PHLEBOTOMY

• PHLEBOTOMY = VENIPUNCTURE •

- greek word phlebos meaning veins + tome meaning incision.

RBC's = Erythrocytes / Erythrocytosis - Erythrocytopenia
- 4.2 - 6.1 trillion per liter
- crescent RBC = sickle cell anemia

WBC's = Leukocytes / Leukocytosis - Leukocytopenia
- 5 - 10 trillion per liter

TOSIS ↕ PENIA

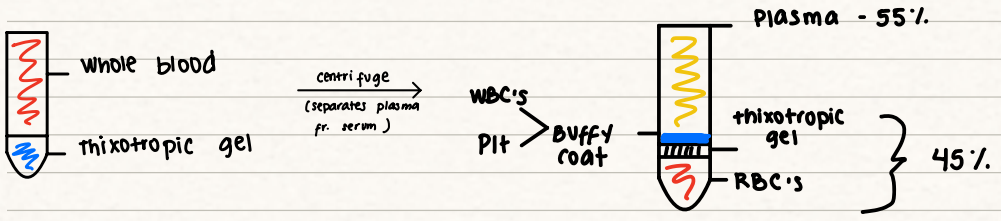
Plt = Thrombocytes / thrombocytosis - thrombocytopenia
- function = coagulation = clot
- 150 - 450 trillion per liter

Hgb = Hemoglobin - part of each RBC, carries iron (12 - 18g / dl)
- Hgb = Hg = Hb -> # of RBC's

Hct = Hematocrit → % of RBC's in blood (37 - 52 %)

• PLASMA •

- The clear, straw, yellowish, un-clotted liquid portion of blood.
- 55% of total volume
- proteins, gasses, electrolytes, sugars, hormones, minerals, vitamins



★ Tubes w/ gel MUST BE Centrifuged
NEVER centrifuge Lavender Tube
NEVER draw blood fr. arteries or legs

ARTERIES

- Thick-walled, oxygenated
- Propel blood, away from ♡
- Aid in maintaining blood pressure
- Branch into arteries

★ Every artery has O^2 blood except pulmonary arteries

VEINS

- Thin-walled, carry oxygen poor (deoxy) blood back to ♡
- carry CO^2, waste back to ♡
- one-way valves
- Branch into venules

★ Every vein has de-O^2 blood except pulmonary veins

CAPILLARIES

- Smallest vessels
- allow gas & waste product exchange
- mixture of arterial + venous blood

ANTECUBITAL FOSSA or space

- most common site for phlebotomy because there are many large + superficial veins

MEDIAN ANTECUBITAL (cubital) - most frequently used, close to surface + easily accessible. Bigger, anchored, bruises less, small risk of injury

CEPHALIC VEIN (thumb side) - 2nd choice for venipunctures, harder to palpate well anchored. Often only palpable vein in obese patients

BASILIC VEIN (pinky side) - 3rd choice, large + palpable, not well anchored, rolls, + bruises easily. Only for emergencies

HEMATOMA - most common complication of phlebotomy procedure (bruising)
1) Failure to apply enough pressure after needle withdrawal
2) needle went through vein

HEMOCONCENTRATION - percentage of formed element higher than plasma
a) an increase in proportion of formed elements to plasma
b) caused by tourniquet being left on too long (more than a minute)

PHLEBITIS - inflammation of vein, result of repeated venipuncture

PETECHIAE - tiny non-raised red spots that appear on the skin due to the very tight application of tourniquet.

• CIRCULATORY SYSTEM •

- transports O^2 to tissues + CO^2 fr. tissues
- 5 - 6 Liters of blood
- RBC's lifespan 120 days

• ACCIDENTAL EXPOSURE TO pt BLOOD •

① Milk finger in downward motion until bleeding stops
② wash w/ warm water + soap
③ Report incident to supervisor

• VASODILATION = vasodilitation
- widening of vessel diameter
- warm

VASOCONSTRICTION
- Narrowing of vessel
- cold

ABNORMAL BLOOD

- Hemolyzed = pink to red (Blood, breakdown)
- Icteric = dark orange - yellow (bilirubin, liver impacted)
- Lipemic = white, cloudy, milky (fat, tryglycerides, cholesterol)

SERUM

- an amber - colored, protein rich liquid that separates out when blood coagulates

Makes up 45% of total blood volume
- Erythrocytes
- Leukocytes } buffy coat
- Thrombocytes

