranks 10th in mortality rates from ischemic heart disease, at a rate of 185.9 deaths per 100,000 for men; the mortality rate for women is 123.4 deaths per 100,000 population

Cardiac Rehabilitation

- Medical evaluation
- Education
- Counseling
- Monitored exercise
Outcomes of Cardiac Rehabilitation

- Prevention of sudden death
- Decrease of cardiac morbidity, infarction, & graft closures
- Relief of symptoms: angina, SOB
- Increase in work capacity (exercise tolerance and performance), ADL (elderly)
- Restore self-efficacy, decreased anxiety, depression, improved self-efficacy
- Improved adaptation to stress
- Increased knowledge (secondary prevention) for person & family
- Early discharge & early rehabilitation; fewer re-admissions
- Fewer drugs; reduce healthcare costs

Cardiac Rehabilitation Definition

- Continuum of services directed to persons with cardiac disease and their families, by an interdisciplinary team, with the goal of achieving and maintaining maximum level of independence and functioning.
History Cardiac Rehabilitation

- 1950’s - M.I. Tx=6 weeks in hospital
- 1960’s - M.I.=2 weeks in hospital + exercise rehab starting 4 - 6 months later
- 1970’s - First studies re: exercise benefits and decrease mortality
- 1980’s & 1990’s - Included patients with CHF, arrhythmia, medically complex

2002 - Exercise training and education in secondary prevention, combined with appropriate pharmacological treatment

Role of Cardiac Rehabilitation

- Early mobilization post M.I.
- Psychological counseling, lifestyle modifications, stress management, and exercise program
- Exercise and stress programs may alleviate need for drugs
- Depression may be a major concern post M.I.
- De-conditioning prior to surgery may indicate need for exercise program
- Lifestyle modification with heart failure patients.
**Goals of Cardiac Rehabilitation**

- Prevent sudden death
- Decrease Co-Morbidities and Health Risks
- Increase Functional Capacity, relief of symptoms
- Restore self-confidence, increase adaptation to stress
- Relieve anxiety and depression
- Effect Positive Lifestyle Change
- Improve Well-Being, restore enjoyable sexual activity
- Early discharge, early rehabilitation
- Fewer drugs
- Fewer readmissions
- Return to Work

**Rehabilitation of the Spouse**

- Event can produce severe emotions - guilt, fear, anger, anxiety, & depression
- Increased overprotective spouse
- Increased dependency of patient
- Impaired communication
Phases of Cardiac Rehabilitation

Phase I -
- In hospital post CABG / M./I.
- 1 - 2 weeks

GOALS
- Assess response to activity and medications
- Teach behaviour modification
- Reduce risk factors

Phases of Cardiac Rehabilitation

Phase II:
- Outpatient
- 1 - 2 weeks

GOALS
- Increase activity, endurance
- Continue exercise
- Assess response
- Teach self-monitor
- Relieve anxiety
- Increase knowledge
Phases of Cardiac Rehabilitation

Phase III:
- Maintenance
- Lifelong

GOALS
- Continue to improve endurance
- Continue fitness program
- Reduction of risk factors

Risk Factors Coronary Heart Disease (CAD)

- **Age**
- **Hyperlipidemia, elevated cholesterol**
  - Genetic & diet
- **De-conditioning, sedentary lifestyle, obesity**
  - Strenuous exercise combined with de-conditioning
- **Hypertension**
  - 130/85
- **Family History**
  - Genetics, shared habits
- **Stress**
  - Agrivate angina, trigger M.I., personality traits - hostility, suppressed anger
- **Alcohol & coffee, SMOKING**
- Alcohol in moderation, caffeine - sinus tachy, arrhythmias
- **Sex hormones**
  - Men at a younger age, controversy re: women and menopause
Model: Essential Components of Cardiac Rehabilitation

Prevention

1. **Primary prevention**, by risk factor modification, can reduce disease incidence;

2. **Secondary prevention**, through early identification and management of the disease states, can increase survival;

3. **Tertiary prevention**, through the rehabilitation from established disease, can further reduce disability and suffering and so enhance individual quality of life.
Coronary Heart Disease

**Coronary artery disease (CAD)**
- Coronary arteries supplying blood to the heart become blocked with atherosclerotic plaque.
- Plaque is a buildup of cholesterol, white blood cells, calcium, and other substances in the walls of arteries and this reduces blood flow to the heart muscle, which can cause chest pain (angina).
- A person may have a heart attack if a plaque breaks open, creating a blood clot that completely blocks blood flow through the artery.

