

DIAGNOSTIC PROCEDURES

samples, specimens

APPLYING MEDICATIONS

routes, complications

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PURPOSES of diagnostic and lab tests

- basic screening as a part of a wellness check (community)
- to confirm a diagnosis
- to monitor a course of illness
- to provide valuable information about the patient's response to treatment



PHASES OF TESTING

I. PREANALYTIC PHASE (hospital wards / primary care providers' offices)

A) PRETEST – *major focus is preparation of the patient (teaching)*

- primary role of the nurse – to teach the patient/family:
 - how to prepare for the test ?
 - what care may be necessary following the test ?
- knowledge of the most common diagnostic or lab testing
- thorough assessment and data collection (e.g. bio-psycho-sociologic, cultural and spiritual data) to help to determine communication and teaching strategies

Special considerations




- radiologic studies – possibility of pregnancy in female patients
- blood samples (phlebotomy/venipuncture) – record of medications (anticoagulant therapy prolonging bleeding), low platelet count, bleeding disorders (history of haemophilia), post-mastectomy arm, post-stroke arm, arm with A-V-fistula (haemodialysis shunt)

B) INTRATEST

- specimen collection (including correct labelling, storage, transportation of the specimen)
 - performing or assisting with certain diagnostic testing (standard precautions, sterile technique)
 - emotional and physical support to the patient
 - monitoring the patient as needed

C) POSTTEST

- activities and observations (immediate or follow-up), nursing care of the patient after the procedure



II. ANALYTIC PHASE – analysis of the specimen collected (in a lab) → results

III. POSTANALYTIC PHASE – interpretation of results (in labs, wards)

Infection precautions



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CONDITIONS causing RISKS in giving injections or collecting blood samples

Patients or clients	Health workers who give injections or collect blood	Community or other health workers
Unnecessary injections	Unnecessary injections	Increased waste from unnecessary injections
Reuse of injection equipment	Two-handed recapping of needles	Unsafe disposal of sharps waste:
Non-sterile or reprocessed syringes and needles	Manipulation of used sharps	<ul style="list-style-type: none">• outside safety boxes
Poor hand hygiene	Lack of sharps box within arm's reach	<ul style="list-style-type: none">• mixed with hospital linen
Cross-contamination through:	Poor positioning of patient	<ul style="list-style-type: none">• in nonsecure disposal sites
<ul style="list-style-type: none">• poor hand hygiene• medication vials	Poor phlebotomy technique	Lack of protective clothing (boots, gloves, etc.) for waste handlers
Improper injection technique or site	Two-handed transfer of blood	Reuse of needles or syringes
Sharps in hospital linen or other unexpected places	Unsafe transport of blood	
	Poor hand hygiene	
	Nonsegregated sharps waste	



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HOW to REDUCE exposure and prevent infection transmission?



- hand hygiene → WHAT KIND? WHEN? TIME OF EXPOSURE?
- barrier protection (disposable gloves → ALWAYS?; other PPE → EXAMPLES?)
- minimal manipulation of sharp instruments (including injection equipment) → EXAMPLES?
- appropriate segregation and disposal of wastes, particularly sharps waste → HOW?
(sharps are items having corners, edges or projections capable of cutting or piercing the skin)



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STANDARD precautions – MANDATORY safety practices



Every direct contact with body fluids is potentially infectious.



Prevent cross contamination – BARRIER TECHNIQUE:

- alcohol hand rub BEFORE and AFTER procedure
- disposable gloves (ALWAYS in taking specimen)
- skin preparation and disinfection (in blood sample collection / injections) – alcohol antiseptic solution / allow air dry 30 sec.

Safety regulation for WASTE HANDLING:

- waste disposal per guidelines
- sharp resistant container to be used for disposal of lancets, needles, scalpel blades (sharp needles and lancets should not be handled by hand or bent, or broken)
- other contaminated waste should be disposed in biohazard marked containers

Practical guidance on GLOVES

Key elements

Glove use



Indications

Wear non-sterile, well-fitting, single-use gloves:

- when there is a likelihood of coming into direct contact with a patient's blood or other potentially infectious materials (e.g. body fluids, moist body substances and saliva [in dental procedures]), mucous membranes and nonintact skin
- when performing venepuncture or venous access injections, because of the potential for blood exposure at the puncture site
- if the health worker's skin is NOT intact (e.g. through eczema, or cracked or dry skin)
- if the patient's skin is NOT intact (e.g. through eczema, burns or skin infections).

Precautions

When undertaking injections, **DO NOT** use gloves:

- for routine intradermal, subcutaneous and intramuscular injections
- if the health worker's skin is intact
- if the patient's skin is intact.

Gloves **DO NOT** provide protection against needle-stick or other puncture wounds caused by sharp objects. Needles, scalpels and other sharps should be handled with extreme caution.

Infection prevention and control practices – SUMMARY



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Do

DO carry out hand hygiene (use soap and water or alcohol rub), and wash carefully, including wrists and spaces between the fingers, for at least 30 seconds (follow WHO's 'My 5 moments for hand hygiene'^a)

DO use one pair of non-sterile gloves per procedure or patient

DO use a single-use device for blood sampling and drawing

Do disinfect the skin at the venepuncture site

DO discard the used device (a needle and syringe is a single unit) immediately into a robust sharps container

Where recapping of a needle is unavoidable, DO use the one-hand scoop technique (see Annex B)

DO seal the sharps container with a tamper-proof lid

DO place laboratory sample tubes in a sturdy rack before injecting into the rubber stopper

DO immediately report any incident or accident linked to a needle or sharp injury, and seek assistance; start PEP as soon as possible, following protocols

Do not

DO NOT forget to clean your hands

DO NOT use the same pair of gloves for more than one patient

DO NOT wash gloves for reuse

DO NOT use a syringe, needle or lancet for more than one patient

DO NOT touch the puncture site after disinfecting it

DO NOT leave an unprotected needle lying outside the sharps container

DO NOT recap a needle using both hands

DO NOT overfill or decant a sharps container

DO NOT inject into a laboratory tube while holding it with the other hand

DO NOT delay PEP after exposure to potentially contaminated material; beyond 72 hours, PEP is NOT effective

Blood tests

- most commonly used diagnostic procedures
- valuable information about the haematologic system (haemopoetic) and many other body systems



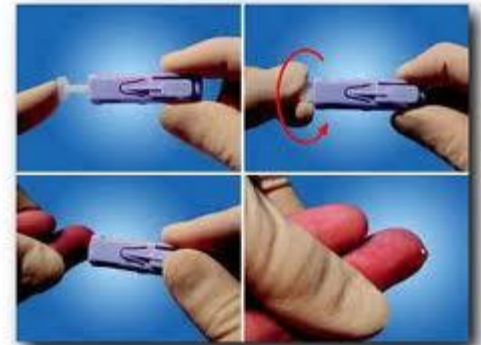
Specimens of **venous blood** are taken for:

- **blood chemistry** – *renal function tests* (BUN, creatinine, proteins), *liver function tests* (albumin, Bi, enzymes – ALT, AST, GMT), *cardiac markers* (LDH, CK, MB fraction of CK, troponins, myoglobin), *lipoprotein profile* (cholesterol, HDL, LDL, triglycerides), *blood chemistry of diabetics* (blood glucose, glycosylated haemoglobin A_{1C} (HbA_{1C}))
- *serum electrolytes* – screening test for electrolytes and acid-base imbalances (Na sodium, K potassium, Cl chloride, Ca calcium total / ionized, Mg magnesium, phosphate, serum osmolality – solute concentration of the blood)
- **haemostasis (coagulation testing)**
- **complete blood count (CBC)**

- **drug monitoring**
- **microbiological testing (blood culture for haemoculture)...**

Specimens of **arterial blood** are taken for:

- *arterial blood gases testing*



Specimens of **capillary blood** are taken for:

- *capillary blood glucose / glucose profile*
- *capillary acid-base balance (acid-base reaction, ABR)*
- *screening for congenital metabolic conditions in newborns (phenylketonuria, congenital hypothyreosis, congenital adrenal hyperplasia, cystic fibrosis)*
- *Ca ionized*
- *CBC, blood biochemistry in infants*





Complete blood count (CBC)

- haemoglobin (hgb) – total amount of haemoglobin in the blood
- haematocrit (hct) – the percentage of RBCs in the total blood volume/plasma (in %)
 - both vary – males having higher levels than females
- erythrocyte count (RBC) – the number of RBCs per cubic mm
- leukocyte count (WBC) – the number of WBCs per cubic mm
- platelet count
- RBC indices – size, weight and haemoglobin concentration of RBCs
- differential count – the proportion of each of the five types of WBCs in a sample of 100 WBCs (neutrophils, lymphocytes, monocytes, eosinophils, basophils)

H & H + RBC count

- ↑ haemoglobin and haematocrit with dehydration (blood becomes more concentrated), burns, COPD
- ↓ haemoglobin and haematocrit with hypervolemia (resulting haemodilution), haemorrhage, pregnancy
- ↓ RBC counts – anaemia
- RBC counts ↑ than normal counts – polycythaemia

WBC + differential count

- determines the number of circulating WBCs/cubic millilitre of whole blood
- ↑ WBC counts – in the presence of a bacterial infection, trauma;
- ↓ WBC counts – a viral infection is present, drug toxicity, autoimmune diseases, bone marrow failure
- differential white cell count (neutrophils, eosinophils, basophils, monocytes, lymphocytes)

Platelet count

- ↑ platelet counts – malignant tumours, polycythaemia vera
- ↓ platelet counts – idiopathic, thrombocytopenic purpura, viral infections, AIDS, chemotherapy drugs, some anaemias

Collecting blood specimens by venipuncture



- **venipuncture** – method to collect venous blood specimen
- nurse/phlebotomist is responsible for collecting the specimen

→ several choices of blood-sampling system are available for phlebotomy:

- **open systems** – a hypodermic needle and syringe and a winged steel needle attached to a syringe (*syringe and needle / syringe and butterfly needle*)

advantages / disadvantages?



- **closed/enclosed systems** – vacuum-extraction tube system (*vacutainer method – sterile double-ended needle and needle holder, vacuum tubes*) and a hypodermic needle and syringe (*S-Monovette/Sarstedt mono method*) – can be used by syringe principle as well as vacuum principle



+ standard equipment



Vacutainer Order of Draw










Blood Culture Bottle Drawn First



Cap Color	Size (mm)	Chemical	ED
Blood Culture Bottle Drawn First			
2.7	1.0X75	All	367063
(Semi-transparent) Sodium Citrate (Light Blue)			
1.6	1.0X75	Peds	367065
Sodium Citrate (Dark Green)			
1.6	1.0X75	Adult	367066
Sodium Citrate (Dark Green)			
1.6	1.0X75	Adult	367067
Sodium Citrate (Dark Green)			
1.6	1.0X75	Adult	367068
Sodium Citrate (Dark Green)			
1.6	1.0X75	Adult	367069
Sodium Citrate (Dark Green)			
1.6	1.0X75	Adult	367070
Sodium Citrate (Dark Green)			
1.6	1.0X75	Adult	367071
Sodium Citrate (Dark Green)			
1.6	1.0X75	Adult	367072
Sodium Citrate (Dark Green)			
1.6	1.0X75	Adult	367073
Sodium Citrate (Dark Green)			
1.6	1.0X75	Adult	367074
Sodium Citrate (Dark Green)			
1.6	1.0X75	Adult	367075
Sodium Citrate (Dark Green)			
1.6	1.0X75	Adult	367076
Sodium Citrate (Dark Green)			
1.6	1.0X75	Adult	367077
Sodium Citrate (Dark Green)			
1.6	1.0X75	Adult	367078
Sodium Citrate (Dark Green)			
1.6	1.0X75	Adult	367079
Sodium Citrate (Dark Green)			
1.6	1.0X75	Adult	367080
Sodium Citrate (Dark Green)			
1.6	1.0X75	Adult	367081
Sodium Citrate (Dark Green)			
1.6	1.0X75	Adult	367082
Sodium Citrate (Dark Green)			
1.6	1.0X75	Adult	367083
Sodium Citrate (Dark Green)			
1.6	1.0X75	Adult	367084
Sodium Citrate (Dark Green)			
1.6	1.0X75	Adult	367085
Sodium Citrate (Dark Green)			
1.6	1.0X75	Adult	367086
Sodium Citrate (Dark Green)			
1.6	1.0X75	Adult	367087
Sodium Citrate (Dark Green)			
1.6	1.0X75	Adult	367088
Sodium Citrate (Dark Green)			
1.6	1.0X75	Adult	367089
Sodium Citrate (Dark Green)			
1.6	1.0X75	Adult	367090
Sodium Citrate (Dark Green)			
1.6	1.0X75	Adult	367091
Sodium Citrate (Dark Green)			
1.6	1.0X75	Adult	367092

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Colour Code	Tube Type	Determinations
	Blood Culture	Aerobic followed by anaerobic - if insufficient blood for both culture bottles, use aerobic bottle only
 Light Blue	Sodium Citrate	Coagulation Testing, PT, INR, APTT, D-Dimer, etc
 Red	Serum	LDH, Ionised Ca, Drugs (Phenytoin, Theophylline, Methotrexate, Lithium), Vitamin D, Parathyroid Hormone, Osmolality, Bone Markers, Endocrine Testing (excluding Thyroid)
 Gold	SST™ II	TSH, FT4, T3, Cortisol, Digoxin, GH, ADNA, Gastrin, B12 Folate, Ferritin, PSA, CEA, AFP, HCG, CA125, CA19.9, CA15.3, Immunoglobulins (IgG, IgA, IgM, IgE), Electrophoresis, B2 Microglobulin, Caeruloplasmin, Infectious Mono, CRP, Thyroid Ab, Liver Ab, Rheumatology, Coeliac Ab
 Light Green	PST™ II	UE, LFT, Cardiac Enzymes, Ca, Mg, Phosphate, Uric Acid, Total Protein, Amylase, Lipids, Bone Profile, Troponin, Iron Status, ACE
 Lavender	EDTA	Full Blood Count (FBC) and ESR C3 / C4, Haemoglobin A1c, Homocysteine, ACTH
 Pink	Cross Match	Blood Transfusion Samples
 Grey	Fluoride Oxalate	Glucose
 Royal Blue	Trace Element	Trace Elements

How many times to invert the tubes?