ARTERIAL BL
- Oxygenated
- Bright Red

VENOUS BL
- De-oxygenated
- Amber = Dark Red
  Hazy brown

GASES

- O^2
- CO^2
- PH = Ph → phosphorus
- HCO_3 - bicarbonate

ELECTROLYTES

- Calcium (CA)
- Chloride (Cl)
- Magnesium (Mg)
- Phosphorous (Ph)
- Potassium (K)
- Sodium (NA)

only in plasma

BLOOD VESSELS

- Arteries
- Arterioles
- Capillaries
- Venules
- Veins

Pulmonary Artery - de-oxygenated blood
Pulmonary Veins - oxygenated blood

HEMOSTASIS

- process that stops bleeding
- blood vessels are repaired after injury
- occurs in 4 stages

① VASCULAR
- predominantly a vasoconstriction, vessel reduces blood flow + blood loss

② PLATELET (from putting pressure)
- Characterized by platelet aggregation (release) forming a platelet wall that seals vessel gap + totally stops blood loss

③ FIBRIN FORMATION (complete coagulation) spider mesh thing
- converts temporary platelet plug to a stable fibrin clot by engulfing the platelets w/ a strong protein called fibrin

④ FIBRINOLYSIS (lysis = breakdown of the fibrin)
- Characterized by melting of the thrombus + total repair of blood vessel by the method of fibrinolysis (break down of fibrin)

• VENIPUNCTURE STEPS •

- introduce yourself
- Identify pt first + last name, DOB
- Explain why + what you're doing
- Wash hands, put on gloves, gather supplies
- Tourniquet 3 - 4" above antecubital fossa + palpate for vein (2 fists)
- Release tourniquet clean w/ 70% isopropyl, circular motion out, let dry
- Assemble supplies, (adapter, bandaid, fold gauze)
- Tourniquet + fist, insert needle bevel up + 15 - 30° angle
- Insert tube when blood flow established, open fist
- Release tourniquet w/in 1 min, release tube, needle, (TTN)
- Invert tube a few times
- apply bandaid

SCLEROSED - veins lack resilience, feel cord-like, + roll easily

HEMOLYSIS - breakdown of RBC's which will falsely increase potassium (K) Increased K means arrythmia.

VENOUS REFLUX - blackflow of blood (from an evacuated tube) into patient's vein which can cause an allergic reaction. This occur's if patients arm is not in proper (descending) position + tube

COLLAPSED VEIN - may be due to excessive pull from the vacuum tube. use of a smaller vacuum.

ORDER OF DRAW 5-7 every tube

YELLOW TOP TUBE

(Sterile) | (non-sterile)

- Function: Anticoagulant
- Additive: Sodium polyanetholesulfonate (SPS) | - acid citrate dextrose (ACD)
- Test: Blood culture | - DNA, Paternity testing
- Specimen: Plasma, whole blood
- Department: Microbiology | - Chemistry

RED TOP TUBE (glass)

- no additive, do not mix, no need for tube inversion
- collected blood clots by normal coagulation process in 30-60 mins.

- Tests: Used in Blood Drug Screens or TDM (therapeutic drug monitoring), blood bank, Ab (antibody), Ag (antigen), HCG (human chorionic gonadotropin hormone), HIV
- Specimen: serum (blood)
- Department: Serology tests (serum), Blood bank, immunology tests

LIGHT-BLUE TOP TUBE

- The tube must be filled completely to maintain the ratio of 9 parts blood to 1 part sodium citrate, if not filled / 3-4 times inversion

- Function: anticoagulant = antecoadulation
- Specimen: whole blood, plasma
- Department: coagulation
- Tests: 1) Prothrombin Time (PT) = Pro Time monitors coumadin (Warfarine, blood thinner)
  2) Activated Partial Thromboplastin Time (APTT or PTT) monitors heparin
  3) Fibrinogen Degradation Products (FDP)
  4) Thrombin Time (TT)
  5) Bleeding Time (BT)
  6) International Ratio (INR)

PT
PTT
TT
BT
INR
FDP

INR - provides an information about a person's blood's tendency to clot (which is often described as how "thin or thick" blood is)
- Higher INR, longer it takes for blood clot
- Target INR range is different for different conditions
- Normal INR approximately 1.0
- As INR increases above target range, risk of bleeding increases / more than 1 = thin
- As INR drops below target range, risk of developing clot is increased / less than 1 = thick

