



Anticoagulant and Antiplatelet Drugs

جامعة ساوة
كلية التقنيات الصحية والطبية
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المرحلة الثانية

Introduction

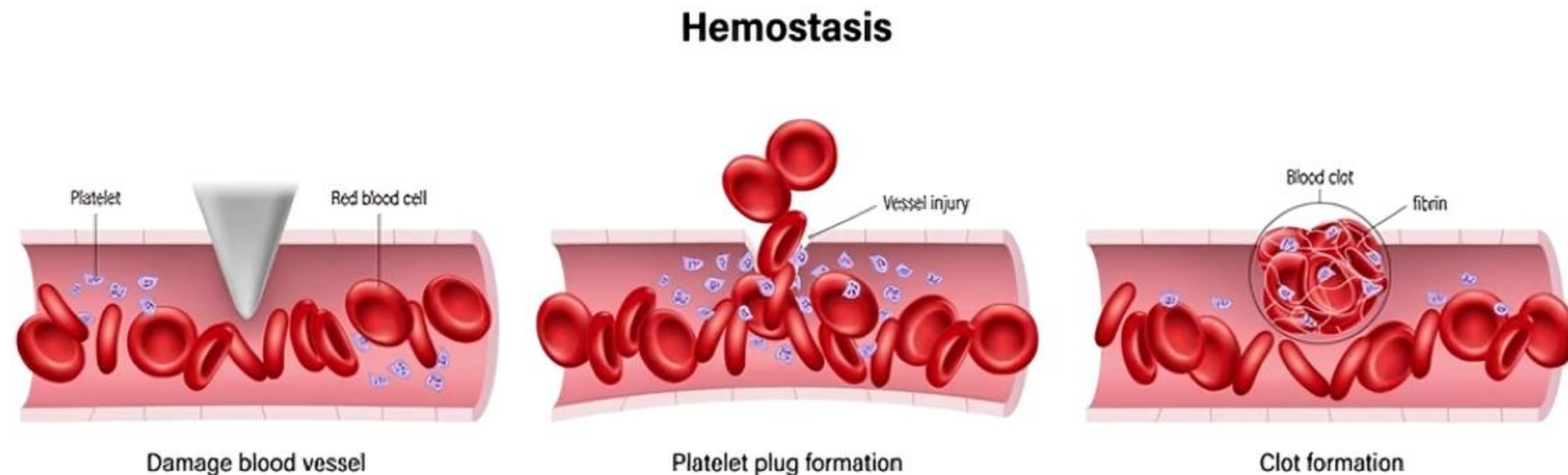
Blood normally circulates as a fluid. When a blood vessel is injured, a process called **hemostasis** prevents excessive bleeding.

Hemostasis involves:

- **Vasoconstriction** (narrowing of the vessel)
- **Platelet plug formation**
- **Coagulation** (clot formation)

Drugs that interfere with these processes are:

- **Anticoagulants:** prevent blood clot formation.
- **Antiplatelet agents:** prevent platelets from sticking together.
- **Thrombolytic agents:** dissolve existing clots



Introduction

Coagulation Mechanism (Simplified)

When a blood vessel is injured:

1. Platelets adhere to the damaged site.
2. Coagulation factors (proteins) are activated in a chain reaction (the **coagulation cascade**).
3. This leads to the conversion of **prothrombin** → **thrombin**.
4. Thrombin converts **fibrinogen** → **fibrin**, forming a stable clot.

NOTE

The clot must be **large enough to stop bleeding**, but **not too large** to block blood flow — hence the need for these drugs to maintain balance.

