HUMAN DISEASES

LIST OF LABORATORY AND DIAGNOSTIC TESTS

BLOOD STUDIES

Chemistry Screen
CHEM 7

- Sodium: 135 – 148 mEq/L
  - Increase:
    - Dietary intake
    - Cushing's syndrome
    - Hyperaldosteronism
    - Sweating
    - Serum loss through burns
    - Osmotic diuresis
  - Decrease:
    - Diet deficiency
    - Addison's disease
    - Vomiting and diarrhea
    - Diuretics
    - Ascites and edema
    - Water intoxication

- Potassium: 3.5 – 5.5 mEq/L
  - Increase:
    - Renal Failure
    - Addison's Disease
    - Aldosterone-sparing diuretics (spironolactone)
    - Crush injury
    - Infection
    - Acidosis
  - Decrease:
    - Diet deficiency
    - Burns
    - GI upset
    - Diuretics
    - Cushing's syndrome
    - Alkalosis
    - Insulin admin.
    - Glucose admin.
    - Cystic fibrosis
    - Ascites and edema
    - Licorice ingestion

Chloride: 96 – 112 mEq/L

- Increase:
  - Dehydration
  - Metabolic acidosis
  - Cushing's syndrome
  - Renal failure
  - Hyperparathyroidism
  - Respiratory alkalosis
  - Eclampsia
- Decrease:
  - Water intoxication
  - Decrease ADH production
  - Vomiting
  - Chronic diarrhea
  - Respiratory acidosis
  - Metabolic alkalosis
  - Addison's disease
  - Diuretics
  - Hypokalemia
  - Burns
  - Aldosteronism

CO2: 21 – 34 mEq/L

- Increase:
  - Vomiting
  - Aldosteronism
  - COPD
  - Metabolic alkalosis
- Decrease:
  - Diarrhea
  - Diuretics
  - Renal failure
  - DKA
  - Starvation
  - Metabolic acidosis
  - Shock
  - Lactic acidosis

Blood Urea Nitrogen (BUN): 6 – 23 mg/dl

- Increase:
  - Hypovolemia
  - Shock
  - Burns
  - Dehydration
  - CHF
  - MI

GI bleeding
Excessive protein intake
Increase protein catabolism
Starvation
Renal disease
Sepsis
Kidney stones
Prostatic obstruction of urethra

Decrease:

Liver failure
Overhydration
Malnutrition, malabsorption

Creatinine: 0.6 – 1.5 mg/dl

Increase:

Renal disease
Rhadomyolysis (damage to skeletal muscle, myoglobin release)
Acromegaly and giantism (increase muscle mass)

Decrease:

Decrease in muscle mass (muscular dystrophy, debilitation)

Glucose: 60 – 120 mg/dl

Increase:

Diabetes
Acute stress
Cushing's syndrome
Pheochromocytoma
Chronic renal failure
Pancreatic tumor of alpha cells (hypersecretion of glucagon)
Acute pancreatitis
Diuretics
Steroids
Acromegaly

Decrease:

Pancreatic tumor of the beta cell (hypersecretion of insulin)
Hypothyroidism
Hypopituitarism
Addison's disease
Liver disease
Insulin overdose
Starvation

Sequential Multiple Analyzer (SMA)

SMA – 6
SMA – 12

C- Reactive Protein: <1.0mg/dl

Increase:

Acute, non-infectious inflammation (arthritis, Crohn's disease)
Vascular disease (lupus, vasculitis)
Myocardial infarction
Transplant tissue rejection
Bacterial infection
Malignancy

Complete Blood Count with Differential

Red blood cell count: 4.2 – 6.1 X 100000.00 /mcl

Increase:

Physiological response to high altitude, COPD and other hypoxic conditions
Hemaglobinopathies (diseases that produce abnormal hemoglobin)

Decrease:

Anemia
Hemaglobinopathies
Cirrhosis
Hemolytic anemia
Hemorrhage
Iron deficiency
Bone marrow failure
Prosthetic heart valves
Renal disease
Pregnancy
Hematologic cancers (multiple myeloma, leukemia, lymphoma)

Hemoglobin: 11 – 18g/dl

Same as for RBCs

Hematocrit: 34 – 54%

Same as for RBCs

RBC indices:

Mean Corpusclular Volume (MVC): 80 – 95 / mm3
Mean Corpuscular Hemoglobin (MCH): 27 – 31pg
Mean Corpuscular Hemoglobin Concentration (MCHC): 32 – 36 g/dl

White blood cell count and differential:

- Total: 5000 -10,000 / mm3
  - Increase:
    - Trauma
    - Infection
    - Leukemia
    - Steroid use
    - Thyroid storm
    - Inflammation
    - Tissue necrosis
  - Decrease:
    - Chemotherapy
    - Bone marrow failure
    - Septic infections
    - Autoimmune disorders
    - Hypersplenism

- Neutrophils: 2500 – 8000
  - Increase:
    - Stress
    - Infection
    - Trauma
    - Cushing's syndrome
    - Inflammation
    - Metabolic conditions (ketoacidosis, gout)
  - Decrease:
    - Overwhelming bacterial infections
    - Viral infections
    - Radiation therapy
    - Chemotherapy
    - Addison's disease

- Lymphocytes: 1000 – 4000
  - Increase:
    - Hepatits
    - Mononucleosis
    - Chronic bacterial infections
    - Leukemia
    - Multiple myeloma
    - Viral infections
  - Decrease:
    - Leukemia
    - Sepsis
    - Immunodeficiency
    - Lupus

HIV
Steroids
Chemotherapy
Radiation therapy

Monocytes: 100 – 700
Increase:
Ulcerative colitis
TB
Parasitic infections
Mononucleosis and other viral infections
Chronic inflammation
Decrease:
Steroids

Eosinophils: 50 – 500
Increase:
Parasitic infections
Allergic reactions
Leukemia
Autoimmune disorders
Decrease:
Steroids

Basophils: 25 – 100
Increase:
Leukemia
Decrease:
Allergic reactions
Stress
Hyperthyroidism

Blood smear: Normal cell count and form
Platelet count: 140,000 – 450,000 / ml
Increase:
Polycythemia
Spleen disorders (hyperspenism)
Lymphoma
Colorectal cancers
Leukemia

Coagulation Studies

Prothrombin time (PT): 10 – 14 seconds
- Increase:
  - Hemophilia
  - Liver disease
  - Vitamin K deficiency
  - DIC
  - Heparin and warfarin administration
- Decrease:
  - Early DIC
  - Extensive cancer (cause not known)

Partial thromboplastin time (PTT): 32 – 45 seconds
- Increase:
  - Same as above
- Decrease:
  - Same as above

Bleeding time: 3 – 7 minutes
- Increase:
  - Bone marrow disorders and tumors
  - Thrombocytopenia
  - Leukemia
  - Hypersplenism
  - Uremia
  - DIC
  - Cushing's disease
  - Hepatic disease

Platelet count: as above

Lipid Profile

Cholesterol: <200 mg/dl
- Increase:
  - Genetic predisposition
  - Diet
- Decrease:
  - Malabsorption
  - Malnutrition
  - Cancers and chronic illness (due to decrease intake of cholesterol

High-density lipoprotein (HDL): <55 mg/dl

- Increase:
  - Genetic predisposition
  - Exercise
- Decrease:
  - Genetics
  - Hepatits, cirrhosis
  - Hypoproteinemia (malnutrition, nephritic syndrome)

Low-density lipoprotein (LDL): 60 – 180 mg/dl

- Increase:
  - Genetics
  - Chronic liver disease and cancer
  - Alcohol consumption
  - Nephritic syndrome (loss of proteins in urine)
  - Cushing's syndrome
  - Hypothyroidism
- Decrease:
  - Genetics
  - Hypoproteinemia
  - Hyperthyroidism

Very-low-density lipoprotein (VLDL): 25 – 50%

Apolipoproteins:

Triglycerides: 35 – 160 mg/dl

- Increase:
  - Genetics
  - Hyperlipidemia
  - Hypothyroidism
  - High carbohydrate diet
  - Unmanaged diabetes
  - Nephritic syndrome
  - Chronic renal failure (high insulin levels cause lipogenesis)
- Decrease:
  - Hyperthyroidism
  - Malabsorption
  - Malnutrition

Liver Function Tests

Bilirubin:

- Total: 0.2 – 1.0 mg/dl
- Direct: 0.1 – 0.3 mg/dl
- Indirect: 0.2 – 0.8 mg/dl
  - Increase:
    - Hemolysis
    - Anemias
    - Large hematomas
    - Sepsis
    - Cirrhosis
    - Hepatits
    - Hyperbilirubinemia in infants

Aspartate Aminotransferase (AST) (SGOT): 0 - .35 U/L

- Increase:
  - Acute MI
  - Post cardiac procedure (cath, angioplasty)
  - Liver disease
  - Muscle trauma
  - Muscular dystrophy
  - Recent convulsions