COLLECTION TUBES / SST - strum separator tube

- speckled tube top, tiger-top, gray-red, marble, gold, splash guard

Additives: Celite, Silica (glass particle)
Tests: 1) Chol = LDL (low density lipoprotein / bad chol) HDL (high density lipoprotein / good)
2) Trig (Fat + Sugar)
3) NFBG (S) = Non-Fasting Blood Glucose (sugar)
4) Organ profile
5) Electrolytes
6) Drug Quantification
Specimen: Serum
Department: Chemistry

LAVENDER TOP TUBE

Additive: EDTA
Specimen: Whole blood, Plasma
Department: Hematology
Tests: 1) RBC count / Erythrocyte
2) WBC count / Leukocyte
3) Platelet count / Thrombocyte
4) Hemoglobin
5) Hematocrit
6) ESR (Erythrocyte Sedimentation Rate)
7) Sickle cell screening

ROYAL BLUE TOP TUBE

Additive: EDTA
Specimen: Whole blood, Plasma
Department: Toxicology
Tests: 1) Trace elements (Iron, Copper, Zinc, Magnesium)
2) toxicology
3) nutrition determinations

COMMON CAUSES OF HEMOLYSIS

- Use of small gauge needle
- Vigurous inversion
- Tapping
- Fist pumping
- Not allowing alcohol to dry completely

Failure to Obtain Blood:

- Tube has lost it's vacuum: This may be due to a manufacturing defect, expired tube or a crack in the tube.
- The negative pressure in vacutainer diminishes w/ time.

Improper positioned needle:

- bevel is resting against wall of vein, slightly rotate needle
- needle is not fully in vein, slowly advance needle.

EDTA TUBES

- Lavender
- Royal Blue
- Pink
- White
- Tan

PRIOR BLOOD DRAWING

Ask the following Q's: Do you have a history of
1) h/o Fainting = syncope = LOC (loss of conciousness) semi fowler's / supine
2) seizures
3) Mastectomy = breast removal
4) Lymphedema = swollen arm
5) Latex sensitivity = hypersensitivity / BP cuff inflate to 40 mm / Hg
6) Dominant Arm

Areas to AVOID for venipuctures:

1) DO not draw blood from an arm w/ IV attached to it. Fluid will alter test results. Do opposite arm.
- Turn off IV for at least 2 mins before venipuncture
- apply tourniquet below IV site, select vein other than IV site
- perform, draw 5ml + discard before drawing the specimen tubes for testing.

2) DO not draw from artificial a-v fistula site, such as those surgically implanted in Dialysis Patients (arterio-venous connection)

PHLEBOTOMY EQUIPMENT

ANTISEPTIC - 70% isopropyl alcohol, mainly venipuncture

Stronger Antiseptic - Iodine for blood cultures or chlorhexidine gluconate
- while drawing blood to check blood culture or alcohol levels

GAUGE : SIZE : BORE - smaller the gauge # the larger the needle size.
- 21-23g = most common in adults
- 23-25g = most common in pediatrics
- 16-18g = large - collection of units of blood bank for donation

BUTTERFLY - wing infusion set

MULTISAMPLE - straight needle, used in large populated clinics

HYPODERMIC - needle for syringe

SYRINGE - for small, fragile veins, Expensive, thus not used often

TOURNIQUETS - prevent the venous outflow of blood fr. arm causing the veins to bulge thereby making it easier to locate the veins
- increase venous resistance
- most commonly used is latex strip.

CHUX - is an impermeable pad used to protect the patient's clothing + bedding

SPECIMEN LABELS - placed on each tube collected after the venipuncture

NEEDLE DISPOSAL CONTAINER - must be a clearly marked puncture-resistant biohazard disposal container

ORDER OF DRAW

1) Yellow - sterile
2) Light blue
3) Red - no additive
4) SST
5) Green - Heparin
6) Lavender - EDTA
7) Gray

Sally = sterile
Brings = blue
Really = red
Good = gold
Grease & = green
Leaves the = lavender
Gravy = gray

* order does not matter after

- Label tubes immediately after blood draw - in sight of patient

GREEN TOP TUBE

Additives : Lithium heparin , Ammonium heparin, Sodium heparin

Tests : 1) Ammonia (must be kept in the ice)
2) STAT electrolytes
3) ABG (arterial blood gases - keep in ice)

Department : Chemistry

GRAY TOP TUBE

Additives: 1) Sodium Flouride (most common) preserves glucose for up to 3 days
2) potassium oxalate
3) lithium- preserves glucose up to 24 hrs.