Coronary Artery Disease

**Signs and Symptoms**
- Angina or "angina pectoris," - a discomfort, heaviness, pressure, aching, burning, fullness, squeezing or painful feeling. Sometimes, mistaken for indigestion.
- Angina is usually felt in the chest, but may also be felt in the shoulders, arms, neck, throat, jaw or back.
Myocardial Infarction (MI)

- death of some of the muscle cells of the heart as a result of a lack of supply of oxygen and other nutrients.
- caused by closure of the coronary artery that supplies that particular part of the heart muscle with blood.
- This occurs 98% of the time from the process of arteriosclerosis ("hardening of the arteries") in coronary vessels.

Abnormal Heart Rhythms

The heart beats in a steady, even rhythm, about 60 to 100 times each minute.

- An irregular or abnormal heartbeat is called an arrhythmia (also called a dysrhythmia) can involve a change in the rhythm, producing an uneven heartbeat, or a change in the rate, causing a very slow or very fast heartbeat.

A pacemaker is a small, battery-operated electronic device which is inserted under the skin to help the heart beat regularly and at an appropriate rate. Leads send the electrical impulses to the heart to tell it to beat.
**Congestive Heart Failure**

Blood moves through the heart and body at a slower rate, and pressure in the heart increases, resulting in not enough oxygen and nutrients to meet the body's needs. The heart chambers respond by stretching and in time, the heart muscle walls weaken and are unable to pump as strongly.

**Right-sided heart failure** occurs in about 1 out of 20

- Right ventricle loses its pumping function and blood may back up into other areas of the body, producing congestion
- Affects the liver, the gastrointestinal tract, and the limbs.
- In addition, the right ventricle may be unable to pump blood efficiently to the lungs and to the left ventricle.
- Kidneys often respond by causing the body to retain fluid (water) and sodium.

**Left-sided heart failure** the blood rich in oxygen from the lungs is not pumped forward into the body and it does not receive enough oxygen especially when exercising. This results in fatigue.

- In addition, the pressure in the veins of the lung increases, which may cause fluid accumulation in the lung.

This results in shortness of breath and pulmonary edema.

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**Cardiomyopathies**

- Infection (bacterial myocarditis), excessive alcohol use, thyrotoxicosis, Rheumatic heart disease, Genetic factor, amyloidosis.
- Hearts are abnormally enlarged, thickened and/or stiffened leading to heart failure and abnormal heart rhythms.
- **Dilated (Congestive)** All four chambers are dilated, and there is also hypertrophy. The most common cause is chronic alcoholism, though some may be the end-stage of remote viral myocarditis.
- **Hypertrophic** The most common form, idiopathic hypertrophic subaortic stenosis (IHSS) results from asymmetric interventricular septal hypertrophy, resulting in left ventricular outflow obstruction.
- **Restrictive** The myocardium is infiltrated with a material that results in impaired ventricular filling. The most common causes are amyloidosis and hemochromatosis.
This very large heart has a globoid shape because all of the chambers are dilated. This is an example of a cardiomyopathy. Treat underlying cause / transplant.

Pericarditis

- inflammation of the pericardium.
- small amount of fluid between the layers of the pericardium.
- pericardium becomes inflamed, the amount of fluid increases, compressing the heart.

**Symptoms of pericarditis:**

- chest pain that:
  - sharp, piercing pain over the center or left side of the chest that increases if the person takes a deep breath
  - a low-grade fever
  - pain when swallowing
- **Causes** - unknown, but may include: a viral, bacterial or fungal infection, heart attack
- cancer
- secondary symptom of rheumatoid arthritis, lupus (systemic lupus erythematosus), or kidney failure
Aorta Disease and Marfan Syndrome

*Diseases and conditions can cause the aorta to dilate, (widen) or dissect (tear), increasing the risk for future life-threatening events:*

1. Atherosclerosis (hardening of the arteries).
2. Hypertension (high blood pressure).
3. Genetic conditions such as **Marfan Syndrome** (connective tissue disorder, the walls of the major arteries are weakened).
4. Connective tissue disorders (that affect the strength of the blood vessel walls) such as, scleroderma, osteogenesis imperfecta, polycystic kidney disease and Turner’s syndrome.
5. Injury.

