PÎRVU MIHAELA DENISA

# SURGICAL PROPAEDEUTICS

## BASIC MEDICAL - SURGICAL TECHNIQUES

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*I owe my mother more than words can ever express!*

*From her suffering, this book came to life…*

*With all my love,*

*Mihaela*

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# 1. FOREWORD

Surgical propaedeutics marks the student's first true encounter with the complex, captivating, and rigorous world of surgery. It is the moment when previously acquired theoretical knowledge begins to gain practical value, and the understanding of human anatomy and physiology gradually transforms into the ability to intervene on the human body with discernment and responsibility.

Our hope is that the following pages will offer the reader genuine support in understanding the foundations of surgery and serve as a solid starting point for the next stages of medical training.

The formation of a competent medical professional always begins with a thorough mastery of basic techniques. In surgery, these techniques are not merely simple maneuvers, but the very foundation upon which the safety of the medical act is built. They instill confidence in one's abilities and reinforce responsibility toward the patient.

Through its structure and the topics addressed, this work becomes an indispensable tool for students, nurses, residents, and all those at the beginning of their surgical journey. Each procedure is presented with emphasis on accuracy, safety, and respect for the patient — essential principles of medical practice.

This book does not aim solely to transmit information, but to shape a professional attitude: rigor, attention to detail, understanding of indications, contraindications, and limitations of each maneuver, as well as the development of mature clinical reasoning that minimizes complications, incidents, or accidents. In surgery, small gestures can have major consequences, and learning them correctly from the very beginning is the key to a solid career.

We hope that the pages that follow will become a true support in the learning process, a reliable guide in daily practice. Surgery is both an art and a science, and this work provides the foundation needed to step confidently into its complex universe.

# 2. INJECTIONS, INFUSIONS, TRANSFUSIONS – Pîrvu Mihaela Denisa

## GENERAL INFORMATION

### DEFINITION

A minor surgical procedure involving the introduction of medicinal substances or active principles into the body using hollow needles. These substances are absorbed into the bloodstream circulating through the targeted region.

### PURPOSE

- Therapeutic
- Diagnostic (e.g., intravenous urography, coronary angiography)
- Local anesthesia
- Induction of general anesthesia

### ADVANTAGES

- Bypasses the digestive tract
- Dosage is not affected by digestive absorption (e.g., accelerated transit)
- Controlled absorption rate of active substances
- Avoids hepatic metabolism
- Precise dosage control
- Allows administration of shock doses for rapid absorption (especially intravenous route)
- Enables administration of slow-release medications not available in tablet form
- Suitable for patients with digestive intolerance
- Allows drug administration in: uncooperative or unconscious patients, patients with severe conditions

### CONTRAINDICATIONS / CAUTION REQUIRED

- Coagulopathy (Haemophilia A, B, von Willebrand disease)
- Anticoagulant therapy
- Tetanus risk

## REQUIRED MATERIALS

### Active substances / medications:

- Aqueous or oily solutions
- Crystalline powders
- Biological products – serums, vaccines

### Solvents

### Presentation forms:

- Ampoules
- Vials with rubber stoppers
- Jars with rubber stoppers
- Pre-filled sterile plastic syringes (e.g., vaccines, anticoagulants) (Figure 1).

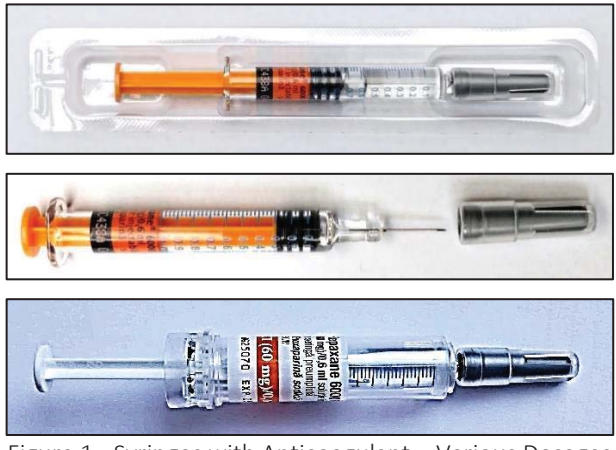

Figure 1 - Syringes with Anticoagulant – Various Dosages

### MATERIALS REQUIRED:

- Syringes
- Needles (steel, platinum)
- Cannulas
- Infusion sets
- Tourniquet
- Antiseptic materials: Cotton swabs with antiseptic solution: 70% alcohol, Iodine Tincture, Dermobacter, etc.
- Protective equipment: Sterile gloves

