**Study Material: Anticoagulants, Antiplatelets & Thrombolytics**

**Learning Objectives**

By the end of this module, you should be able to:

* Understand the **mechanism of action** of anticoagulants, antiplatelets, and thrombolytics.
* Identify common **examples** in each drug class.
* Explain the **clinical indications** for each group.
* Recognize **adverse effects** and **precautions**.
* Differentiate between drug classes based on **site of action** in the hemostatic process.

**I. Introduction to Hemostasis**

Hemostasis is a **natural defense mechanism** to prevent blood loss. It involves:

1. **Vasoconstriction**
2. **Platelet aggregation** (Primary hemostasis)
3. **Fibrin clot formation** (Secondary hemostasis)

When overactive, these processes can cause **thrombosis**, which requires **pharmacological intervention** using:

* **Anticoagulants**
* **Antiplatelets**
* **Thrombolytics**

**II. Anticoagulants**

**Mechanism of Action**

Anticoagulants interfere with the **coagulation cascade**, primarily affecting clotting factors to **prevent fibrin formation**.

**Clinical Uses**

* Deep vein thrombosis (DVT)
* Pulmonary embolism (PE)
* Atrial fibrillation (stroke prevention)
* Mechanical heart valves
* Post-surgical thromboprophylaxis

**Types of Anticoagulants**

**1. Heparin (Unfractionated and LMWH)**

* **MOA**: Enhances activity of **antithrombin III**, which inhibits **thrombin (IIa)** and **Factor Xa**.
* **Examples**: Heparin, Enoxaparin (LMWH)
* **Monitoring**: aPTT (for UFH), anti-Xa levels (for LMWH)
* **Antidote**: **Protamine sulfate**

**2. Vitamin K Antagonists**

* **MOA**: Inhibit synthesis of **Vitamin K-dependent clotting factors** (II, VII, IX, X)
* **Drug**: **Warfarin**
* **Monitoring**: INR (target 2.0–3.0)
* **Antidote**: **Vitamin K**, Fresh frozen plasma (FFP)

**3. Direct Oral Anticoagulants (DOACs)**

* **Factor Xa Inhibitors**: Rivaroxaban, Apixaban
* **Direct Thrombin Inhibitors**: Dabigatran
* **No routine monitoring required**
* **Antidotes**:
  + **Dabigatran** – Idarucizumab
  + **Rivaroxaban/Apixaban** – Andexanet alfa

**III. Antiplatelet Drugs**

**Mechanism of Action**

Inhibit **platelet activation and aggregation**, primarily targeting **primary hemostasis**.

**Clinical Uses**

* Prevention of **myocardial infarction (MI)**
* **Ischemic stroke**
* **Coronary artery disease**
* **Post-angioplasty or stent placement**

**Types of Antiplatelets**

**1. Cyclooxygenase (COX) Inhibitors**

* **Drug**: **Aspirin**
* **MOA**: Irreversibly inhibits COX-1 → ↓ Thromboxane A2 synthesis → ↓ platelet aggregation
* **Low dose (75–150 mg/day)** for antiplatelet effect

**2. ADP Receptor Blockers (P2Y12 Inhibitors)**

* **Drugs**: Clopidogrel, Prasugrel, Ticagrelor
* **MOA**: Inhibit P2Y12 receptors on platelets → block ADP-mediated aggregation

**3. Glycoprotein IIb/IIIa Inhibitors**

* **Drugs**: Abciximab, Eptifibatide, Tirofiban
* **MOA**: Block final common pathway for platelet aggregation

**IV. Thrombolytics (Fibrinolytics)**

**Mechanism of Action**

Dissolve already formed clots by converting **plasminogen → plasmin**, which degrades **fibrin**.

**Clinical Uses**

* Acute **myocardial infarction** (STEMI)
* Acute **ischemic stroke**
* Massive **pulmonary embolism**
* Severe **DVT or limb-threatening thrombosis**

**Examples of Thrombolytics**

| **Drug** | **Notes** |
| --- | --- |
| **Alteplase (tPA)** | Recombinant tissue plasminogen activator |
| **Reteplase** | Longer half-life variant of tPA |
| **Tenecteplase** | Single-bolus tPA derivative |
| **Streptokinase** | Derived from Streptococci; antigenic |

**V. Adverse Effects & Contraindications**

| **Drug Class** | **Major Adverse Effect** | **Contraindications** |
| --- | --- | --- |
| Anticoagulants | Bleeding, heparin-induced thrombocytopenia (HIT) | Active bleeding, recent surgery, severe HTN |
| Antiplatelets | GI bleeding, dyspepsia | Peptic ulcer, bleeding disorders |
| Thrombolytics | Intracranial hemorrhage | Recent stroke, trauma, uncontrolled HTN |

**VI. Summary Table**

| **Class** | **Target** | **Example** | **Effect** |
| --- | --- | --- | --- |
| Anticoagulants | Coagulation factors | Warfarin, Heparin | Prevent clot propagation |
| Antiplatelets | Platelet function | Aspirin, Clopidogrel | Prevent clot formation |
| Thrombolytics | Fibrin in clots | Alteplase, Streptokinase | Dissolve existing clots |

**VII. Key Points for Exams & Practice**

* **Aspirin** is the first-line drug for **MI prevention**.
* **Heparin** is preferred in **hospital setting** due to rapid onset.
* **Warfarin** requires **INR monitoring** and is affected by diet and drugs.
* **DOACs** are preferred for convenience but require renal function monitoring.
* **tPA** is time-sensitive in **stroke**—ideally within **4.5 hours** of symptom onset.