Other Vascular Diseases

**Vascular disease** includes any condition that affects your circulatory system.

Table 3: Threshold for Initiation of Treatment and Target Values for Blood Pressure


<table>
<thead>
<tr>
<th>Condition</th>
<th>Initiation of Treatment (SBP/DBP mmHg)</th>
<th>Target (SBP/DBP mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diastolic ± systolic hypertension</td>
<td>&gt;140/90</td>
<td>&lt;140/90</td>
</tr>
<tr>
<td>Isolated systolic hypertension</td>
<td>SBP &gt; 160</td>
<td>&lt;140</td>
</tr>
<tr>
<td>Diabetes</td>
<td>≥130/80</td>
<td>&lt;130/80</td>
</tr>
<tr>
<td>Renal Disease</td>
<td>≥130/80</td>
<td>&lt;130/80</td>
</tr>
<tr>
<td>Proteinuria &gt; 1gm/day</td>
<td>≥125/75</td>
<td>&lt;125/75</td>
</tr>
</tbody>
</table>
Congenital Heart Disease

**Congenital heart disease** is the most frequent form of major birth defects in newborns affecting close to 1% of newborn babies (8 per 1,000).

- malformation of the heart or great blood vessels near the heart.
- environmental or genetic factors impairing fetal development.
- often compensated for before birth by the fetal blood circulation.
- always present at birth.
- often diagnosed within the newborn period.
- can cause the circulation to detour or obstruct its flow.
- can cause cyanosis (blueness) from not enough oxygen in the blood.

- CHD calls for expertise in diagnosis, treatment and genetic counseling.

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**Abnormal passages in the heart or between blood vessels**

**Atrial septal defect (ASD)** is a hole in the wall that separates the upper chambers, atria of the heart, causing blood to leak from one atrium to the other.

**Ventricular septal defect (VSD)** is a hole in the wall that separates the lower chambers, ventricles of the heart, causing blood to leak from one ventricle to the other.

**Atrioventricular septal defect (AVSD)** includes an ASD, VSD, and abnormal development of the atrioventricular valves, tricuspid and mitral. This causes blood to flow abnormally inside the heart, (atrioventricular canal defect).

**Patent ductus arteriosus (PDA)** is a persistent connection between the aorta.

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**Problems with the heart valves**

- Involve any of the valves and include the following types of problems:

  - **Stenosis.** The valve opening is narrow and does not open completely.
  - **Atresia.** The valve does not form, so there is no opening for blood to pass from one chamber to another.
  - **Regurgitation.** The valve does not close completely, so blood can leak back through the valve.
Congenital Heart Disease

Problems with placement or development of blood vessels near the heart

- **Transposition of the great vessels** is a defect in which the location of the aorta and pulmonary artery coming off the heart is switched. Therefore, blood without oxygen is continually pumped to the body, instead of blood with oxygen.

- **Tetralogy of Fallot** is a combination of four defects:
  1. **Pulmonary valve stenosis**, the narrowing of the pulmonary valve.
  2. **VSD** is a hole in the wall that separates the left and right ventricles.
  3. **Overriding aorta** is a defect in which the aorta is positioned between the left and right ventricles, over the VSD.
  4. **Right ventricular hypertrophy** is the thickening of the right ventricle. The thickening is caused by the heart having to work harder because of the other defects.

- **Truncus arteriosus** is a defect of the great vessels. The aorta and pulmonary artery do not form as separate arteries.

- **Coarctation of the aorta** is a narrowing of the aorta. It slows or blocks the flow of blood from the heart to the body.

- **Anomalous pulmonary venous return** is a defect in which one or more of the four pulmonary veins, which normally return oxygen-rich blood from the lungs to the heart, return to the wrong chamber in the heart.