Alanine transferase (ALT) (SGPT): 40 – 36 IU/L

- Increase:
  - Hepatic disease
  - Cholecystitis
  - Pancreatitis

Gamma-glutamyl transpepidase (GGT): 8 – 38 U/L

- Increase:
  - Hepatic disease
  - Myocardial infarction
  - Alcohol ingestion
  - Pancreatic disease
  - Epstein-Barr virus
  - Mononucleosis
  - Reye's syndrome
  - Cytomegalovirus

5'-nucleotidase: 0.0 – 1.6 U

- Increase:
  - Hepatic biliary obstruction (bile duct obstruction, cholestasis)
  - Hepatic disease

Leucine aminopepidase (LAP): 75 – 200 U/ml
- Increase:
  - Hepatobiliary disease

Alkaline phosphatase (ALP): 30 – 120 U/L
- Increase:
  - Hepatic disease
  - Normal third trimester of pregnancy
  - Normal bone growth in children
  - Bone cancers in adults
  - Hyperparathyroidism
  - Intestinal infarction (necrotic bowel)
  - Myocardial infarction
- Decrease:
  - Low Blood phosphate levels
  - Malnutrition
  - Pernicious anemia
  - Vitamin C deficiency

Renal Function Tests

Blood Urea Nitrogen (BUN): as above
Creatinine: as above
Creatinine clearance: 87 – 139 ml/min
- Increase:
  - Exercise
  - Pregnancy
  - Increase cardiac output
- Decrease:
  - Renal disorders
  - CHF
  - Shock
  - Dehydration
  - Cirrhosis with ascites

Thyroid Panel
Radioactive iodine uptake (RAIU):
Thyroxine (tetraiodothyronine) (T4): 4 – 12mcU/dl
- Increase:
  - Hyperthyroid (Grave's disease, toxic goiter)
- Decrease:
  - Hypothyroid (cretinism, myxedema)
  - Pituitary hyposecretion of thyrotropin

Hypothalamus hyposecretion of Thyrotropin Releasing Hormone
Protein malnutrition (albumin, which carries T4 is reduced)
Iodine deficiency

Free thyroxine index: 0.8 – 2.4 ng/dl
Increase:
Hyperthyroid
Decrease:
Same as for thyroxine

Triiodothyronine (T3): 70 – 205 ng/dl
Increase:
Same as for T4
Decrease:
Same as for T4

T3 uptake test: 24 – 34%
Increase:
Hyperthyroid
Protein malnutrition
Renal failure
Cushing's disease
Cirrhosis
Decrease:
Hypothyroid
Hypopitutiarism
Hypothalamic failure
Hepatitis and cirrhosis

Thyroid Stimulating Hormone (TSH): 2 – 4 mU/L
Increase:
Hypothyroidism
Excessive iodine intake
Radioactive iodine studies
Removal of thyroid
Pituitary or hypothalamic disorders
Chronic illness

Thyrotropin-releasing hormone (TRH)
As above

Arterial Blood Gas Analysis (ABG)

pH: 7.35 – 7.45
Arterial oxygen (PaO2): 80 – 100 torr
Arterial carbon dioxide (PaCO2): 35 – 45 torr
Bicarbonate (HCO3-): 21 – 28 mEq/dl
Saturation (SAT): 95 – 100%
Oxygen content (O2 content): 15 - 22
Base excess (BE): +/- 2

Cardiac Markers

Troponin I: <.03 ng/ml
Troponin T: < 0.2 ng/ml
- Increase:
  - Myocardial injury

Myoglobin: < 90mcg/ml
- Increase:
  - MI
  - Skeletal muscle injury (rhabdomyolisis, trauma)
  - Malignant hyperthermia
  - Muscular dystrophy
  - Seizures

Creatine Phosphokinase (CPK): 30 – 170 U/L
- Increase:
  - Cardiac muscle injury
  - Skeletal muscle injury
  - Brain disorders (tumors, bleeds, stroke, etc…)
  - Adenocarcinoma of lung and breast (cause unknown)
  - Lung injury
  - Shock
  - Crush injury
  - hypokalemia

CEREBROSPINAL FLUID (CSF) TEST (LUMBAR PUNCTURE)

Appearance: clear
Glucose: 40 – 85 mg/dl
Osmolality: 290 – 298 mOsm/L
Pressure: 70 – 180 torr (mmHg)
Protein: 15 – 45 mg/dl
Total (blood) Cell Count: 0 – 5 cells/mcl
White Blood Cell Count: 0 – 6 cell/mcl

URINE STUDIES (URINALYSIS)

