LaFleur Brooks' Health Unit Coordinating

7th edition

Chapter 16

Other Diagnostic Studies

Lesson 16.1

Neurodiagnostic and Cardiovascular Studies

1. Define the terms in the vocabulary list.
2. Write the meaning of the abbreviations in the abbreviations list.
3. Describe the purpose of electrodiagnostics and describe the indications that would initiate a doctor's order for a patient to undergo an electrodiagnostic procedure.

Lesson 16.1

Neurodiagnostic and Cardiovascular Studies (cont'd)

4. State the difference between a noninvasive procedure and an invasive procedure.
5. Describe the purposes of an electroencephalogram (EEG) and a quantitative electroencephalogram (QEEG).
6. State the category of medication (provide an example) that should be noted on the requisition when ordering an EEG.

Lesson 16.1

Neurodiagnostic and Cardiovascular Studies (cont'd)

7. Identify and describe the purpose of three evoked potentials.
8. Describe the purpose(s) of performing a caloric study, an electromyogram (EMG), and a nerve conduction study (NCS).
9. Explain the general purpose of cardiovascular electrodiagnostic procedures.

Lesson 16.1

Neurodiagnostic and Cardiovascular Studies (cont'd)

10. State the category of medication (provide an example) that should be noted on the requisition when an ECG is ordered.
11. List and describe three noninvasive cardiovascular electrodiagnostic procedures.
12. List and describe one cardiovascular nuclear medicine procedure and two cardiovascular ultrasound procedures.

Electrodiagnostics

- Procedures used to evaluate and diagnose conditions/diseases of:
  - Cardiovascular system
  - Nervous system
  - Muscular system
- Indications include numbness, tingling, weakness, muscle cramping, or pain.
- Performed with use of electrical activity and electronic devices to evaluate disease or injury to a specified area of the body

Noninvasive and Invasive Procedures

- Noninvasive procedures
  - Diagnostic or therapeutic technique that does not require that the skin be broken or a cavity or organ of the body be entered
  - Would not require the patient to sign a consent form
- Invasive procedures
  - Diagnostic or therapeutic technique that does require an incision or entry of a body cavity or organ
  - Require a signed consent form

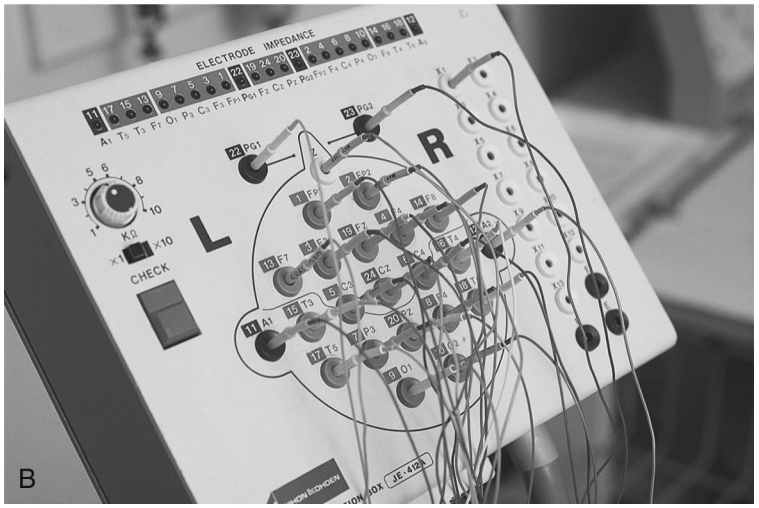
Electroencephalogram (EEG) and Quantitative Electroencephalogram (QEEG)

- EEG
  - Recording of the electrical activity of the brain performed to:
    - Identify and assess patients with seizures
    - Study brain function
  - Results may be used to diagnose brain tumors, epilepsy, other brain diseases, or injuries and to confirm brain death or cerebral silence.
- QEEG
  - Uses digital pattern recognition to identify functional problems
    - E.g., Attention Deficit Hyperactivity Disorder (ADHD)

Medications to Note When Ordering an EEG or QEEG

- Anticonvulsant medications, such as phenobarbital (Luminal) and phenytoin (Dilantin), should be noted when a procedure involving the neurologic system is ordered.