3-4 times (tube for haemostasis testing)

5-10 times – all the other tubes

WHY to invert? – to mix the blood with additives: anticoagulant agents (EDTA, K₂EDTA, K₃EDTA, sodium citrate, heparin, lithium heparin) or gel, stabilising agents (fluoride oxalate)

Procedure - venipuncture

Best practices for venipuncture / blood collection

→ provision of an appropriate location:

- in an outpatient department or clinic – „*phlebotomy cubicle*“ containing:
 - a clean surface with two chairs (one for the phlebotomist and the other for the patient)
 - a handwash basin with soap, running water and paper towels
 - alcohol hand rub
- in inpatient areas and wards:
 - close the bedside curtain/room door (privacy)
 - ensure that blood sampling is done in private and clean manner

→ provision of clear instructions:

- ensure that the indications for blood sampling are clearly defined (written protocol or documented instructions)

→ **preparation of equipment** within safe and easy reach on a tray or trolley:

- alcohol hand rub
- well-fitting, non-sterile gloves
- paper-towels to protect the bed linen / patient clothes
- a tourniquet
- a supply of laboratory sample tubes – to be stored dry and upright in a rack (sterile glass or plastic tubes with rubber caps / vacuum-extraction blood tubes / glass tubes with screw caps)
- an assortment of blood-sampling devices (safety-engineered devices or needles and syringes) of different sizes
- 70% alcohol swabs for skin disinfection
- gauze or cotton-wool ball (to be applied over the puncture site)
- laboratory specimen labels, writing equipment, laboratory forms
- leak-proof transportation bags and containers
- a puncture-resistant sharps container
- non-allergic adhesive tape on the skin

→ **the patient preparation (adult and conscious):**

- introduce yourself to the patient
- ask the patient to state his/her full name
- check that the laboratory form matches the patient's identity (i.e. match the patient's details with the laboratory form, to ensure accurate identification) → at least 2 patient's identifiers
- ask for allergies, phobias or if he/she has ever fainted during previous injections or blood draws (ability to cooperate)
- if the patient is anxious or afraid, reassure the person and ask what would make him/her more comfortable
- make the patient comfortable in a supine / semi-Fowler's position (if possible) with arms extended (small pillow / towel under the arm)
- place a clean paper or towel under the patient's arm
- discuss the test to be performed and obtain verbal consent – understanding the purpose of the procedure

(the patient has a right to refuse a test at any time before the blood sampling, so it is important to ensure that the patient has understood the procedure)

→ **special considerations in patient preparation:**

- recent history of taking blood samples, i.v. medications / devices inserted, wounds or burns on upper extremities etc.
- blood clotting disorders / medications
- previous experience with the procedure (negative impact)
- following the instructions provided within patient preparation for the procedure:
 - if possible, 24-72 hours withdrawal from medication treatment (individually)
 - taking blood sample after night rest, in the morning (after fasting 10 to 12 hours, except children, depending on the type of lab test)
 - fluids are recommended to prevent dehydration (tap water / tea)
 - no smoking
 - no coffee, alcohol intake
 - no chewing gum
 - no physical activity

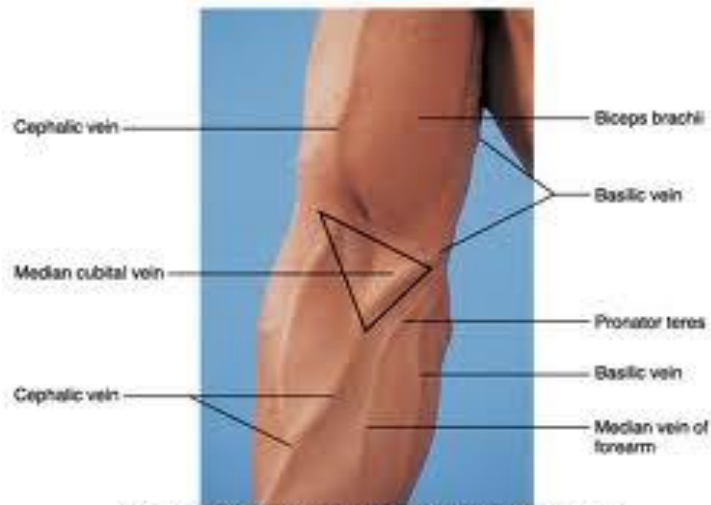


→ **perform hand hygiene (may be applied earlier):**

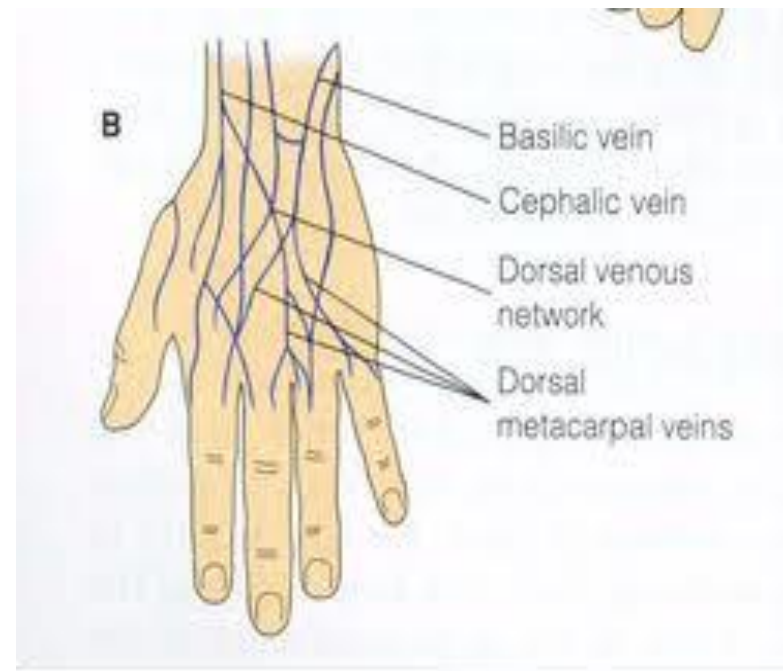
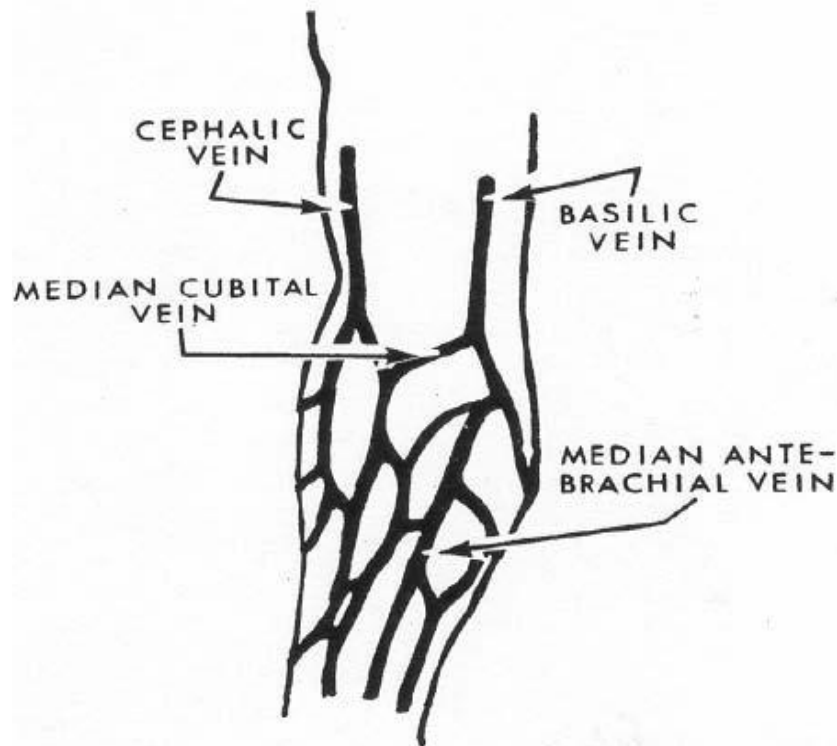
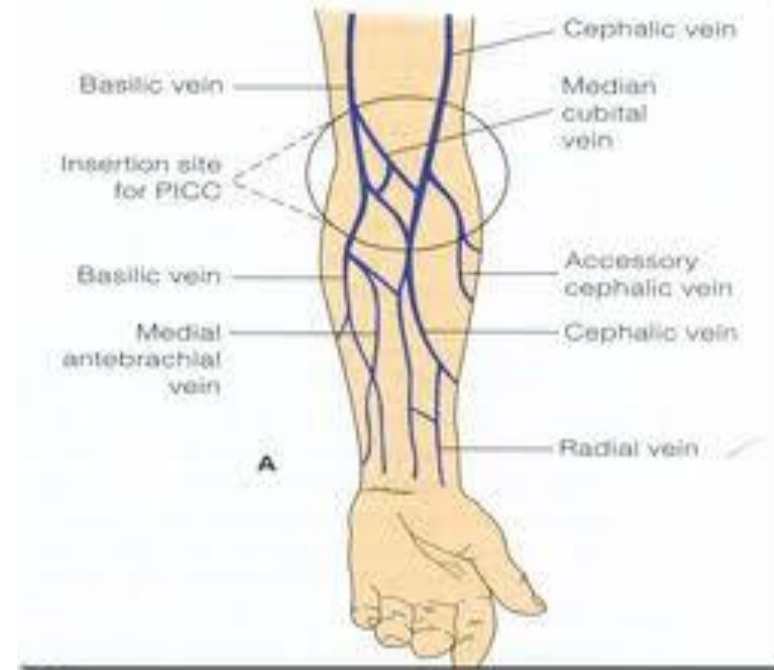
- wash hands with soap and water, dry with single-use towels
- if hands are not visibly contaminated, clean with alcohol rub – use 3 ml of alcohol rub all over the hands until dry
- after performing hand hygiene, put on well-fitting, non-sterile gloves