Classification of Anticoagulant Drugs

A. Parenteral (injectable) anticoagulants

1. Heparin

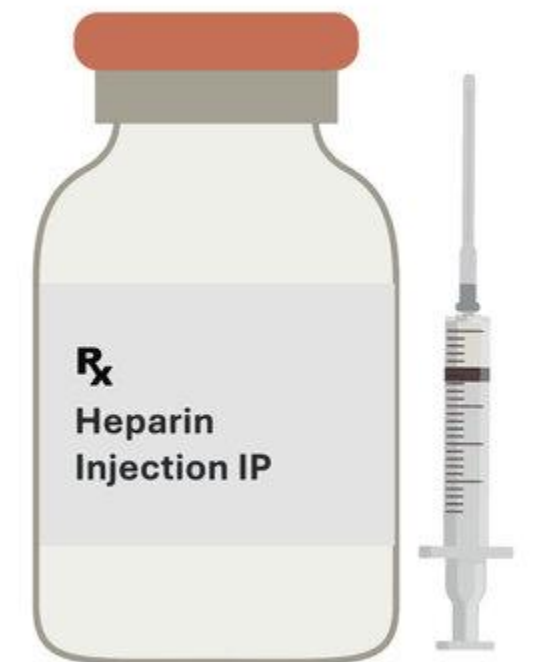
- Unfractionated Heparin (UFH)
- Low Molecular Weight Heparin (LMWH): e.g. *Enoxaparin*, *Dalteparin*

B. Oral anticoagulants

1. Warfarin (Coumarin derivative)

2. Direct Oral Anticoagulants (DOACs):

- *Dabigatran* (direct thrombin inhibitor)
- *Rivaroxaban*, *Apixaban*, *Edoxaban* (factor Xa inhibitors)



Mechanism of Action

1.Heparin

- Enhances the activity of **Antithrombin III**, a natural inhibitor of clotting factors (mainly **thrombin and factor Xa**).
- Acts immediately when given intravenously.

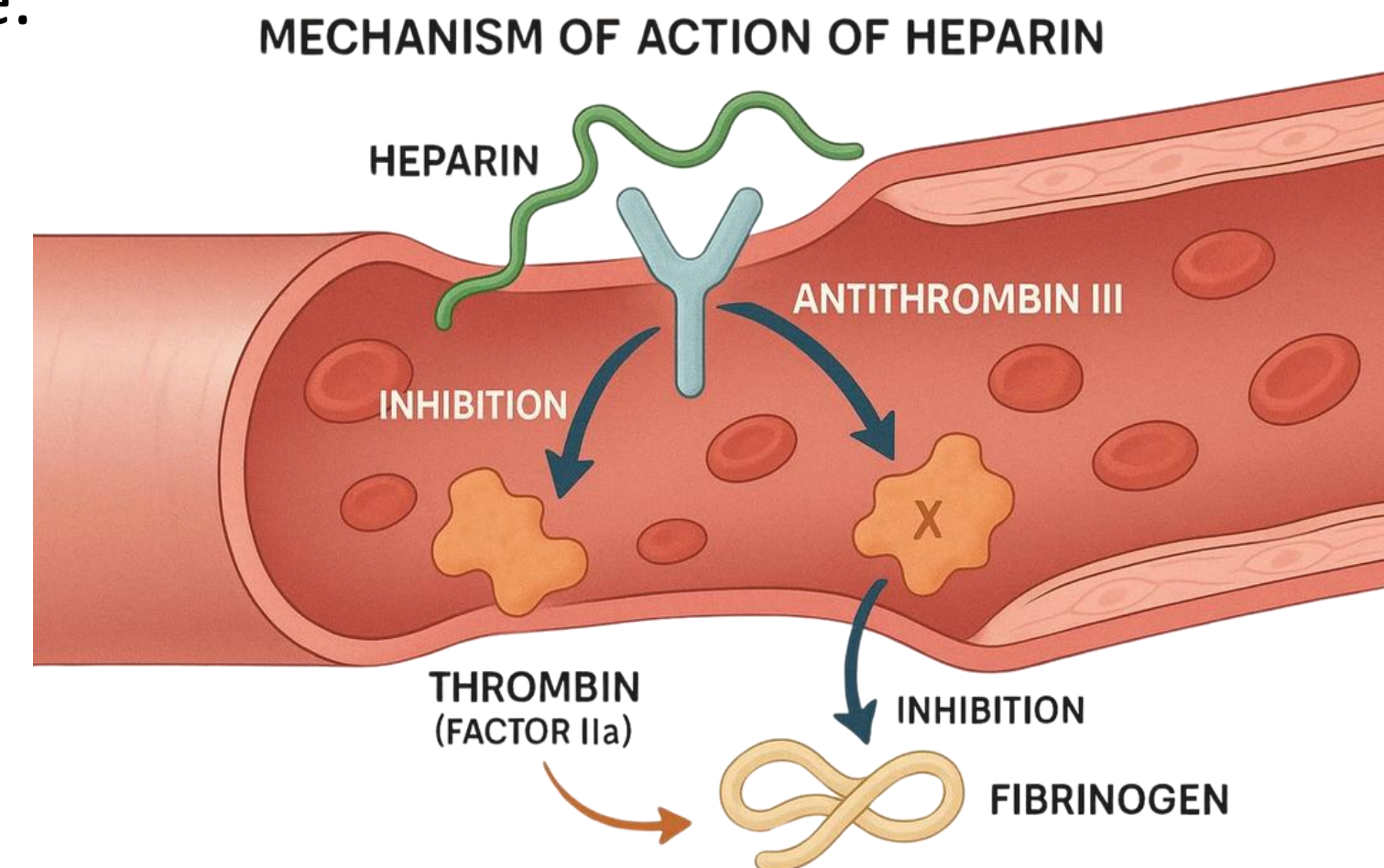
Uses:

- Prevention and treatment of deep vein thrombosis (DVT).
- Pulmonary embolism.
- During surgery and dialysis to prevent clotting in the machine.

Adverse effects:

- Bleeding (most important).
- Heparin-induced thrombocytopenia (HIT).
- Osteoporosis (with long-term use).

Antidote: *Protamine sulfate* (neutralizes heparin).

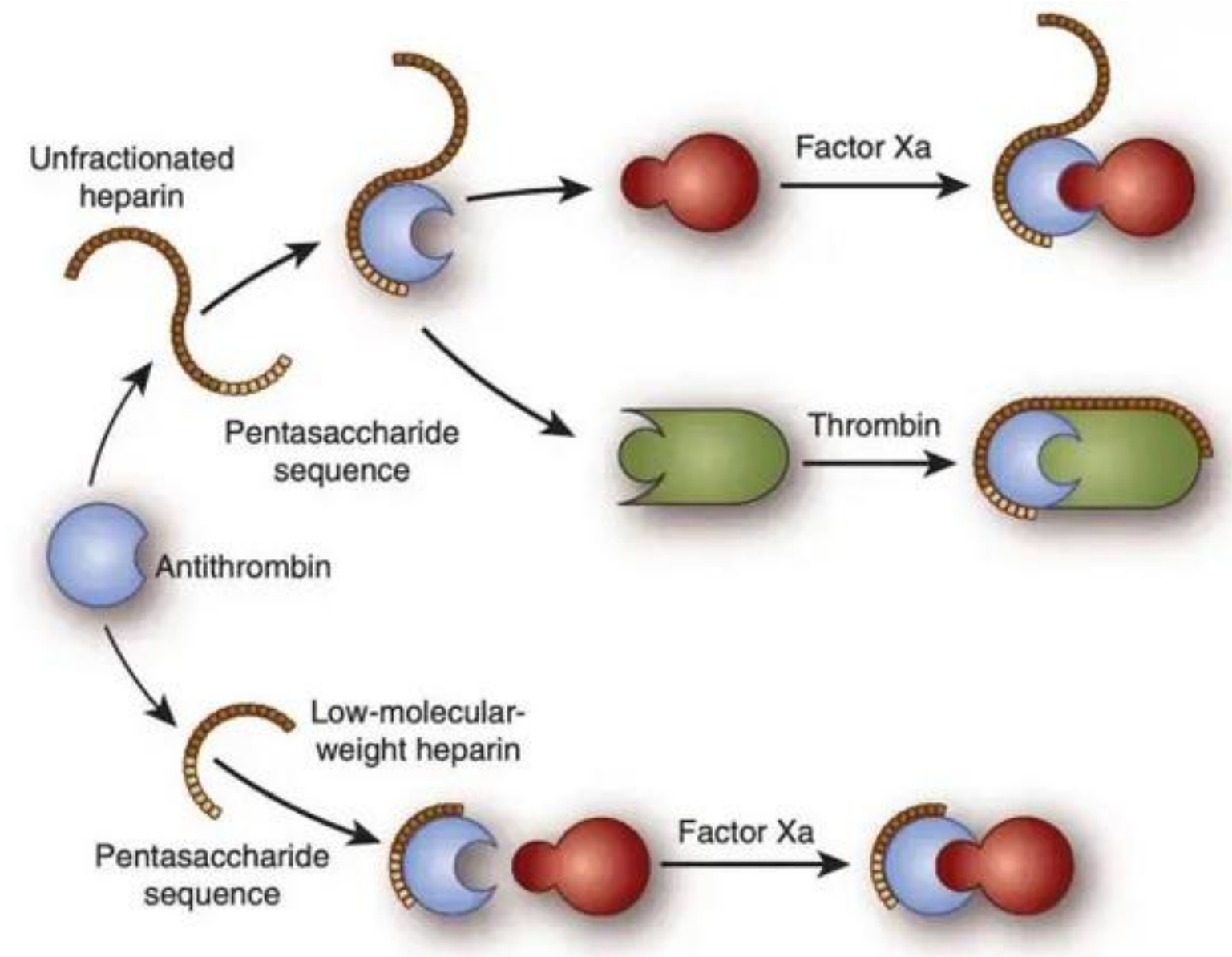


Mechanism of Action

2. Low Molecular Weight Heparins (LMWHs)

- Act mainly on **factor Xa**.
- Longer duration of action.
- Given subcutaneously.
- Lower risk of bleeding than unfractionated heparin.

Examples: *Enoxaparin, Dalteparin.*



Mechanism of Action

3. Warfarin