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Congenital Heart Disease

Problems with development of the heart

- **Hypoplastic left heart syndrome** is a combination of defects in which the left side of the heart does not develop properly. Defects usually include mitral atresia, aortic atresia, and a tiny left ventricle.

- **Single ventricle** describes a group of heart defects in which only one ventricle is present instead of two. It can be a single right or a single left ventricle.
Treatment of Congenital Heart Defects

Depends on the type and severity of the defect, age, size, and general health.

**Medicines**
- **Digoxin** is thought to improve heart function and can keep the heartbeat regular.
- **Diuretics** treat the buildup of fluid in the heart and body.
- **ACE inhibitors** decrease the work the heart has to do and may help remodel the heart and blood vessels to work more efficiently.
- **Beta Blockers** slow the heart rate and lower blood pressure to decrease the workload on the heart.
- **Inotropes** strengthen the heart’s pumping ability.
- **Prostaglandin E1** is used to keep the ductus arteriosus open in some defects until corrective surgery can be performed. This improves blood flow and oxygen levels until the defect is corrected. The ductus arteriosus normally closes within a few days after birth.

**Cardiac Catheterization**
- Patent ductus arteriosus can be closed, and narrow valves and blood vessels can be opened up.

**Surgery**
- Close holes with stitches or with a patch, Repair valves
- Widen arteries or openings to valves
- Put the great vessels (aorta and pulmonary artery) in their correct positions

Open-heart surgery can improve a child’s health but not repair:
- band around the pulmonary artery
- connecting an artery from the aorta to the pulmonary artery
- Connecting the veins that bring oxygen-poor blood directly to the pulmonary artery when the right ventricle is not developed (for example, hypoplastic left heart syndrome)

**Heart Transplants**
- Babies born with multiple defects that are too complex to repair may need a heart transplant.
**Angina Pectoris**

- **Nitrates**
  - relaxes the veins and relaxes the coronary arteries, the amount of blood that returns to the heart and eases the heart's workload.
  - relaxing the coronary arteries, it increases the heart's blood supply.

- **Beta Blockers, Calcium antagonists**
  - reduce blood pressure. This reduces the heart's workload and need for oxygen.
  - Drugs called beta-blockers and calcium antagonists are used to slow the heart down.

- **Combination therapy**
  - Aspirin

- **Side-effects**
  - Aspirin may cause upset stomach.
  - Nitrates may cause a flush (redness in the face) and headaches.
  - Beta blockers cause tiredness and sexual problems in some patients. Calcium channel blockers may cause constipation and

**Management of Unstable Angina**

- **Percutaneous Transluminal Coronary Angioplasty**
  - 30% recurrence in 6 months

- **Short-stay-miss lifestyle advice, counseling, and exercise program of cardiac rehabilitation**
Coronary Artery Bypass Surgery

- Purpose is to provide the heart muscle beyond the area of in a coronary artery with an adequate, new blood supply.

- 50-60% successful

Valvar Heart disease

Nature and causes
- Congenital Heart disease
- Rheumatic heart
  - Mitral & aortic stenosis and regurgitation
- Degenerative changes

Surgery

Role of Rehabilitation
- Exercise - de-conditioned
- Congenital - skilled counseling
Heart failure

- Lifestyle modification
- Tailored exercise program

Orthostatic Hypotension

Cardiac causes of sudden-onset postural hypotension include unrecognized MI or cardiac arrhythmia.

- inability to increase cardiac output include severe dilated cardiomyopathy, aortic stenosis, constrictive pericarditis, and advanced heart failure of any cause.
- Baroreceptors in the aortic arch and carotid bodies activate autonomic reflexes that rapidly normalize BP by causing a transient tachycardia.
- When afferent, central, or efferent portions of the autonomic reflex arc are impaired by diseases or drugs, myocardial contractility or vascular responsiveness is depressed, hypovolemia is present, or hormonal responses are faulty.
- Hypovolemia is the most common cause of symptomatic orthostatic hypotension. Hypovolemia is often induced by excessive use of diuretics (eg, loop diuretics such as furosemide, bumetanide, and ethacrynic acid).
- vasodilator therapy with nitrate preparations and Ca blockers or with ACE inhibitors.
- excessive doses of antihypertensive drugs and multiple drug use, are also frequent causes.
**Hypertension**