## COMPONENTS OF A SYRINGE

**Barrel (Tube)** – The transparent, graduated part marked in milliliters; holds the liquid to be injected or aspirated.

**Plunger** – The movable part inserted into the barrel; enables aspiration or injection of fluid.

**Seal (Rubber Piston)** – Ensures airtight closure between the plunger and barrel for smooth and accurate movement.

**Flange** – Finger support that helps control the plunger's movement during use.

**Connector (Hub or Tip)** – The part that connects the syringe to the needle (Figure 2).


Figure 2 - Components of a Syringe: a. Barrel b. Plunger c. Seal (Rubber Piston) d. Flange e. Hub (Connector) f. Needle g. Protective Cap

## TYPES OF SYRINGES:

**Luer Syringes** (Figure 3):

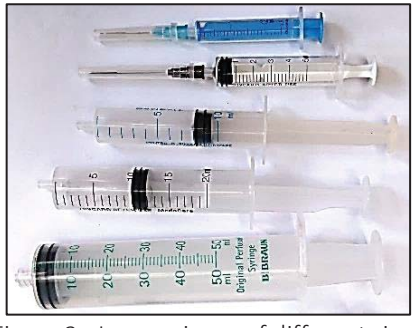

Figure 3 - Luer syringes of different sizes

**Roux and Collin Syringes –** Made exclusively of metal; used in dental anesthesia procedures.

**Guyon Syringe** – Designed for ENT (ear, nose, throat) and urological irrigation; available in volumes of 100 mL, 200 mL, and 250 mL (Figure 4).


Figure 4 - Guyon Syringe

## COMPONENTS OF A SYRINGE NEEDLE

Hub (Base) – The plastic part that connects securely to the syringe.

Cannula – The metallic shaft through which the fluid flows.

Bevel (Tip) – The angled cut at the needle's end that facilitates smooth penetration.

Lumen – The internal channel of the needle through which the liquid passes.

Protective Cap – The cover that shields the needle to prevent injury and contamination (Figure 5).

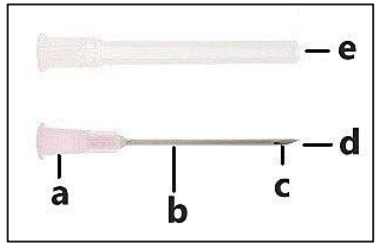


Figure 5 - a. Hub b. Cannula c. Bevel d. Lumen e. Protective Cap

## GAUGE SCALE

The Gauge Scale originates from an empirical wire measurement system used in 18th and 19th century Britain. Today, it is applied to estimate the external and internal diameter of syringe needles.

There is no strict correspondence between a needle's gauge number and its exact diameter. However, there is an inverse proportionality:

- A higher gauge number indicates a thinner needle
- A lower gauge number indicates a thicker needle

Additionally, there is no standardized correlation between the needle hub color and its gauge size, as this varies by manufacturer (Figure 6).

### Common Uses by Gauge Size:

- 18–19 G – Used for loading syringes
- 20–22 G – Used for intramuscular injections
- 25–30 G – Used for intradermal and subcutaneous injections

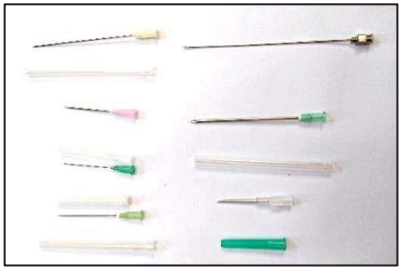

Figure 6 - Needles – Various Sizes

## INCIDENTS, ACCIDENTS, AND COMPLICATIONS

- Local hematoma
- Vessel rupture
- Needle breakage
- Skin or vascular necrosis
- Tissue necrosis (due to hypertonic solution injected para-venously)
- Allergic reactions
- Subcutaneous nodules
- Abscesses, phlegmons – aseptic or septic
- Air or fat embolism
- Neuralgia
- Phlebitis, thrombophlebitis
- Pharmacodynamic-related accidents – sensitization phenomena, allergic reactions
- Transmission of viruses – infectious hepatitis, HIV/AIDS

## POST-INJECTION CARE

- Generally, no special care is required
- A sterile dressing should be applied at the puncture site
- For intravascular injections, hemostasis is achieved by compressing the site for a few minutes with a cotton swab soaked in alcohol

## TYPES OF INJECTIONS

- Intramuscular Injections
- Intravenous Injections
- Intradermal Injections
- Subcutaneous Injections
- Intra-arterial Injections