→ **select a venipuncture site:**

- extend the patient's arm and inspect the antecubital fossa / forearm / dorsal part of hand (from distal part to proximal)
- locate a vein of good size – visible, straight, prominent and clear by inspection and palpation (the *median cubital vein* usually the most easy to be punctured; under the *basilic vein* runs an artery and a nerve, so puncturing here runs the risk of damaging the nerve or artery and is usually more painful)



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- the vein should be visible without applying the tourniquet
- locating the vein will help in determining the correct size of needle (green / yellow / black hub?)
- apply the tourniquet about 4–5 finger widths (5-10 cm) above the venipuncture site (no longer than 1 min.) and re-examine
- DO NOT insert the needle where veins are diverting (increased chance of a haematoma), to post-mastectomy arm, post-stroke arm, arm with A-V-fistula, where haematoma, inflammation, swelling, burns, wounds, mole/naevus in site
- in hospitalized patients DO NOT take blood from an existing peripheral venous access site (false results due to haemolysis, contamination and presence of intravenous fluid and medication) – but it is ACCEPTABLE to draw blood specimens when first introducing venous device, before connecting the cannula to the intravenous fluids
- in case of central venous lines there is risk of contamination or erroneous laboratory test results

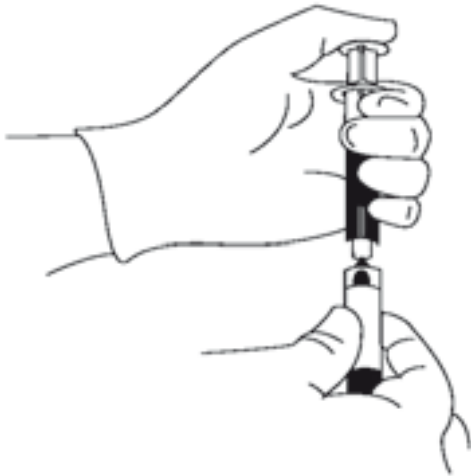
→ **disinfect the entry site:**

- unless drawing blood cultures (chlorhexidine followed by 70% alcohol), clean the site with a 70% alcohol swab and allow to dry
- apply firm but gentle pressure (various methods, e.g. start from the centre of the venipuncture site and work downward and outwards to cover an area of 2 cm or more for 30 seconds – check the cleanliness of the swab)
- allow the area to dry for at least 30 seconds
- DO NOT touch the cleaned site; in particular, DO NOT place a finger over the vein to guide the shaft of the exposed needle
- if the site is touched, repeat the disinfection

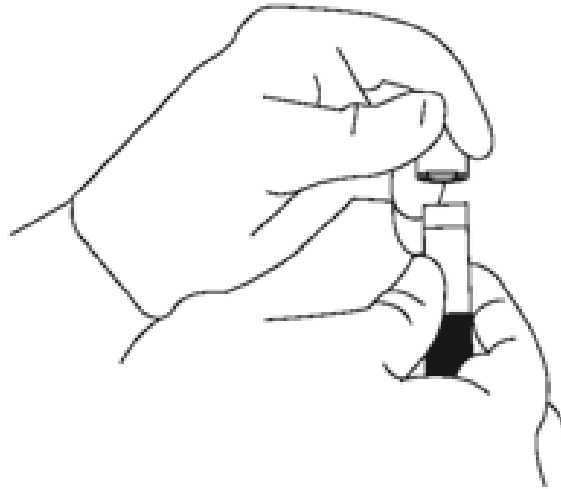
→ **perform venipuncture:**

- anchor / stabilize the vein (e.g. by holding the patient's arm and placing a thumb BELOW the venipuncture site and gentle pulling the skin taut, stretched down)
- ask the patient to form a fist so that the veins are more prominent
- enter the vein swiftly at a 30 degree angle and continue to introduce the needle along the vein at the easiest angle of entry (30 to 45 degree, then lower the angle to 15 to 30)
- once sufficient blood has been collected, release the tourniquet BEFORE withdrawing the needle (or as soon as blood flow is established, and always before it has been in place for two minutes or more) – 1 min. is considered to be a limit!
- withdraw the needle gently and apply gentle pressure to the site with a dry gauze or cotton-wool ball
- ask the patient to hold the gauze or cotton wool in place for 2 to 3 min., with the arm extended and raised
- ask the patient NOT to bend the arm, because doing so causes a haematoma

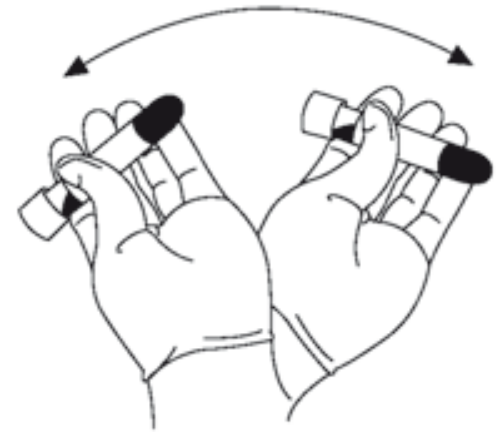
Filling the tubes – in open method



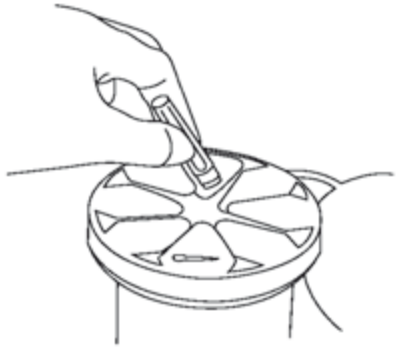
Press the plunger in slowly to reduce haemolysis (better after removing the needle).



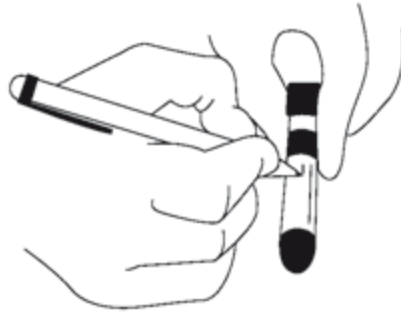
Place the stopper in the tube.



Following laboratory instructions, invert the sample gently to mix the additives with the blood before dispatch



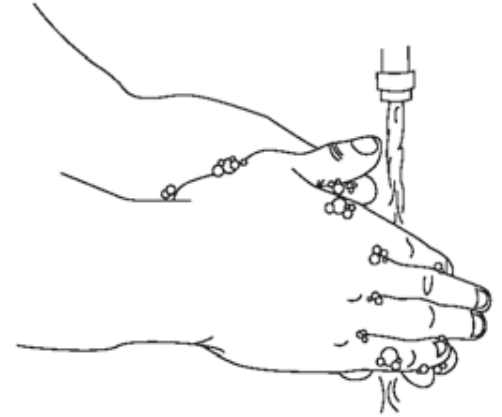
Discard the used needle and syringe or blood-sampling device into a puncture-resistant container.