*Blood pressure* of 140/90 mmHg or above, measured on both arms

- **Essential hypertension**
  - Age. Over time, the number of collagen fibers in artery and arteriole walls increases, making blood vessels stiffer, thus a smaller cross-sectional area in systole, and so a raised mean arterial blood pressure.
  - High salt intake, Sedentary lifestyle, Smoking, Alcohol abuse, High levels of saturated fat in the diet.
  - Obesity- In obese subjects, losing a Kilogram of mass generally reduces blood pressure by 2 mmHg.
  - Stress, low birth weight, diabetes mellitus,

- **Secondary hypertension** - 5% of the cases
  - Cardiac output is raised early in the disease course, with total peripheral resistance normal; over time cardiac output drops to normal levels but TPR is increased.
  1. Inability of the kidneys to excrete sodium.
  2. An overactive renin / angiotension system leads to vasoconstriction and retention of sodium and water.
  3. An overactive sympathetic nervous system, leading to increased stress responses.

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**Holter Heart Monitor**

- Electrical activity of the heart is recorded (similarly to the recording of an electrocardiogram),

  - usually for a 24-hour period while a diary of the patient’s activity is recorded during this period.

- Recording is analyzed, a report of the heart’s activity is tabulated, and irregular heart activity is correlated with activity.
Medications

- Cardiac medications can be used to relieve particular symptoms, or they can actually prevent some types of cardiac problems.
- **Angina attack**, such as nitroglycerin, beta blockers and calcium channel blockers.
- **Lower blood pressure**, such as diuretics or water pills, beta blockers, calcium channel blockers, ACE inhibitors and other blood vessel relaxers.
- **Regulate the heart rhythm** (called antiarrhythmics) such as digoxin, verapamil, quinidine, procainamide, sotalol, amiodarone, propafenone and many others.
- **Prevent the formation of blood clots** (anticoagulants) such as aspirin and warfarin (Coumadin).
- **Strengthen the pumping action of the heart** such as digoxin and the ACE inhibitors (including captopril, enalapril, lisinopril and many others).
- **Lower blood lipids** (cholesterol and triglyceride) to help prevent future heart attacks.

Lifestyle Modifications

1. **Diet** - emphasize fruits & vegetables, and low-fat dairy products
2. **Weight** - BMI greater or equal to 25 & a waist circumference less than 102 cm (men) & 88 cm (women)
3. **Exercise** - moderate intensity dynamic exercise 30-60 minutes, 4 to 7 times a week
4. **Alcohol consumption** - Two standard drinks per day or 14 drinks per week for men, one per day or 9 drinks per week for women
5. **Smoking**
6. **Stress** - I.D. three situations caused stress - What are triggers? - How do you respond when your 'buttons are pushed'? - Set realistic goals-one stressor at a time - Strategies to deal with stress? - Explore ways to slow down, relax and avoid creating more stress.
Benefits of Exercise

- Improved efficiency of oxygen transport system
- Structural and functional changes in working muscles
- Increase in total blood volume and hemoglobin
- Rate pressure product (heart rate x systolic blood pressure) decreased
- Stroke volume increased
- Possible stabilization of atherosclerotic plaque
- Restores self-confidence, improvement in mood, and alleviation of depression
- Reduction in CAD risk factors:
  - Decreased body fat, total cholesterol, HDL-cholesterol/HDL cholesterol
  - Increased insulin sensitivity and glucose tolerance
  - Enhanced fibrinolytic activity
  - Decreased resting and exercise plasma catecholamine levels

Contraindications to Exercise

- Acute pericarditis, myocarditis
- Unstable angina
- Uncontrolled complex ventricular arrhythmias
- Severe aortic stenosis
- Uncontrolled resting hypertension
- Symptomomatic congestive heart failure
- Untreated third degree heart block
- Thrombophlebitis
- Recent pulmonary embolism
- Acute systemic illness or fever
Exercise Rules Minimizing Risk

- Always warm up and warm down (5-minutes)
- Avoid extremes of heat and cold
- Regular exercise, avoid peaks
- Avoid intensive competition
- Adhere to prescribed limits
- Reduce exercise load with angina or anxiety develops
- Report lightheadedness, chest pain, or syncope
- Muscle strengthening