Electroencephalography (EEG)



Evoked Potentials (EPs)

- Group of diagnostic tests
  - Measure changes and responses in brain waves that are evoked from stimulation of a sensory (visual, auditory, or somatosensory) pathway
  - Objective – voluntary patient response is not needed.
  - Performed by a physician in less than 30 minutes

Evoked Potentials (EPs), cont'd

- Visual evoked potential (VEP)
  - Used to diagnose neurologic disease, lesions of the eye, disorders of neurologic development, and eyesight problems or blindness in infants
  - Used during eye surgery to provide a warning of possible damage to the optic nerve
- Brainstem auditory-evoked response (BAER) or auditory brainstem-evoked potential (ABEP)
  - Used in low-birthweight newborns to screen for hearing disorders
  - Also effective in the early detection of brain tumors of the posterior fossa

Caloric Study and Electronystagmography (ENG)

- Caloric Study (Oculovestibular Reflex Study)
  - Used to evaluate function of the vestibular portion of the eighth cranial nerve (CN VIII)
  - Can aid in the differential diagnosis of abnormalities that may occur in the vestibular system, brainstem, or cerebellum
- Electronystagmography (ENG)
  - Used to evaluate patients with vertigo and to differentiate organic from psychogenic vertigo, to identify the site of a lesion if present, and to evaluate unilateral deafness.

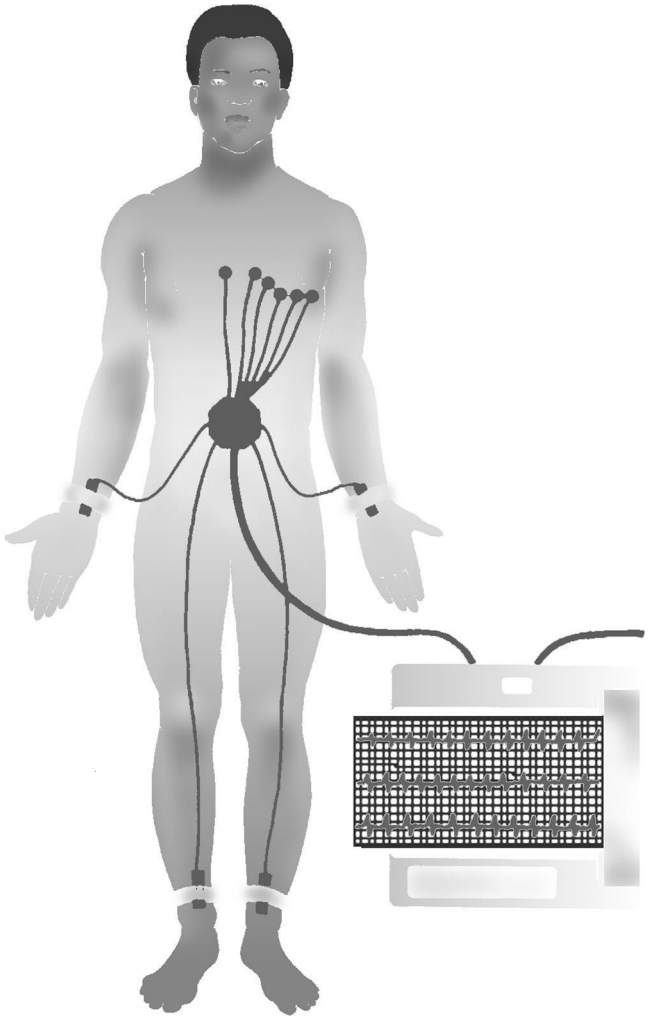
Electroneurography: Nerve Conduction Studies (NCS) and Electromyogram (EMG)

- NCS
  - Used to identify peripheral nerve injury in patients with localized or diffuse weakness
  - To differentiate primary peripheral nerve disease from muscular injury
  - To document the severity of injury in legal cases
  - It is also used to monitor nerve injury and response to treatment.
- EMG
  - Used in the assessment of patients with diffuse or localized muscle weakness
  - To identify primary muscle diseases
  - To differentiate them from primary neurologic pathologic conditions

Electrocardiogram (EKG or ECG)

- Noninvasive procedure that measures the electrical impulses the heart generates during the cardiac cycle
- Some EMR systems may automatically record the EKG into the patient's EMR, or the HUC may scan it into the EMR.
- The HUC should indicate whether the patient has a pacemaker or an automatic implanted cardiac defibrillator (AICD or ICD) when ordering.