Check the label and forms for accuracy.



Discard sharps and broken glass into the sharps container. Place items that can drip blood or body fluids into the infectious waste.



Remove gloves and place them in the general waste. Perform hand hygiene. If using soap and water, dry hands with single-use towels.

If UNSAFE phlebotomy – POOR VENIPUNCTURE practice

→ adverse effects for PATIENTS are rare:

- pain and bruising at the site of puncture
- nerve damage
- haematoma
- injury to anatomical structures in the vicinity of the needle entry
- blood sample is poorly collected (should be $\geq 90\%$ of the tube volume indicated)
- fainting
- blood sample is destroyed during the procedure or transportation (haemolysis of the blood)
- the results may be inaccurate and misleading to the clinician (e.g. due to haemo-concentration in tourniquet application for longer than 1 min., due to insufficient mixing up the sample)
- the patient may have to undergo the inconvenience of repeat testing



Blood culture



- careful disinfection (check institutional policy) – antiseptic to be allowed to be dried
- **clean tops of culture bottles** (institutional policy regarding cleaning with 70% alcohol after cleaning with antiseptic solution – chlorhexidine, followed by air-drying)
- collect 10 to 15 ml of venous blood by venipuncture in 20-ml syringe from venipuncture site (bottle for adults – 5-10ml, kids – 2 ml)
- **discard needle** and replace it by new sterile needle before injecting blood sample into culture bottle
- if both aerobic and anaerobic cultures are needed, inoculate **anaerobic** first

Capillary blood sample



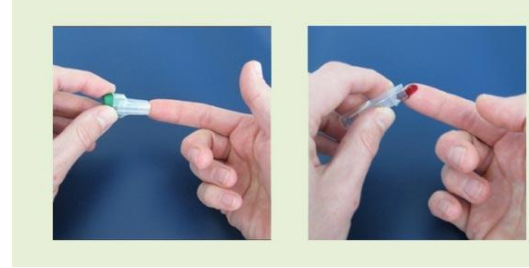
ASTRUP – ABR



- 1 or 2 micro glass capillaries / pre-heparinised
- 4 plastic caps
- metallic staples
- magnet
- ice-filled plastic bag
- NO BUBBLES!



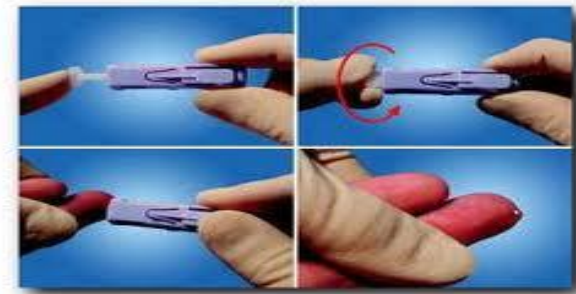
GLYCAEMIA (blood glucose) GP (profile)



- blood glucose meter (even voice activated)
- blood glucose reagent strip compatible with the meter
- sterile lancet or needle, lancet injector (optional)
- sample tube (microtube) / pre-heparinised

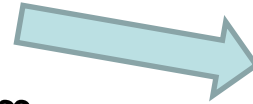


Capillary blood sample



- assess skin at the puncture site (circulation – colour, warmth, capillary refill, intactness)
- assess record of medications (anticoagulants to prolong bleeding)
- self-care abilities (visual impairment, finger dexterity) if to be performed repeatedly by the patient (home glucose test kits)
- vascular puncture site – lateral aspects of the fingers (to avoid nerve endings, calloused areas in the tips), earlobes, outer aspects of heels in infants, alternative puncture sites (forearms)
- increase blood flow to the puncture site (application of dry/wet heat) – need for hyperaemia
- disinfect the puncture site, let it dry 30 sec. (risk of haemolysis)
- pierce the skin with the darting motion (lancet / needle / injector) – gently squeezing the puncture site (less painful)
- first drop of blood to be wiped out (risk of haemodilution of the first drop by serous fluid)
- gently squeeze, don't push too much (risk of haemodilution)

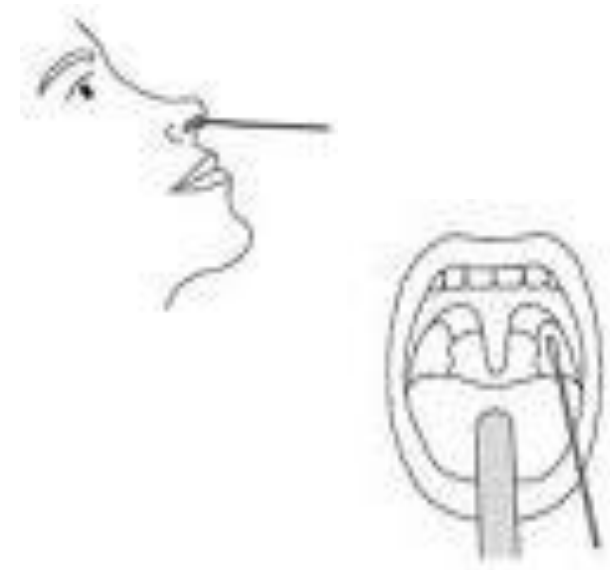
Nose, throat + sputum specimens



Sputum – the mucous secretion from lungs, bronchi and trachea (not saliva!)

- sterile containers
- **expectorated specimen** upon awaking (before brushing teeth) in the morning
- not able to be caught out → **induced specimen of the sputum:**
 - inhalation / nebulisation followed by suctioning the specimen right from the trachea (sterile procedure, used mucous trap tool connected to suction machine)
 - postural drainage
 - percussion

- can cause discomfort to sensitive mucosal membranes (throat culture may cause gagging, kids can „fight“ – have to be held properly by mother, other nurse's assistance)





APPLYING MEDICATIONS

- generic name – the name of the active ingredient / active substance of the medication (ibuprofenum, paracetamolum, acetaminophen)
- brand name (trademark name) – the manufacturer gives to the medication (Nurofen, Brufen, Ibalgin, Panadol, Paralen, Tylenol).

R_x

Prescription

- Enelbin ret 1-1-0 tbl.
- Enelbin ret 20mg-0-40mg tbl.
- Enelbin ret 2x1 drg. (Q12) – every 12 hrs
- Enelbin ret 3x30 gtt. (Q8) – every 8 hrs

Types of drugs according to their EFFECT

Palliative	Relieves the symptoms of a disease but does not affect the disease itself.	morphine sulphate, aspirin for pain
Curative	Cures a disease or condition.	penicillin for infection
Supportive	Supports body function til other treatments or the body' s response can take over.	norepinephrine bitartrate for low blood pressure; aspirin for high body temp.
Substitutive	Replaces body fluids or substances.	thyroxine for hypothyroidism, insulin for diabetes mellitus
Chemotherapeutic (CYTOSTATICS)	Destroys malignant cells.	busulfan for leukemia
Restorative	Returns the body to health.	vitamins, mineral supplements

Standard abbreviations

Forms

tbl. – tabulettae – tablets

pil. – pillules – pills

gran. – granula – granules

drg. – tabulettae obductae – pills with the cover (dragée)

cps. – capsulae (capsules)

pulv. – pulveres – powder

gtt. – guttae – drops

ung. – unguentum – ointment, cream

lot. – lotio (lotion)

pastae – paste

emplastra – plasters

supp. – suppositoria – suppository

sol. – solutiones – solutions

spec. – species – tea

mixt. – mixturae – mixtures

tinc. – tincturae – tinctures

Ret – retard (slower start effect)