Function : All gray tubes contain glucose preservative

Department : Chemistry

Tests : 1) Fasting blood glucose (FBS)
2) Glucose tolerance test (GTT = OGTT)
3) Blood alcohol levels

TAN TOP TUBE

Additive : EDTA

Test : Lead level

Dpt : Special Chemistry

WHITE TOP TUBE

Additive : EDTA
(not v. important)

PINK TOP TUBE

Additive : EDTA

Test : Pregnancy

Specimen : Whole blood

Dpt : Hematology

SKIN PUNCTURE

- method of choice for infants, under 1 yr. old
- Adults - scarred
  - Fragile veins
  - Hardened veins
  - Home glucose monitoring
  - Patients w/ IV

PNEUMATIC TUBE SYSTEMS = efficiently transport carriers at high speeds w/ proven reliability

IATROGENIC ANEMIA = results from blood loss due to repeated venipunctures for the purposes of obtaining specimens for laboratory testing.
- not uncommon
- most often seen in seriously ill hospitalized pt.

PROCEDURE

- Order of draw is critical - Blood smear
  - EDTA
  - Heparin
  - serum
- Apply pressure to puncture site
- Label specimen in sight of patient

SPECIAL SPECIMEN HANDLING

Tests that require a chilled specimen are
1) ABG - arterial blood gasses
2) Ammonia
3) Gastrin
4) Parathyroid Hormone - PTH

Light sensitive specimens - should be protected fr. light by wrapping tubes in aluminum foil immediately after draw.
1) Bilirubin
2) Vitamins A + B6

Reasons for performing Dermal Punctures

1) Bleeding time determinations
2) Blood glucose testing
3) younger than 1
4) Frequent blood tests
5) Elderly pts.
6) IV therapy
7) Obese patients
8) pt. w/ burns, scars over puncture sites
9) Venous thrombosis
10) Complication w/ deep venous puncture

BLOOD SMEAR - must be thin, evenly fading toward mid of slide, "feathered" edge.

1) patient name
2) Identification #
3) Date of draw
4) Time of draw
5) your initials

STEPS prior / during phlebotomy procedure
1) before leaving, check venipuncture site.

Normal bleeding time = 2 - 8 mins
- less than 2 mins = thick blood
- more than 8 mins = thin blood

VOCAB

CMP = comprehensive metabolic profile → SST Tube

HEMATURIA = blood in urine

DERMAL PUNCTURE = skin = capillary

CBC = complete blood count = lavender

- Wipe off first drop to prevent contamination.

BASAL STATE = 8 -12 hours fasting

Bilirubin
Urea
Potassium
Phosphorus
} never use iodine

QNS = quantity not sufficient

Group of tests = profile panel

OB = obstetrics

- Improper skin prep will lead to culture contamination

NEUTROPHILS = engulf bacteria

- Exchange of O^2 + CO^2 occurs w/in capillaries
- Check H/H prior to a blood donation = hemoglobin / hematocrit
- Mislabeling of tubes will lead transfusion reaction
- Pathogens cause Dz

BBP = Blood borne pathogen - hepB / HBV must

Post Prandial = after meal

PKU = Phenyl Ketone Urea / done on newborn heek

Autologous Blood = Donating own blood 72 hrs. prior to procedure

Capillary blood collections / Dermal Puncture

- When venipuncture is impossible, it is possible to perform a majority of lab tests on micro samples obtained by dermal (skin) puncture, w/ exception of ESR, blood cultures.
  Have to be venipuncture (even under 1)
- Deep penetration into the skin can cause serious injury such as **osteomyelitis** = most common complication (inflammation of bone + bone marrow)
- A lancet should be used, which delivers a pre-determined depth that can range from:
  1) .65 - .85 mm premature
  2) 2.00 mm infants
  3) 3.00 mm adults

INFANTS - the heel is used for dermal punctures on infants less than 1 yr.
- areas recommended are medial + lateral areas of planter surface of foot
- these are determined by drawing lines medially extending fr. the mid of great toe to heel + laterally fr. mid of 4th + 5th toes to heel (calcaneus = avoid)
- priek perpendicular to ridges

AVOID area of fingers that are :
1) cold
2) swollen
3) inflamed
4) calloused
5) cyanotic

POCT - POINT OF CARE TESTING

- Medical diagnostic testing
- Performed outside the clinical laboratory in close proximity to where the patient is receiving care. (bedside setting)
- Performed by non-laboratory personnel Ex. Glucose check / Urine analysis