Electrode Placement for EKG/ECG



Medications to Note When Ordering an ECG

- Specific cardiac medications, such as digoxin (Lanoxin), diltiazem (Cardizem), and nitroglycerin (Nitro-Bid, Nitro-Dur, Nitrostat, Transderm-Nitro), should also be noted when ordering.

Rhythm Strip

- Shows the waveforms produced by electrical impulses from the heart
- One lead of the EKG is used (usually lead II).
- May also be printed from a continuous EKG when a patient is in a telemetry unit and is wearing a monitor

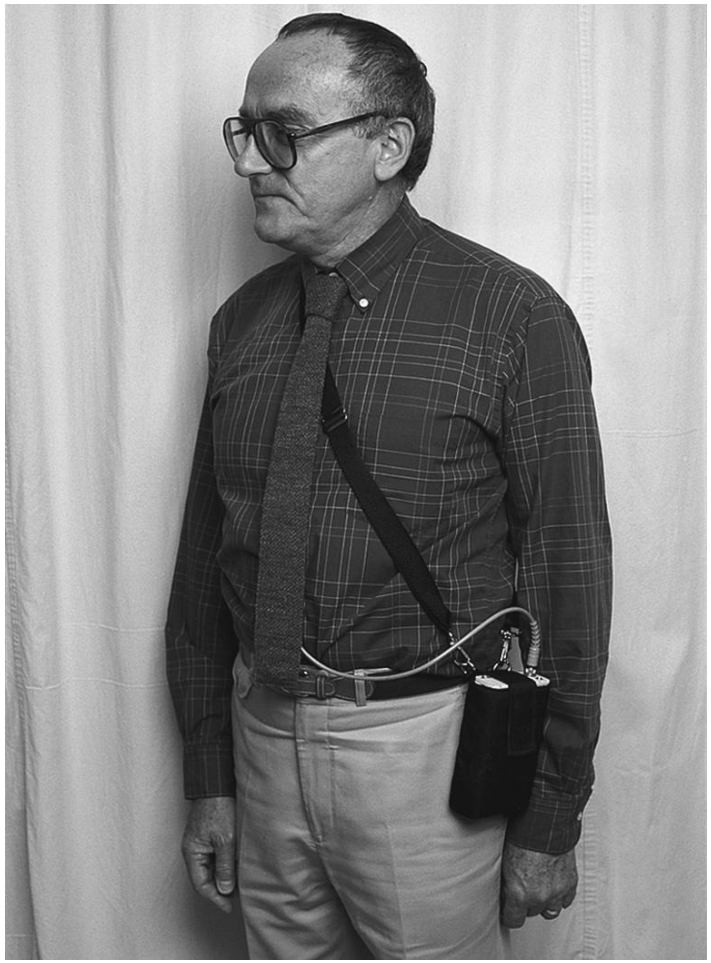
Noninvasive Cardiovascular Electrodiagnostic Procedures

- Impedance cardiography (ICG)
  - A noninvasive monitoring system that measures total impedance to the flow of electricity in the heart
  - Used to assess, plan, and individualize the treatment plan for patients with heart failure, severe trauma, or fluid management

Noninvasive Cardiovascular Electrodiagnostic Procedures, cont'd

- Holter monitor: A portable continuous recording of the electrical activity of the heart for periods up to 72 hours
  - An EKG tape recorder is worn in a sling or holder around the chest or waist.
  - The EKG is recorded on a magnetic tape during unrestricted activity, rest, and sleep.
  - The Holter monitor includes a clock that permits accurate time monitoring on the EKG tape.
  - While wearing the halter monitor, the patient maintains a diary of activities and any symptoms experienced, including the time of occurrence.