F – forte (stronger effect)

Lente – longer effect

Rapid – effects quickly (*HMR*,
Actrapid)

Ultra rapid – almost immediately

Routes

s.l. – sub lingual (underneath the tongue)

p.o. – per os (oral, via mouth)

i.v. – intra venous (into, via vein)

s.c. – sub cutaneous (under the skin)

i.c. / i.d. – intra cutaneous/dermal (into the skin)

inh. – inhalatio (breathe, inhale)

5 „Rights“ of medicine administration

- Right Patient (2 identifiers)
- Right Time
- Right Dosage
- Right Route
- Right Medication

+ check for allergies



FACTORS affecting medication action

→ factors other than drug itself can affect drug action:

- developmental factors – age (ability to cooperate, developmental factors, physiological changes in elderly), pregnancy (risks for foetus)
- gender (hormonal differences, distribution of body fat and fluids in men/women)
- ethnic and genetic factors (drug polymorphism)
- diet (TTC + milk, Biseptol + lemons, oranges)
- environment (temperature → vasodilatation / vasoconstriction)
- psychological factors (placebo effect)
- illness and disease (e.g. aspirin in fever vs. aspirin in normal temperature)
- time of administration (relation to meals intake)
- **routes of administration** (various routes) → (therapeutic/adverse) effect – local, systemic; drug characteristics – pharmacodynamics and pharmacokinetics

advantages / disadvantages?

Oral (p.o.)



When to crush?

- tube feeding, swallowing troubles, giant size, kids



When, why to divide?

- appropriate dose



Various forms (pills, liquids, mixtures, tinctures, spray)

The order is **Cymbalta (duloxetine HCl) 120 mg PO daily**.

How many capsules of this antidepressant drug will you administer to the P? Read the label A.

A

Dispense in a tightly closed container.
Keep out of the reach of children.
Eli Lilly and Company
Indianapolis, IN 46285, USA
WW 8931 AMX
Expiration Date/Control No.

NDC 0002-3240-30
30 capsules
PU3240

Cymbalta®
duloxetine HCl
DELAYED
RELEASE
CAPSULES

30 mg

Each capsule contains 33.7 mg of duloxetine hydrochloride equivalent to 30 mg duloxetine.

Rx only

www.Cymbalta.com

Lilly

Medication Guide to be dispensed to patients.
See accompanying literature for dosage.
Store at 25°C (77°F); excursions permitted to 15-30°C (59-86°F).

3 0002-3240-30 6

B

NDC 0074-3771-60

OMNICEF®
(cefdinir) for oral suspension

125 mg/5 mL

SHAKE WELL BEFORE USING.
Keep bottle tightly closed.
Any unused portion must be discarded 10 days after mixing.

RECONSTITUTE WITH
36 mL WATER

60 mL
(when reconstituted)

www.Omnicef.com

Rx only

Usual Dosage: Children 14 and younger: In a single dose or in two divided doses, depending on age, weight, and type of infection. See package insert for full prescribing information. This bottle contains 1.5 g cefdinir. Do not accept if seal over bottle opening is broken or missing.

DIRECTIONS FOR RECONSTITUTION
Prepare suspension at time of dispensing by adding a total of 36 mL water to the bottle. Tap bottle to loosen the powder, then add about half the water, and shake. Add the remaining water and shake to complete suspension. This provides 60 mL of suspension.
Each 5 mL contains 125 mg cefdinir after reconstitution.
Expiration date of powder

3 0074-3771-60 2

Manufactured by:
Cephal International Corporation
Carroll, Puerto Rico 00985
Under License to:
Pajisawa Pharmaceutical Co., Ltd.
Osaka, Japan

for:
Abbott Laboratories
North Chicago, IL 60064

PULL

©2004, Abbott Laboratories

The physician orders **Omnicef (cefdinir) 500 mg PO q12h**. Determine the number of mL you are going to administer to the P. Read the label B.

A (Cymbalta)

Convert 120 mg to capsules.

$$120 \text{ mg} = ? \text{ cap}$$

Cancel the milligrams and calculate the equivalent amount in capsules.

$$120 \text{ mg} \times \frac{? \text{ cap}}{? \text{ mg}} = ? \text{ cap}$$

Because the label indicates that each capsule contains 30 mg, you use the unit fraction $\frac{1 \text{ cap}}{30 \text{ mg}}$

$$\cancel{120}^4 \text{ mg} \times \frac{1 \text{ cap}}{\cancel{30} \text{ mg}} = 4 \text{ cap}$$

So, you would give 4 capsules by mouth once a day to the patient.

B (Omnicef)

Convert 500 milligrams to mg.

$$500 \text{ mg} = ? \text{ mL}$$

Cancel the milligrams and calculate the equivalent amount in milliliters.

$$500 \text{ mg} \times \frac{? \text{ mL}}{? \text{ mg}} = ? \text{ mL}$$

Because the label indicates that every 5 mL of the solution contains 125 mg of Omnicef, use the unit fraction $\frac{5 \text{ mL}}{125 \text{ mg}}$

$$\cancel{500}^4 \text{ mg} \times \frac{5 \text{ mL}}{\cancel{125} \text{ mg}} = 20 \text{ mL}$$

So, you would give 20 mL by mouth every 12 hours to the patient.



Parenteral route, needle gauge guide

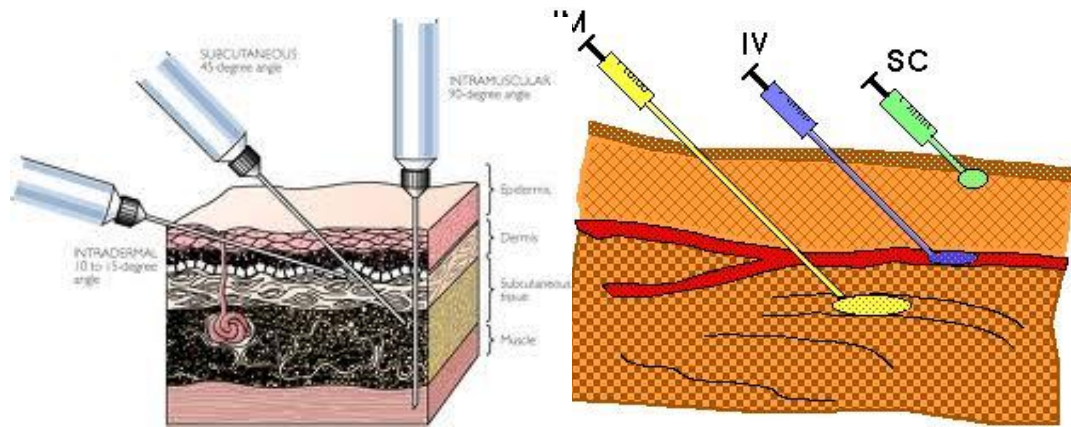
Size	Lenght	Colour code	Use
18G	40 mm	pink	tranfusion (ery masa), perforation needle
20G	40 mm	yellow	i.m and i.v
21G	40 mm	green	i.m and i.v
22G	30-40 mm	black	i.m
23G	25-30 mm	blue	i.m
24G	30 mm	violet	i.m
25G	16-25 mm	orange	s.c
27G	18 mm	grey	i.c

Skin preparation and disinfection in injections

Type of Injection	Skin preparation and disinfection	
	Soap and water	60–70% alcohol (isopropyl alcohol or ethanol)
Intradermal	Yes	No
Subcutaneous	Yes	No
Intramuscular	Yes	No
• Immunization	Yes	No
• therapeutic	Yes ^a	Yes ^a
Venous access	No	Yes



World Health
Organization



Practical guidance on skin preparation and disinfection

To disinfect skin, use the following steps (27–29):

1. Apply a 60–70% alcohol-based solution (isopropyl alcohol or ethanol) on a single-use swab or cotton-wool ball. DO NOT use methanol or methyl-alcohol as these are not safe for human use.
2. Wipe the area from the centre of the injection site working outwards, without going over the same area.
3. Apply the solution for 30 seconds then allow it to dry completely.