## STANDARD INJECTION TECHNIQUE

- Inform the patient and obtain consent
- Position the patient comfortably according to injection type
- Open the vial or ampoule
- Draw the substance into the syringe
- Replace the needle
- Apply tourniquet if needed
- Disinfect the injection site using antiseptic-soaked swab
- Remove the protective cap from the needle
- Insert the needle through the skin and anatomical layers to the intended depth
- Gently aspirate to confirm correct placement:
    - Vein – dark red blood
    - Artery – bright red blood
    - Muscle/Subcutaneous – no blood
- Inject the active substance as prescribed
- Withdraw the needle and syringe with a firm motion
- Massage the injection site to promote hemostasis
- Dispose of waste in designated containers

## 1. INTRAMUSCULAR INJECTION

### ADVANTAGES:

- rapid absorption into the bloodstream
- allows the administration of larger volumes (up to 5 ml)
- irritating substances can also be administered (due to the reduced innervation of the muscle)
- most medicinal substances (oily preparations, heavy-metal salts) are administered only by the intramuscular route

## PREFERRED INJECTION SITES (Figure 7)

- **Gluteal region** – care must be taken to avoid the sciatic nerve and major blood vessels, which could cause neuritis, neuralgia, paralysis, hematomas
    - Dorso-gluteal – upper outer quadrant of the buttock (identified by drawing an imaginary cross); traditionally used
      Risks: potential injury to the sciatic nerve or injection into large vessels
    - Ventrogluteal – lateral gluteal area, considered the safest site (targeting the gluteus medius muscle)
        - Located above the line connecting the posterior superior iliac spine and the greater trochanter (figure 8 - line 1-2)
        - Advantages: far from nerves and major vessels
    - Seated position – injection can be administered in the upper buttock area above the support plane

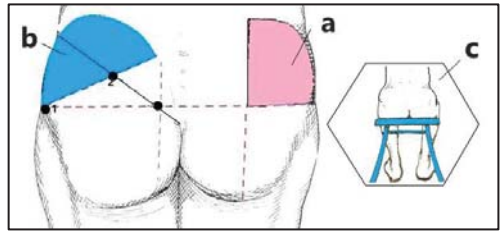


Figure 7 - Intramuscular Injection Sites:
a. Dorsogluteal b. Ventrogluteal c. Upper buttock area (seated position)

- **Deltoid region** – ideal for vaccines
- **Lateral thigh – quadriceps muscle** (*vastus lateralis*); commonly used in children

## REQUIRED MATERIALS

- Syringe (2–5 mL capacity)
- Long needle (4–7 cm) with extended bevel
- Medicinal solution
- Sterile swabs and disinfectant

## TECHNIQUE

- Proper patient positioning (prone, lateral decubitus or sitting)
- Skin disinfection
- Aseptic preparation of the injection site
- Insert the needle perpendicularly to the skin with a firm motion until it reaches the muscle layer
- Gently aspirate the syringe (no blood should appear)
- Inject the contents slowly

- Withdraw the needle and syringe swiftly
- Apply a sterile swab
- Massage the area gently

### ADVANTAGES

- Rapid absorption into the bloodstream
- Allows administration of larger volumes (up to 5 mL)
- Suitable for irritating substances (due to reduced innervation of muscle tissue)
- Most medications (e.g., oily solutions, heavy metal salts) are administered exclusively via intramuscular route

### DISADVANTAGE

- Potential muscle mass reduction due to local scarring and sclerosis

## 2. INTRAVENOUS INJECTION

A method of administering medication directly into the circulatory system, offering the fastest absorption and immediate therapeutic effect.

Venipuncture is also used for blood sample collection.

### INDICATIONS

- Rapid absorption of active substances
- Administration of infusible solutions
- Use of hypertonic solutions (which may be irritating or aggressive to other tissues)

### CONTRAINDICATIONS

- Oily or irritating solutions (risk of fat embolism or phlebitis)
- Fragile or inflamed veins

### INJECTION SITES – PREFERRED LOCATIONS

**Superficial Veins** (Figure 8)**:**

- Upper limb veins:
  - Antecubital fossa
  - Basilic and cephalic veins
  - Venous "M" pattern in the forearm
  - Dorsal hand vein
- Great saphenous vein
- External jugular vein

- Superficial temporal vein
- Superior sagittal sinus of the dura mater
- Anterior fontanelle

Figure 8 - Commonly punctured veins for intravenous injection

Deep Veins (used for central venous; performed only under sterile conditions by physicians)