Patient Wearing a Holter Monitor



Noninvasive Cardiovascular Electrodiagnostic Procedures, cont'd

- Tilt Table Test (TTT) (upright tilt testing)
- A noninvasive test that uses a “tilt table” to change the position of the patient from lying to standing while measuring the EKG and blood pressure
- TTT is used to assess patients that complain of syncope (fainting).

Noninvasive Cardiovascular Electrodiagnostic Procedures, cont'd

- Exercise electrocardiogram (also called a treadmill stress test)
  - A noninvasive study performed with the use of a treadmill or a stationary bicycle to evaluate cardiac response to physical stress
  - Provides information on myocardial response to increased oxygen requirements and determines the adequacy of coronary blood flow
  - Occluded arteries are unable to meet the heart's increased demand for blood during testing.

Patient Taking an Exercise Stress Test

Cardiovascular/Nuclear Medicine Studies

- Thallium and Sestamibi stress tests
  - Two-step procedures involving both the nuclear medicine and cardiovascular departments
  - The HUC may have to coordinate procedures by communicating with both departments by phone, computer, or downtime requisition.
  - The patient may be required to sign a consent form.

Cardiovascular Ultrasound Studies

- Echocardiography
  - Noninvasive ultrasound procedure
  - Creates a graphic recording of the internal structure of the heart and the position and motion of the cardiac walls and valves
  - Usually includes 2D M-mode echo and a Doppler study
- Intracardiac Echocardiogram (ICE)
  - Invasive procedure
  - Studies the heart in pediatric patients

Lesson 16.2

Other Diagnostic Studies

13. Discuss the purpose of cardiac catheterization and the purpose of inserting a Swan-Ganz catheter and an arterial line (art-line or a-line).
14. Identify and discuss the purposes of at least three vascular plethysmography procedures.
15. Identify at least three vascular ultrasound studies and discuss the purpose of each.
16. List at least six endoscopic procedures and the body parts visualized and discuss the importance of patient preparation before a visual examination of the gastrointestinal system.

Lesson 16.2

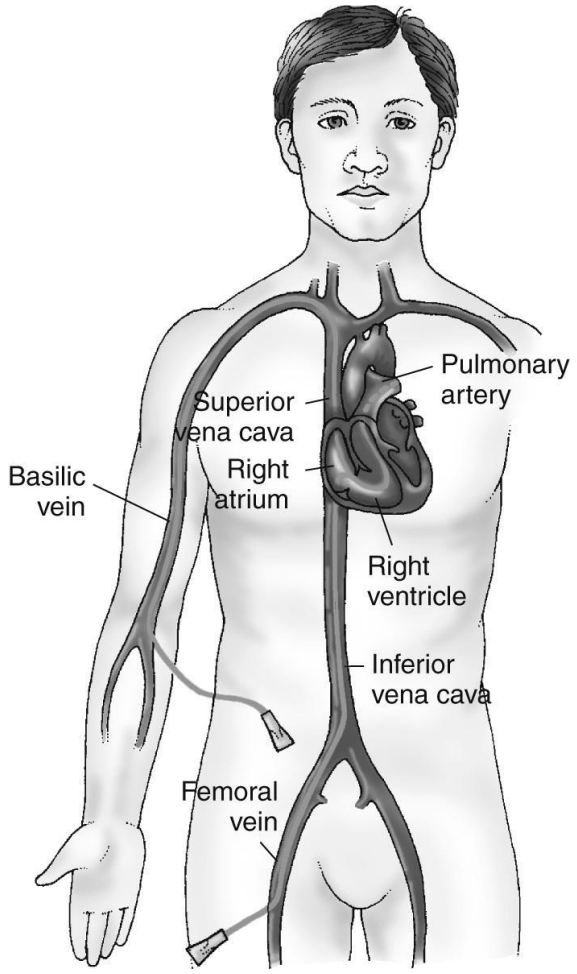
Other Diagnostic Studies (cont'd)

17. Identify three gastrointestinal studies that may be performed in the endoscopy department.
18. Discuss the general function of the cardiopulmonary (respiratory care) department, list at least four cardiopulmonary procedures, and identify the category of medication (provide an example) that would need to be noted when ordering arterial blood gas (ABG) monitoring.
19. Discuss the function of the sleep study department and list a patient's symptoms that would initiate a doctor's order for a sleep study.