DO NOT pre-soak cotton wool in a container – these become highly contaminated with hand and environmental bacteria.

DO NOT use alcohol skin disinfection for administration of vaccinations.



World Health
Organization

intracutaneous / intradermal inj. (i.c./i.d.)

- into the skin – dermal layer of the skin just beneath the epidermis (not underneath)
- diagnostic (TB screening, skin tests for allergy) and therapeutic (BCG vaccination) purposes
- **the angle** – almost parallel to skin surface (10 to 15-degree angle)
→ small wheal on the skin
- only small amounts 0.1 – 0.5 ml
- 1 ml syringe (insuline syringe), calibrated into 100 i.u.
- **the sites:** inner lower arm (lower/middle part of forearm) = ventral forearm, the upper chest, the back in scapular area (+ deltoid muscle, abdomen)

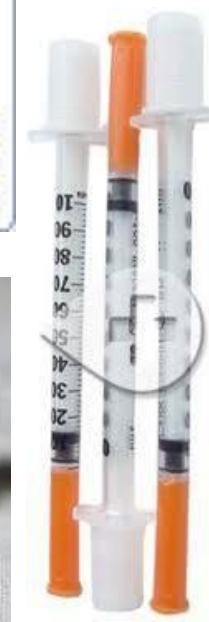
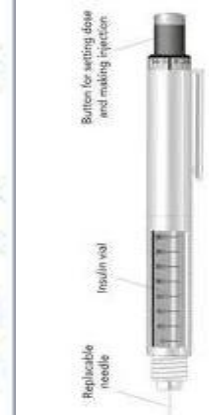
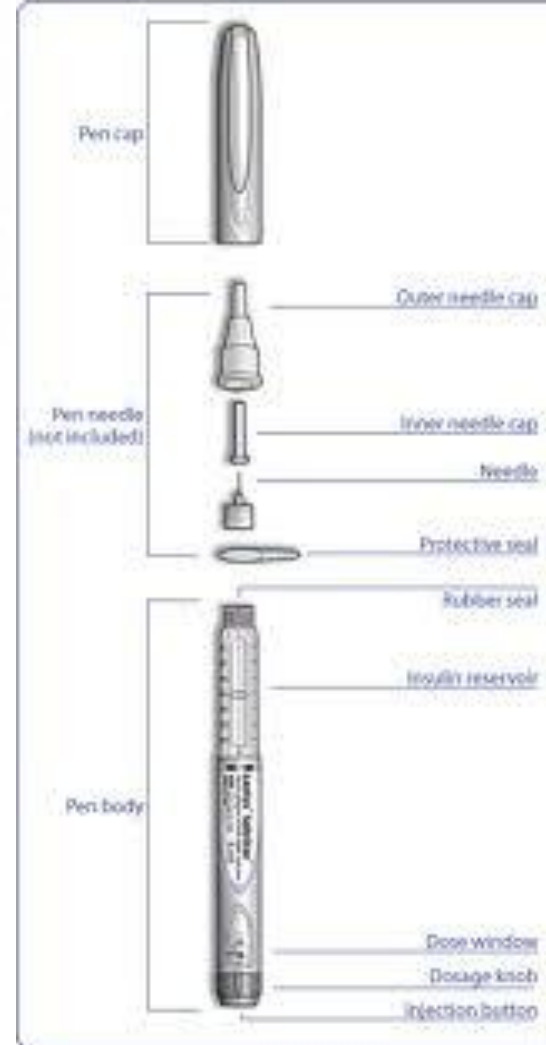
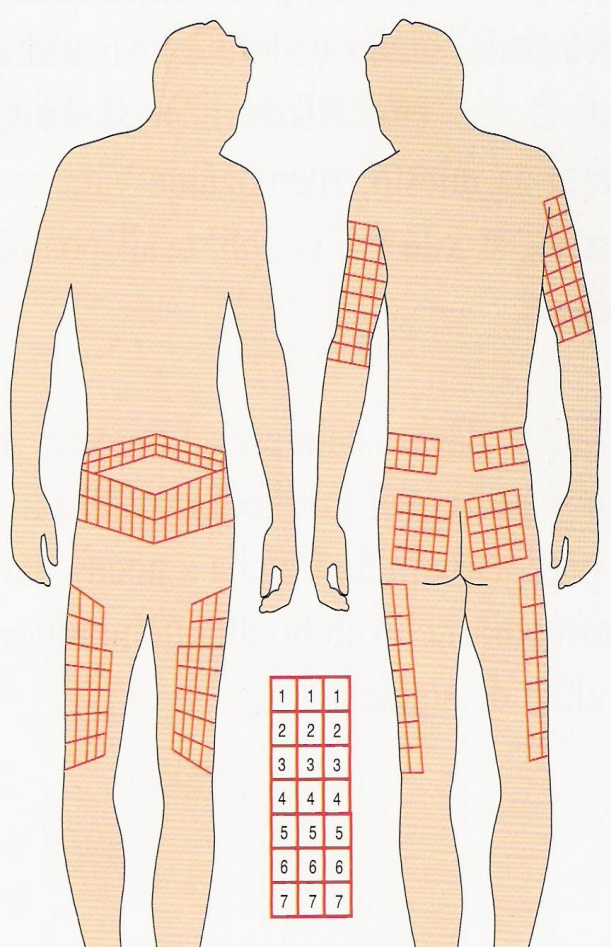
subcutaneous injection (s.c.)

- small doses of medication 0.5 ml – 1 ml
- slower absorption of a medication when compared to i.m. and i.v.
- to folded skin (pinch the skin) – subcutaneously
- vaccines, insuline, LMWH
- **the angle:** 45-degree angle → 2.5 cm of tissue can be grasped at the site; 60 to 90-degree angle → 5 cm of tissue can be grasped at the site
- **the sites:** outer aspect of the upper arms, anterior aspect of the thighs, (convenient) abdomen, scapular areas, upper ventrogluteal and dorsogluteal areas
- if frequently → **rotate sites** in order to minimize tissue damage, avoid discomfort, aid absorption
- the type of syringe: 2 ml syringe + orange hub needle; Insulin → insulin syringe (calibrated to 100 i.u.); Heparin → tuberculin syringe; LMWH – prefilled cartridge, with safety covering system / needle blocking system



Sites on the Body Where
a Subcutaneous Injection
Can Be Given





insulin s.c



Injectons by a syringe

- are usually given into the deep SC tissue through a two-finger pinch of the skin at a 45 to 90-degree angle
- the pinch of skin is used to avoid the risk of administering insulin IM
- all suspensions of insulin (e.g. NPH, IZS, pre-mixes, lente) must be resuspended before injection by rolling or inverting the vial or pen injector device (10 times) so that the cloudy suspension mixes thoroughly and uniformly



Pen injector technique

- not in refrigerator, self-injection technique
- requires careful education including the need to ensure that no airlock or blockage forms in the needle; a wait of 5–10 seconds after pushing in the plunger helps to ensure complete expulsion of insulin through the needle

Heparin + LMWH s.c



- routinely used for **prophylactic reasons** – prevention of venous thrombolism (in any surgery lasting more than 30 minutes, with general anaesthesia, obese patients, patients with previous DVT, patients above 50 years of age, or patients with cancer..., + treatment reasons (unstable angina).

Special precautions

- how to store (place, temperature)
- how to administer (abdominal area preferred; don't aspirate if prefilled cartridge)
- assess the site and select the site
- monitor side effects



intramuscular injection (i.m.)