- Internal Jugular veins
- Subclavian veins
- Femoral veins

## REQUIRED MATERIALS

- Sterile syringe
- Fine needle, butterfly needle, or cannula
- Medicinal solution
- compresses, antiseptic swabs
- Tourniquet
- Gloves

## TECHNIQUE (Figure 9, 10, 11)

- Position the patient according to the puncture site
- Identify the vein: apply the tourniquet to highlight veins; choose an accessible vein, preferably on the non-dominant limb
- Disinfect the area
- Align the needle with the vein and insert it in the direction of blood flow
- Insert the needle at a 30–45° angle

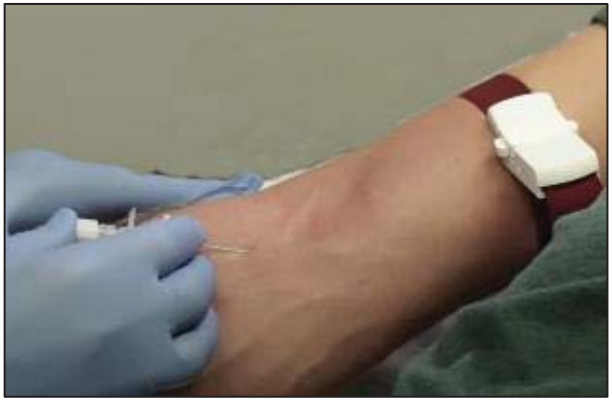

Figure 9 - Venous puncture after tourniquet application

- Advance the needle 1–2 cm into the vein

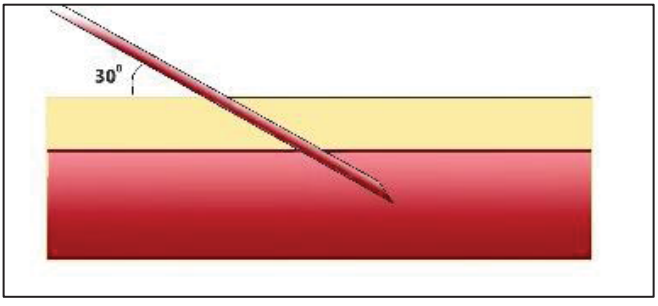


Figure 10 - Needle Insertion into a Vein

- Gently aspirate to confirm placement – venous blood should appear
- Remove the tourniquet
- Slowly inject the solution or attach an infusion set
- Withdraw the needle and apply a sterile swab
- Compress the vein for several minutes

Figure 11- Intravenous Drip

## ADVANTAGES

- Fast and effective action

- Precise dosage control
- Ideal for medical or surgical emergencies, intensive treatments, and situations where oral administration is not possible
- Avoids degradation of medication in the digestive tract
- Essential in emergency care catheterization

## 3. INTRADERMAL INJECTION

### INDICATIONS

- Diagnostic – skin tests (e.g., tuberculin, allergen testing)
- Therapeutic – desensitization treatments for allergies
- Local anesthesia

### PREFERRED SITES

- Anterior forearm (middle third)
- Outer arm or thigh
- Any area requiring local anesthesia

### REQUIRED MATERIALS

- 1 mL syringe with fine needle (27–30 G)
- Sterile swabs and disinfectant
- Disposable gloves
- Medication to be injected
- Adhesive bandages

### TECHNIQUE (Figure 12)

- Obtain informed consent
- Position the patient
- Disinfect the skin
- Insert the needle with the bevel facing upward into the superficial dermis until the needle opening disappears under the skin
- Inject 0.1 mL (1–2 drops) to form a papule of 0.4–0.6 cm
- The injection site will show a “orange peel” appearance due to skin deformation

Figure 12 - Intradermal injection

## 4. SUBCUTANEOUS INJECTION:

Administration of medication into hypodermis (the layer of fat located beneath the skin), ideal for substances that require slow and steady absorption, such as insulin and anticoagulants.