Cardiac Catheterization

- Used to visualize the heart chambers, arteries, and great vessels
- Used most often to evaluate chest pain or abnormalities detected in a cardiac stress test
- Used to locate the region of coronary occlusion (blockages) and to determine the effects of valvular heart disease
- A catheter is passed into the heart through a peripheral vein (right-heart cath) or artery (left-heart cath).

Cardiovascular Catheterization



Swan-Ganz Catheter

- A special procedure that is performed by a doctor in a critical care unit
- A balloon-tipped catheter is inserted through the subclavian vein into the right side of the heart that goes through the right ventricle past the pulmonic valve and into a branch of the pulmonary artery.

Arterial Line (Art-Line or A-Line)

- A catheter that is placed in an artery that continuously measures the patient's blood pressure
- Most commonly used in intensive care and anesthesia to monitor the blood pressure in real-time (rather than by intermittent measurement)

Vascular Plethysmography Studies

- Venous plethysmography
  - Noninvasive method of determining venous thrombosis and deep vein thrombophlebitis (DVT)
  - Measures changes in the volume of an extremity
    - Usually performed on a leg to rule out DVT
- Arterial plethysmography
  - Performed to rule out occlusive disease of the lower extremities, it may also be used to identify arteriosclerotic disease in the upper extremity.

Vascular Plethysmography Studies, cont'd

- Impedance plethysmography (IPG)
  - Noninvasive study that is performed to estimate blood flow and quantify blood volumes
  - Electrodes are applied to the lead, and electric resistance charges are recorded.

Doppler Ultrasound

- A procedure used to monitor moving substances or structures
  - Such as flowing blood or a beating heart
- Also used to:
  - Locate vessel obstructions
  - Observe fetal heart sounds
  - Image heart functions

Arterial Doppler Ultrasound

- Designed specifically for testing outer extremities, such as arms and legs
- Used to evaluate the blood flow to and through:
  - The upper extremities (arms)
  - The lower extremities (legs)

Arterial Doppler Ultrasound, cont'd

- Used to evaluate:
  - Numbness and tingling sensations in the hands, arms, feet, and legs
  - Sensation of fatigue and heaviness in the arms and legs
  - The possibility of thoracic outlet syndrome

Vascular Doppler Ultrasound

- Noninvasive
- Provides real-time imaging that displays how patient's blood is flowing through the arteries
  - This makes it easier to detect narrowing of the arteries, blockages, and blood clots.
  - Also helps with monitoring the progression of arterial disease in a patient

Duplex Scanning

- Vascular duplex scanning is called “duplex” because it combines the benefits of Doppler with B-mode scanning.
- A computer provides a two-dimensional image of the vessel, along with an image of blood flow.
- Color Doppler ultrasound can be added to arterial duplex scanning, which assigns color for direction of blood flow within the vessel.