Appearance: clear
Color: Straw, amber
Odor: aromatic
pH: 4.6 – 8.0
- Increase:
  - UTI
  - Diet high in citrus and vegetables
- Decrease:
  - Diet high in meats and cranberries
  - Acidosis
  - Starvation
  - Dehydration

Protein: 0 – 8 mg/dl (50 – 80mg/dl for 24-hour urine)
- Increase:
  - Multiple myeloma
  - Cancers of lymph, prostate, colon, breast, lung
  - Renal disease (glomerulonephritis)
  - Pre-eclampsia

Specific Gravity: 1.005 – 1.030
- Increase:
  - Dehydration
- Decrease:
  - Overhydration
  - Renal disease

Leukocyte esterase: negative
- Positive for leukocytes: UTI

Chloride: 110 – 250mEq/day
- Increase:
  - Dehydration
  - Starvation
  - Diuretics
  - Addison's disease
  - Excessive salt intake
- Decrease:
  - Cushing's syndrome
  - Steroid use
  - CHF
  - Excessive sweating
  - Vomiting and diarrhea

Sodium: > 20mEq/L

- Increase:
  - Dehydration
  - Renal failure
  - Diuretics
  - Adrenal cortex disease
  - DKA
- Decrease:
  - CHF
  - Diarrhea
  - Cushing's disease
  - Aldosteronism
  - Inadequate sodium intake

Potassium: 25 – 100mEq/L/day

- Increase:
  - Chronic renal failure
  - Starvation
  - Cushing's syndrome
  - Hyperaldosteronism
  - Licorice (excessive intake)
  - Alkalosis
  - Diuretics
- Decrease:
  - Dehydration
  - Addison's disease
  - Malnutrition
  - Vomiting
  - Diarrhea
  - Acute renal failure

Nitrites: none

- Present: UTI (bacteria take nitrates and convert them to nitrites)

Ketones: none

- Present:
  - Fatty acid catabolism
  - Alcoholism
  - Fasting
  - Starvation
  - High-protein diet
  - Fever in children

Bilirubin: none
Present:
Cholelithiasis
Liver injury
Drug toxicity

Urobilinogen: 0.01 – 1.0 Ehrlich units/ml
Increase:
Hemolysis

Crystals: none
Present:
Gout (uric acid)
Parathyroid disease and malabsorption (calcium and phosphate)

Casts: none
Present:
Proteinuria
Some normal after heavy exercise
Renal disease
Infections, trauma, and tumors of vagina, urinary bladder, ureters, urethra

Glucose: none (50 – 300mg/dl in 24-hour urine)
Increase:
Hyperglycemia
Pregnancy
Increased ICP (probably due to increased MAP)
Nephrotoxic chemicals (mercury, lead, carbon monoxide, drugs)

White Blood Cells: 0-4 under low-power microscope field

WBC casts: none
As above for casts

Red Blood Cells: less than 2
RBC casts: none
As above for casts

FECAL STUDIES
Occult blood
Present:
Hemorrhoids
Polyps
Cancer
Crohn's disease
Ulcerative cholitis

Ovum and Parasite (O&P)
- Hookworm (ascaris)
- Tapeworm (strongloides)
- Giardia (protozoan)
- Cryptosporidium

Fecal Fat

Stool culture and sensitivity
- Salmonella
- Clostridium
- Campylobacter
- Yersinia
- E. coli (pathogenic)
- Staphylococcus
- H. Pylori

ELECTRODIAGNOSTIC STUDIES

Cardiac Stress Test
Electrocardiogram (ECG, EKG)
Electroencephalogram (EEG)
Holter monitoring

ENDOSCOPIC STUDIES

Arthroscopy
Laparoscopy
Bronchoscopy
Cystoscopy
Esophagogastroduodenoscopy (EGD)
Sigmoidoscopy
Colonoscopy

NUCLEAR SCAN STUDIES

Bone
Brain
Lung
Heart
Gall bladder
GI
Thyroid
Kidney
Schilling Test
Positron Emission Tomography (PET)

ULTRASOUND STUDIES

Abdominal
Pelvic
Breast
Carotid artery
Fetal profile
Prostate (transrectal)
Scrotum
Thyroid
Vascular

X-RAY STUDIES

AP – Anterior / Posterior
LATERAL – side view
KUB – Kidneys, Ureters, Bladder
Computerized Tomography (CT Scan)
Barium Swallow
Barium Enema
Small Bowel Series
Intravenous Pyelography (pylegram) (IVP)
Angiography (Angiogram)

MAGNETIC RESONANCE IMAGING (MRI)