### INDICATIONS

Medications requiring slow absorption

### REQUIRED MATERIALS:

- Small-capacity syringe (0.5–2 ml)
- Thin hypodermic needle (30–52 mm)
- Medicinal solution (isotonic or oily)
- Disinfectant swab
- Disposable gloves

### INJECTION SITES FOR SUBCUTANEOUS INJECTION (Figure 13):

- Outer surface of the upper arm – deltoid region
- Abdomen – periumbilical region
- Anterolateral region of the thigh

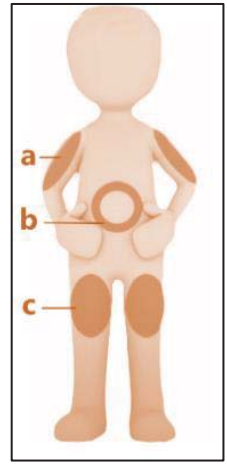


Figure 13 - Injection site - subcutaneous injection: a. deltoid region, b. periumbilical region, c. anterolateral thigh region

TECHNIQUE (Figure 14)

- Obtain informed consent
- Position the patient comfortably
- Identify the injection site
- Disinfect the skin
- Using the left hand, create a skin fold between the thumb and index finger
- Insert the needle parallel to the skin, about 2–3 cm deep into the fold, without penetrating the muscle layer
- Gently aspirate to verify needle placement
- Slowly inject the medication

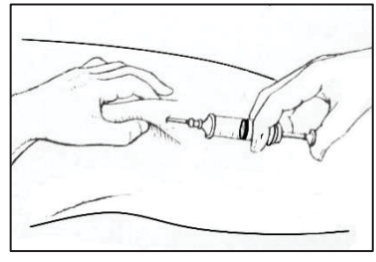

Figure 14 - Injection technique for subcutaneous injection

## 5. INTRA-ARTERIAL INJECTION

A rare method of administering medication directly into arteries.

Primarily used in interventional radiology, oncology, localized pain management, and arterial blood sampling (e.g., ABG – Arterial Blood Gas analysis).

May require imaging guidance: fluoroscopy, ultrasound, or CT

## INDICATIONS

- Administration of vasodilators or antispasmodic agents
- Angiography – iodinated contrast agents for diagnostic or exploratory purposes
- Intra-arterial chemotherapy – localized treatment of tumors or metastases:
    - Hepatic artery – for liver metastases
    - Superior hemorrhoidal artery – for unresectable colorectal lesions
- Administration of contrast agents in imaging procedures
- Chronic pain management – in selected cases (e.g., complex regional pain syndrome)
- Thrombolytic therapy – for acute ischemic events (e.g., stroke, myocardial infarction)

## RISKS

- Increased risk of ischemia due to endothelial irritation or vasoconstriction
- Tissue necrosis
- Severe pain during injection

## INJECTION SITES

- Radial artery
- Femoral artery
- Aorta
- Brachial artery (more difficult due to small caliber; may require surgical exposure)

## TECHNIQUE

- Aseptic preparation of the site
- Locate arterial pulse using the index and middle fingers of the left hand
- Puncture the skin with the needle perpendicular to the artery
- Imaging guidance may be used
- Aspirate to create pressure, then advance the needle until bright red arterial blood appears in the syringe
- Slowly inject the medication
- Withdraw the needle firmly
- Apply compression for several minutes using an alcohol-soaked swab

## BLOOD COLLECTION

### DEFINITION

A medical procedure used to obtain a blood sample for diagnostic, monitoring, or preventive purposes.

### TYPES OF BLOOD COLLECTION

- Venipuncture – the most common method
- Capillary puncture – mainly used in children or for rapid tests (e.g., blood glucose, bleeding time, coagulation)
- Arterial puncture – for specialized tests (e.g., arterial blood gases – ABG)
- Can be performed using a syringe and needle or a Vacutainer system.

### REQUIRED MATERIALS (Figure 15)

- Vacutainers – special tubes with colored caps depending on the test type (Table1)
- Holder – supports the needle and Vacutainer
- Double-ended needle – specific to the Vacutainer system
- Tourniquet
- Disposable gloves
- Sterile swabs with alcohol or antiseptic
- Barcode labels – for sample identification
- Kidney tray – for organizing materials
- Biohazard container – for contaminated materials


Figure 15 - a. vacutainer, b. holder, c. double needle for vacutainer

Table 1: VACUTAINER TUBE GUIDE

| COLOR | ADDITIVE | COMMON TESTS |
|---|---|---|
| RED | NONE | Biochemistry, serology |
| PURPLE/VIOLET | EDTA (ANTICOAGULANT) | Complete blood count (cbc), hematology tests |
| LIGHT BLUE | SODIUM CITRATE (9:1) | Coagulation tests (e.g., PT, APTT) |
| GREEN | HEPARIN | Blood gases, plasma biochemistry |
| BLACK | SODIUM CITRATE 3.8% | Esr (erythrocyte sedimentation rate) |
| GRAY | SODIUM FLUORIDE + POTASSIUM OXALATE | Glucose, lactate |
| YELLOW | GEL SEPARATOR + SPECIAL ADDITIVE | Microbiological cultures |

# INFUSION THERAPY

## DEFINITION

A form of treatment used to administer medications, electrolytes, solutions, and nutrients intravenously.