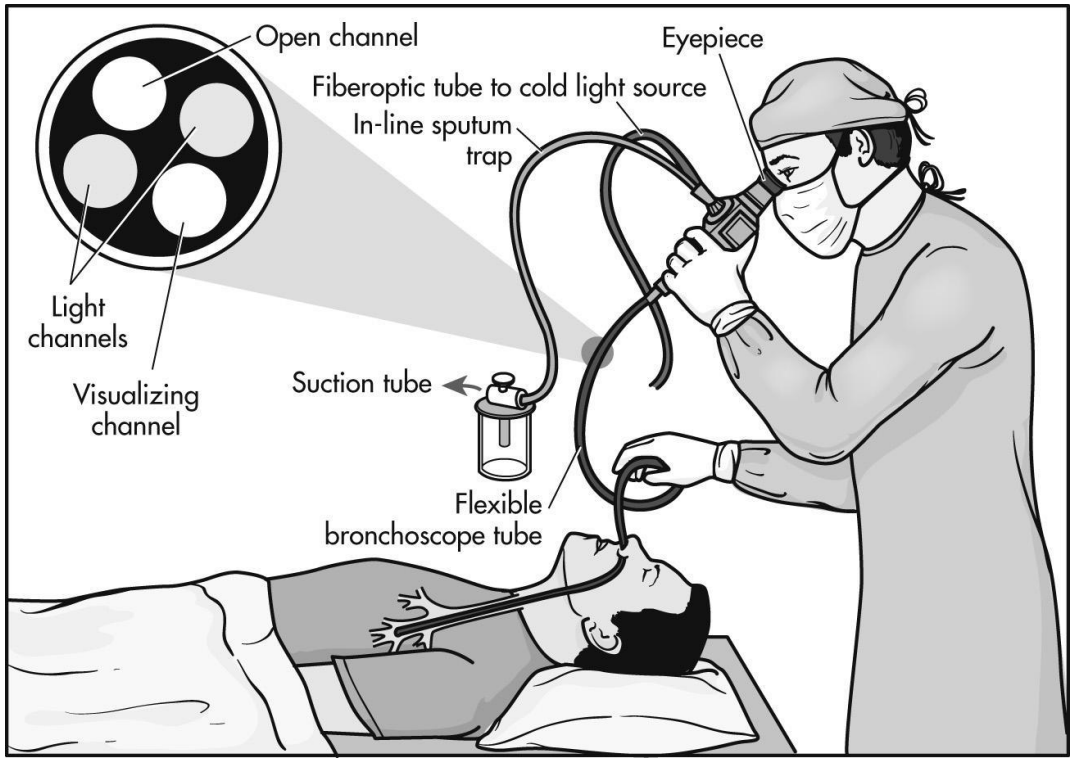
Endoscopy

- An invasive procedure performed to visualize and examine a body cavity or hollow organ
- Usually named for the organ or body area to be visualized and is performed by a doctor
- Many procedures are performed with a video chip in the tip of a camera placed over the viewing lens.
  - The color image is transmitted to a television monitor.

Endoscopy Studies

- Endoscopic examinations that are commonly performed in a hospital setting on an inpatient or outpatient basis:
  - Arthroscopy: visual examination of a joint interior
  - Bronchoscopy: visual inspection of the bronchi
  - Endoscopic retrograde cholangiopancreatography (ERCP): inspection of the bile and pancreatic ducts
  - Esophagogastroduodenoscopy (EGD): visual examination of the esophagus, stomach, and duodenum

Bronchoscopy



Endoscopy Studies, cont'd

- Transesophageal echocardiogram (TEE)
  - Examines cardiac function and structure with the use of an ultrasound transducer placed in the esophagus
    - The transducer provides views of the heart structure and its major blood vessels.

Endoscopy Studies, cont'd

- Capsule Endoscopy or Capsule Enteroscopy, Small Bowel Endoscopy, or the “pill cam”:
  - Noninvasive visual examination of the esophagus and small intestine by means of a camera located in a small capsule swallowed by the patient
- Colonoscopy
  - A visual examination of the large intestine from the anus to the cecum
- Sigmoidoscopy
  - A visual examination of the sigmoid portion of the large intestine

Patient Preparation for Gastrointestinal Endoscopies

- The patient would have to be cleaned out (cathartics or enemas) before gastrointestinal endoscopy is performed.
- The presence of stool would obscure visualization of the intestinal walls.
- Barium studies would have to be performed after GI endoscopy because barium also would obscure visualization of the intestinal walls.