Heart Rate Calculation

- Heart rate for exercise = 60-80% of maximum heart rate
- \(220 - \text{age} = \text{Maximum Heart Rate}\)
- \(220 - 55 = 165\)
- \(165 \times 0.6 = 99\)
- \(165 \times 0.8 = 132\)
Supervised Cardiac Rehabilitation for intermediate or moderate risk factors

**History & Clinical Findings**

- Severity of infarction, enzyme levels, CHF symptoms, physical working capacity, ischemic signs during exercise testing
- History of angina or previous M.I.
- Contraindications to exercise - mainly heart failure.

**Selection for Cardiac Rehabilitation**

**ECG characteristics**

- ECG site of the infarction has prognostic significance - anterior vs inferior
- Persistent ST segment depression
- Combined anterior infarction, ventricular premature beats, signs of left ventricular dysfunction
- Non-Q wave higher risk for re-infarction, higher arte of coronary insufficiency; Q wave infarction - CHF; and non-Q wave

**Conventional Risk factors**

- High serum cholesterol, smoking increase risk for sudden death
- Ejection fraction below 40%, ventricular ectopy of >=10/hour, rales in two upper lobes lungs
- Hx. Of hypertension 3Xs risk
- Low physical activity
- Type A behaviour, high stress
Rehabilitation after Surgery

**Evaluate symptoms, signs**
- Chest pain - ischemic
- Dyspnea -
- Palpitations, extra systoles
- Atrial fibrillation
- Dizziness, faintness
- Loss of memory
- Fatigue - consider depression
- Leg edema
- Pulmonary rales or gallop
- Hypertension
- Leg arteries - claudication
- ECG at rest
- Echocardiography and Doppler
- Exercise stress test

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**Psychological Factors**

1. Early initiation of psychological intervention
2. Inclusion of partner
3. Examination of specific sources of anxiety
4. Structured plan for systemic & early resumption of activity following discharge.
- Educate about chest pain which does not go away after 20 minutes rest
- Educate family about CPR
- Admission anxiety, what is happening & why?
- Fear of high tech equipment
- Pain causes anxiety
- Euphoria brief, anxiety about effect on their lives and then depression
- Denial - not a problem if it does not interfere with compliance
- Home-coming depression, weepy, feel weak
- Increased irritability, partners may blame themselves
- Women may be expected to assume all household chores
- Sexual dysfunction r/t anxiety, drugs,
- Undue illness behaviour - phobia avoidance of activity or effort, hopelessness and dependent attitude.
Stressful Events

1. Can you identify three situations that caused you stress?
2. What triggered them?
3. What happens when your buttons are pushed?
4. Support to set realistic goals – one stressor at a time.
5. Think critically about strategies to reduce stress.
6. What are some ways you can slow down, relax and avoid creating more stress?

Stages of Change

**Transtheoretic Model**
1. Precontemplation - not considering change for 6 months
2. Contemplation - considering change in next 6 months
3. Preparation - planning change in behaviour next 30 days
4. Action - changing behaviour
5. Maintenance - success - at least for 6 months
6. Relapse - resumption of previous behaviour, normal event in making a behavioural change.

**Decisional Balance Model**
Horne and Weinman, 1999
Medication adherence is linked to perception of necessary need of he medication and concerns about the potential adverse effects in which the person balances the perceived risks.

**Self-efficacy Model**

**Self-care Model**

Intentional non-adherence is a significant problem (WHO, 2003, p.142)
Communication / Interaction = Adherence

- Motivational interviewing - direct client toward motivation for change
- Behavioural strategies - simplify medication use

_Therapeutic Relationship_

**Model: Essential Components of Cardiopulmonary Rehabilitation**

- Team assessment
- Evaluation
- Prevention
- Psychosocial support
- Exercise
- Patient/family education
References


References

Contact

Susan Oates, RN, MScN.
Advanced Practice Nurse, Rehabilitation
Professional Practice
West Park Healthcare Centre
82 Buttonwood Ave.
Toronto, ON, M6M 2J5
ph. (416) 243-3600, ext. 4530
fax: (416) 243-0490
email: susan.oates@westpark.org