## TYPES OF INFUSION SOLUTIONS

### 1. MEDICATIONS:

- Diluted in crystalloid solutions (e.g., antibiotics, analgesics, antispasmodics, vitamins)
- Direct infusion from pre-filled vials (e.g., analgesics, antibiotics)

### 2. HYDRO-ELECTROLYTIC SOLUTIONS:

- Used to regulate fluid and mineral balance

### 3. ACID–BASE SOLUTIONS

- Used to correct blood pH levels

**4. PARENTERAL NUTRITION SOLUTIONS -** Artificial nutritional support containing amino acids, glucose, lipids, and electrolytes (Figure 16):

- Kabiven
- Smof Kabiven
- Olimel
- Nutriflex
- Aminoven
- Intralipid
- Hypertonic glucose
- Lipofundin


Figure 16 - Solutions for parenteral nutrition

**5. ARTIFICIAL BLOOD AND PLASMA SUBSTITUTES -** Solutions that restore hydro-electrolytic volume and partially mimic the properties of blood and plasma

Classification by Particle Size and Membrane Permeability

**A. Crystalloids** – Small molecules (Figure 17).

- Rapidly restore circulating volume
- Quickly distribute into the extracellular space
- Commonly used for fluid and electrolyte imbalance, especially in volume resuscitation

Crystalloids are administered in emergency situations, but when given in large volumes, they can lead to edema and hypoproteinemia.

**Examples:**

- Isotonic saline (0.9% NaCl)
- Hypertonic saline (3% or 7.5% NaCl) – for severe hyponatremia with cerebral edema risk
- Ringer's lactate
- Osmofundin
- Glucose 5%, 10%
- Sodium bicarbonate solution
- Combined electrolyte solutions (e.g., Plasma-Lyte)


Figure 17 - Crystalloids

**B. Colloids –** macromolecular substances (Large molecules). Remain longer in the intravascular space, do not easily cross capillary membranes. Maintain oncotic pressure and increase intravascular volume.

Used in severe hypovolemic or hemorrhagic shock. May cause allergic reactions and coagulation disorders (Figure 18).

**Examples:**

- Albumin 5% or 20%
- Gelofusine (modified gelatin)
- Dextran 40 / 70 (synthetic polysaccharides – plasma expanders)
- Gelatins (e.g., Haemaccel – collagen derivatives)
- Hydroxyethyl starch (HES)
- Fresh frozen plasma


Figure 18 - Colloids

## REQUIRED MATERIALS

- Venipuncture tools: needle, butterfly needle, cannula, syringe
- Infusion set
- Transfusion kit
- Auxiliary materials (Figure 19)

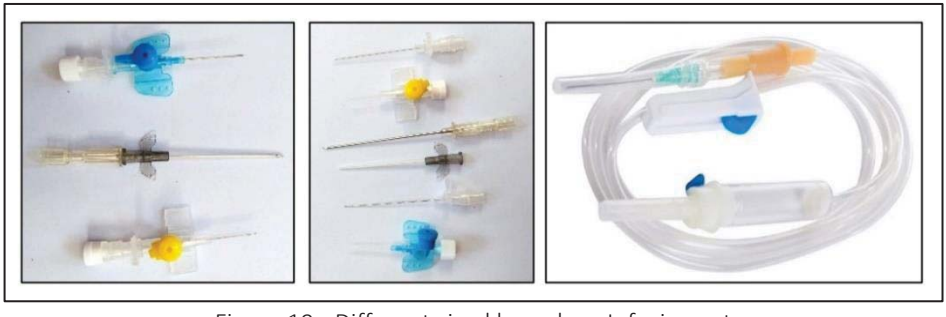

Figure 19 - Different sized branches, Infusion set

## COMPONENTS OF AN INFUSION SET (PERFUSOR)

- Trocar Protective Cap
- Trocar– Sharp, made of ABS (Cannula, Needle)
- Air filter
- Air intake cap
- Drip chamber (filling chamber)
- Fluid Filter
- PVC connector tube
- Flow Regulator (roller clamp)
- Injection port – flexible rubber
- Luer lock needle connector
- Needle with protective cap (Figure 20).