Gastrointestinal (GI) Studies Performed in Endoscopy

- Gastric Analysis: performed to measure the stomach's secretion of hydrochloric acid and pepsin and to evaluate the stomach and check for duodenal ulcers
- Esophageal Manometry: used to identify and document the severity of disease that affects the swallowing function of the esophagus
  - Is used to document and quantify gastroesophageal reflux
  - Includes measurement of the lower esophageal sphincter and a graphic recording of swallowing waves (motility)

Gastrointestinal (GI) Studies Performed in Endoscopy, cont'd

- Secretin Test: evaluates pancreatic function after stimulation with the hormone secretin – measures the volume and bicarbonate concentration of pancreatic secretions
  - Lower than normal volume suggests an obstructing malignancy or cystic fibrosis.

Cardiopulmonary (Respiratory) Department

- Evaluates, treats, and cares for patients with breathing or other cardiopulmonary (pertaining to the heart and lungs) disorders
- May perform presurgical evaluations
- Patients who require respiratory care range from premature infants whose lungs are not fully developed to elderly people whose lungs are diseased.
- The division of the cardiopulmonary department that does testing may be called the Pulmonary Diagnostic Lab.

Diagnostic Tests Commonly Performed by Cardiopulmonary

- Oximetry: noninvasive method used to monitor arterial O2 saturation levels (SaO2) in patients at risk for hypoxemia
  - Ued to monitor oxygenation status during the perioperative period, in patients who have a compromised respiratory status caused by illness or disease, and in those receiving heavy sedation or mechanical ventilation
  - A monitoring probe or sensor is clipped to the finger or ear

Diagnostic Tests Commonly Performed by Cardiopulmonary, cont'd

- Arterial blood gases (ABGs): used to monitor patients on ventilators or critically ill nonventilated patients, to establish preoperative baseline parameters and to regulate electrolyte therapy
  - The blood sample for this diagnostic study is obtained from the patient's artery by the respiratory care therapist (also called a practitioner).
- Blood gases may be ordered for patients on room air (RA), or while they are receiving oxygen.

Ordering ABGs and Sending ABG Specimens

- The HUC must note:
  - If the patient is on room air (RA) or if on oxygen, the flow rate (number of liters per minute)
  - If anticoagulants are being administered to the patient, the names of medications such as enoxaparin [Lovenox], heparin [Hepalean], warfarin [Coumadin])

Diagnostic Tests Commonly Performed by Cardiopulmonary, cont'd

- Arterial Blood Gases with Lytes: a point-of-care (POC) ABG portable analyzer may be used to perform ABG tests as well as electrolytes (sodium, potassium, chloride, and bicarbonate) and hematocrit measurements.
- Capillary Blood Gases (CBGs): blood is obtained from the infant's capillary arterial vessel, usually from the heel, by the respiratory care therapist.
  - performed primarily on infants
- Continuous Arterial Blood Gases with Lytes: Continuous ABG monitor may be used in a pediatric or ICU setting on patients for whom blood volume changes are critical.

Point-of-Care STAT Analyzer

Diagnostic Tests Commonly Performed by Cardiopulmonary, cont'd

- Pulmonary function tests (PFTs): performed to detect abnormalities in respiratory function and to determine the extent of pulmonary abnormality
  - Tests usually include spirometry, measurement of air flow rates, and calculation of lung volumes and capacities.

Sleep Study Department

- Performs studies to assess a patient's sleep patterns
- Ordered for patients who snore excessively, experience narcolepsy, insomnia, or have motor spasms while sleeping, as well as in patients with documented cardiac rhythm disturbances limited to sleep time

Included in Sleep Studies

- Polysomnography: a comprehensive recording of the biophysiological changes that occur during sleep
- Polysomnogram (PSG): monitors many body functions including brain (EEG), eye movements (EOG), muscle activity or skeletal muscle activation (EMG), heart rhythm (ECG), and breathing function or respiratory effort during sleep

Included in Sleep Studies, cont'd

- Inductive plethysmography: measures the patient's respiratory function and can differentiate central apnea from obstructive sleep apnea during a sleep study
  - Air flow, oximetry, and impedance monitors also are applied.
- The patient is allowed to sleep per normal routine and is monitored for respiratory disturbances such as apnea.