- into the muscle
- medications absorbed more quickly than in s.c. due to greater blood supply to muscles
- larger volume of fluid without discomfort (muscle size, location, condition)
- amount – 3 ml (well developed adult muscles – gluteus medius / gluteus maximus), 1 - 2 ml (less developed muscles), only 0.5 to 1 ml to deltoid muscle
- choice of needle (gauge) – muscle, solution (suspension, oil), amount of fat tissue, age, habitus of the patient
- **the angle:** 90-degree angle

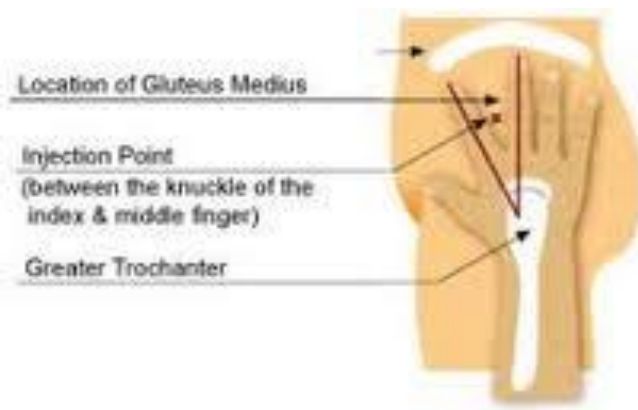
Dorsogluteal site: gluteus maximus

- locating the muscle: P lies in prone / lateral position, divide buttock into the quadrants → outer upper aspect is the right site for i.m. injection



Ventrogluteal site: gluteus medius

- locating the muscle: stand facing P's hips (lateral position with the knee bent)
- place the heel of hand on P's greater trochanter of femur, fingers pointing towards P's head and spread index and middle finger into a V
- give the injection between those two fingers

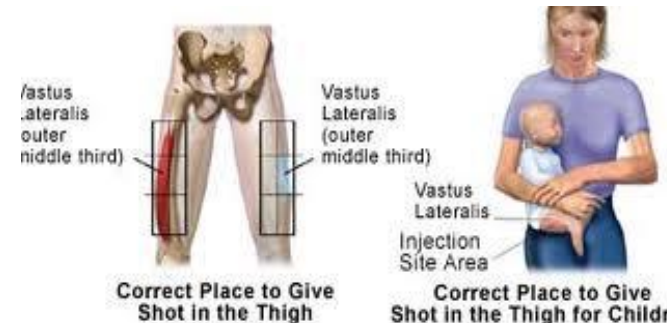
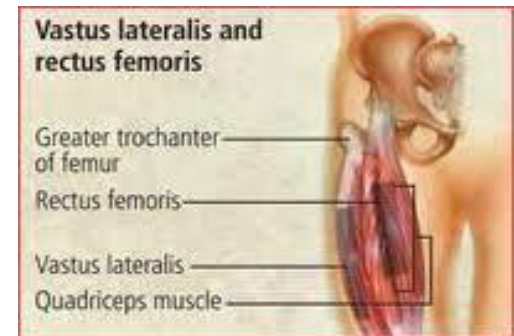
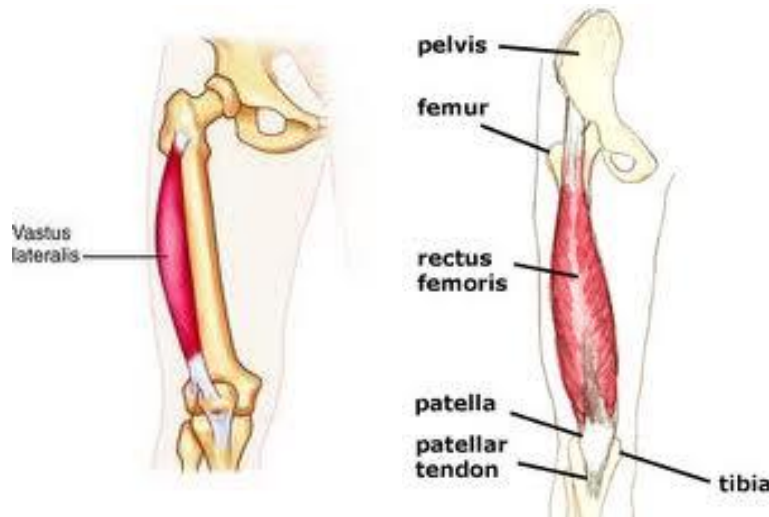
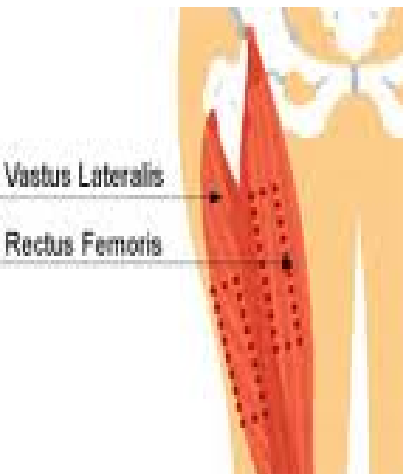


Vastus Lateralis site: located in the thigh

- locating the muscle: divide the front of the thigh into thirds from the top to the bottom of the thigh
- the needle should enter the **middle third of the muscle (anterolateral)**
- in infants 1 year and younger, adults

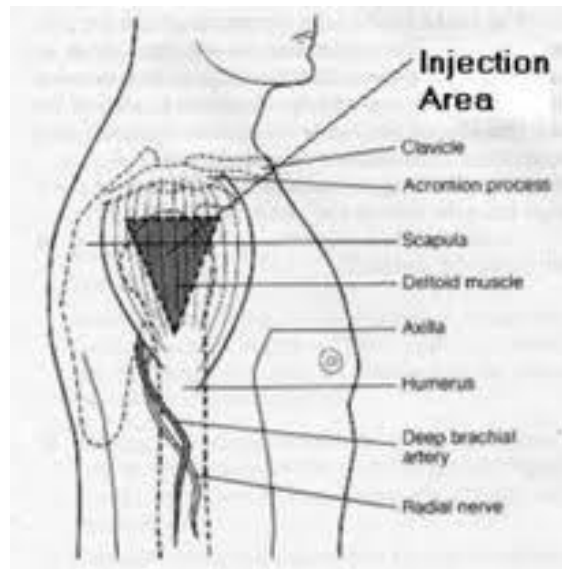
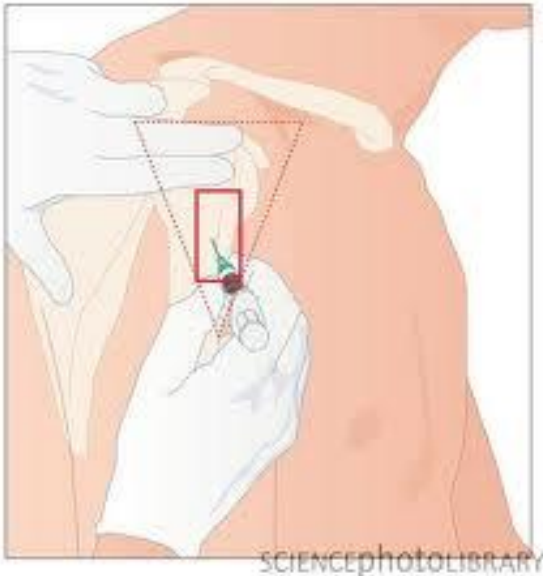
Rectus Femoris site: located in the thigh

- locating the muscle: divide the front of the thigh into thirds from the top to the bottom of the thigh
- the needle should enter the **middle third of the muscle (anterior aspect)**
- self-injection



Deltoid site: the upper arm, below the shoulder

- locating the muscle: place the palm of your hand on the shoulder, spread your thumb from the other 4 fingers in upside down V shape
- give injection into the middle of the V



Thank you for your attention...

Questions?

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