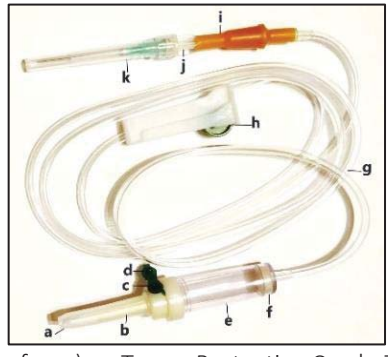


Figure 20 - Infusion Set (Perfusor): a. Trocar Protective Cap b. Trocar (Cannula, Needle) – Sharp, made of ABS c, d. Air Filter + Air Intake Cap e. Drip Chamber (Filling Chamber) f. Fluid Filter g. PVC Connector Tube h. Flow Regulator (Roller Clamp) i. Injection Port – Flexible Rubber j. Luer Lock Needle Connector k. Needle with Protective Cap

## INFUSION SYSTEM SETUP

- Unpack the infusion kit and remove the protective needle cap
- Purge air from the infusion set by allowing solution to flow through
- Secure the infusion set to the IV stand with the roller clamp locked
- Perform venipuncture and insert the needle or cannula (Figure 21)

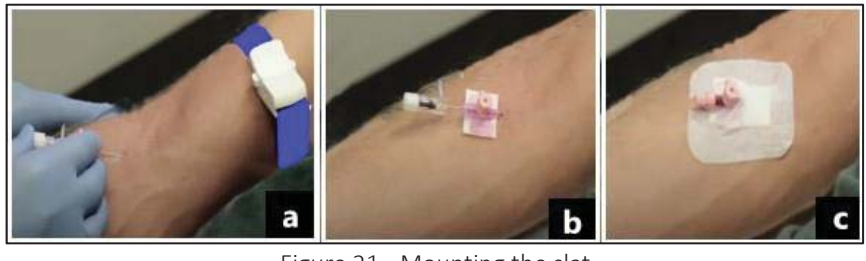


Figure 21 - Mounting the slat

- System fixation – secure the infusion set properly
- Flow rate adjustment – a 500 mL infusion is administered slowly over approximately 1–2 hours, depending on the solution content and patient needs. The usual rate is 50–70 drops per minute (Figure 22)
- Monitoring – observe the patient and infusion site throughout the procedure
- At the end of the procedure, the cannula may be retained (by sealing the designated cap) or removed

Figure 22 – infusion during surgery, infusion for medication administration

## ADVANTAGES

- Rapid and efficient absorption
- Bypasses the digestive tract
- Allows for personalized treatment

## RISKS

- Local infections
- Electrolyte imbalances
- Allergic reactions (rare)
- Fluid overload in patients with cardiac or respiratory conditions

# BLOOD TRANSFUSION

## DEFINITION

A medical procedure in which blood or blood components are administered into a patient's circulatory system. It is a biological treatment, comparable to a tissue graft, and must comply with immunological and compatibility laws, particularly the ABO and Rh systems.

## ABO SYSTEM

The ABO system classifies blood based on the presence or absence of antigens A and B, which are carbohydrate molecules attached to proteins or lipids on the surface of red blood cells. These antigens determine a person's blood type and are critical for transfusion compatibility — acting like "labels" on red blood cells.

### ANTI-A AND ANTI-B ANTIBODIES

These are natural agglutinins found in the plasma of individuals who lack antigen A or B on their red blood cells. They are produced in response to environmental exposure to A and B antigens (e.g., on bacteria), which stimulate the immune system from early childhood. In cases of incompatible transfusion, these antibodies attack red blood cells carrying foreign antigens (Table 2).

Table 2: DISTRIBUTION OF ANTIGENS AND AGGLUTININS BY BLOOD TYPE

| Blood group | Antigens on RBCS | Agglutinins in serum | | International formula | Complete formula |
|---|---|---|---|---|---|
| O (I) | - | ALPHA | ANTIA | O (I) ALPHA BETA | O (ALPHA, BETA) |
| | | BETA | ANTI B | | |
| A (II) | A | BETA | ANTI B | A (II) BETA | A(BETA) |
| B (III) | B | ALFA | ANTI A | B (III)ALFA | B(ALFA) |
| AB (IV) | A | - | - | AB(IV) | AB (0) |
| | B | - | - | | |

Group O has no antigens but both anti-A and anti-B antibodies → universal donor.

Group AB has both antigens and no antibodies → universal recipient.

## RH SYSTEM

In the general population, the D antigen (Rh factor) is a transmembrane protein found on red blood cells. Rh compatibility is crucial in transfusions and pregnancy.

If a person has the D antigen → Rh positive

If the D antigen is absent → Rh negative

In transfusions, it is crucial to respect Rh compatibility. During pregnancy, Rh incompatibility between the mother and fetus can lead to hemolytic disease of the newborn.

- 84% of people are Rh positive (+)
- 16% are Rh negative (–)

Rh-positive individuals do not produce anti-Rh antibodies because their immune system recognizes the D antigen as self.

Normally, the serum (plasma) of Rh-negative individuals does not contain anti-Rh agglutinins (i.e., antibodies against the D antigen). However, these antibodies can develop through isoimmunization, such as:

- Repeated Rh-positive transfusions in Rh-negative individuals
- Pregnancy where the father is Rh-positive and the mother is Rh-negative

## INDICATIONS FOR TRANSFUSION

- Massive hemorrhage – hypovolemic shock (trauma, surgery, GI bleeding)
- Severe anemia syndromes
- Coagulopathies, hemophilia, thrombocytopenia, disseminated intravascular coagulation (DIC) – (fresh frozen plasma or platelet concentrate is indicated)
- Hematologic/oncologic treatments (e.g., leukemia, myelodysplasia)
- Bone marrow failure – small, repeated transfusions to stimulate hematopoiesis
- Detoxification – replacing toxin-laden blood with fresh blood (e.g., severe poisoning)
- Preoperative preparation for major surgeries with anticipated blood loss

## CONTRAINDICATIONS FOR BLOOD DONATION

### ABSOLUTE CONTRAINDICATIONS

- Age over 65

- Infectious diseases: hepatitis (HBsAg+), syphilis, malaria, HIV/AIDS
- Epilepsy
- Drug or food allergies
- Malignant blood disorders
- Type I diabetes mellitus

### RELATIVE CONTRAINDICATIONS

- GI conditions (polyps, hemorrhoids, ulcers)
- Dermatological conditions
- Type II diabetes mellitus
- Gout (during remission)

### TEMPORARY CONTRAINDICATIONS

- Menstruation, pregnancy, breastfeeding
- Recovery from viral hepatitis – 1 year
- Recent surgery
- Blood/plasma transfusion within the last 6 months
- Vaccinations: tetanus (24 hours), rabies (1 year)
- Dental extractions (3–5 days)
- Fever
- Anemia

## TYPES OF TRANSFUSION SOLUTIONS

### WHOLE BLOOD

- Fresh
- Preserved (loses biological properties but retains oxygen transport capacity)

**PACKED RED BLOOD CELLS (PRBCS)** – caution in patients with leukemia, cardiac conditions, or hypochromic anemia

**LEUKOCYTE CONCENTRATE** – obtained via centrifugation and extraction of the buffy coat

**PLATELET CONCENTRATE** – indicated in severe thrombocytopenia and massive transfusions. Limitations: short platelet lifespan and risk of viral transmission (hepatitis, HIV, CMV)

### BLOOD SUBSTITUTES (NATURAL/BIOLOGICAL)

- Plasma (whole, defibrinated, frozen, dried) – may transmit hepatitis

- Human albumin – maintains oncotic pressure; does not transmit hepatitis
- Globulin solution 6% at pH 7.4

## ROUTES OF ADMINISTRATION

- Intravenous
- Intra-arterial
- Intracardiac
- Intraosseous

## REQUIRED MATERIALS

- Venipuncture tools
- Transfusion set
- Auxiliary materials:
    - IV stand
    - Antiseptic, needle/cannula, syringe, tourniquet, adhesive

## PROCEDURE

- Remove the metal cap
- Unpack the transfusion kit, remove needle, allow blood to flow
- Eliminate air from the system
- Perform venipuncture
- Assemble the system
- Adjust flow rate: 20–40 drops/min
- Monitor the patient

### TRANSFUSION DURATION

- Red blood cell concentrates: 2–4 hours
- Plasma / platelets: 30–60 minutes
- May be accelerated in emergencies with strict monitoring

## COMPLICATIONS AND INCIDENTS

- Incompatible blood transfusion → acute hemolytic reaction (donor RBCs destroyed by recipient antibodies)
- Hypothermia – transfusion of cold blood
- Transmission of infectious diseases:
    - Hepatitis B, C
    - HIV
    - Syphilis
    - Malaria

    - Cytomegalovirus
- Allergic reactions:
    - Febrile responses, chills (anti-leukocyte alloantibodies)
    - Reactions to preserved blood
- Circulatory overload
- Post-transfusion hemosiderosis
- Post-transfusion purpura – severe thrombocytopenia due to anti-platelet antibodies
- Technical errors
- Pulmonary complications – due to leukocyte or platelet aggregates in stored blood
- Post-transfusion immunosuppression