- Inhibits **vitamin K-dependent clotting factors** (II, VII, IX, X).
- Taken orally.
- Takes **2–3 days** to start working.

Uses:

- Long-term prevention of thromboembolism in patients with atrial fibrillation or prosthetic heart valves.

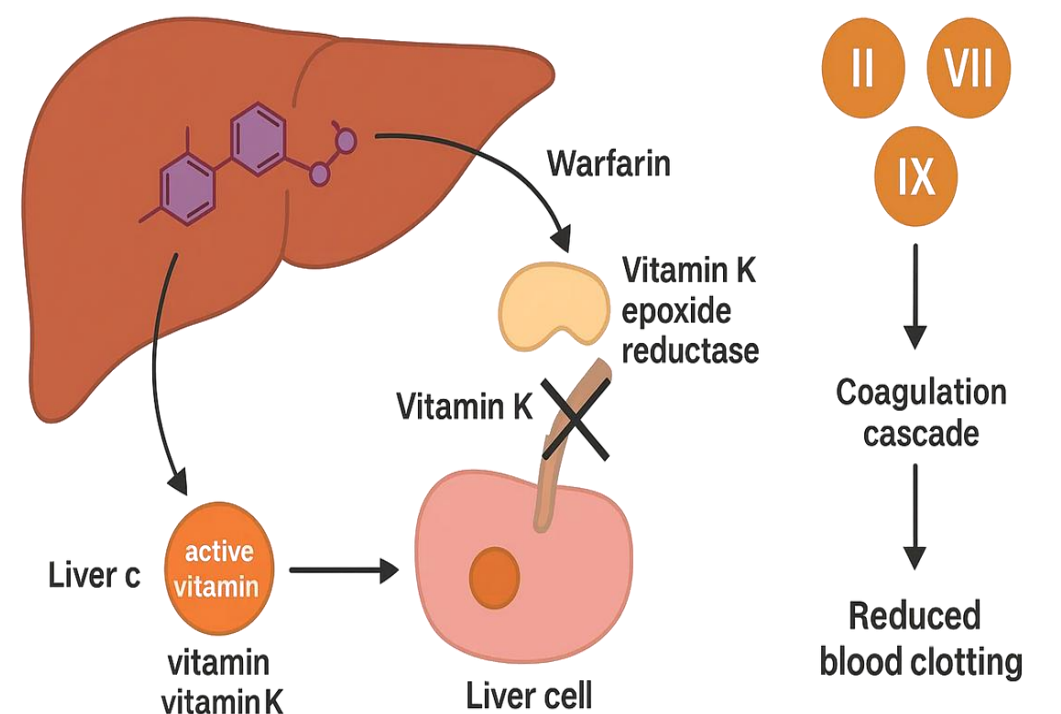
Adverse effects:

- Bleeding, skin necrosis, teratogenic effects (dangerous in pregnancy).

Antidote: *Vitamin K (phytonadione).*

Monitoring: *INR (International Normalized Ratio)* must be checked regularly.

Mechanism of Action of Warfarin



Mechanism of Action

4. Direct Oral Anticoagulants (DOACs)

1. **Dabigatran**: directly inhibits **thrombin**.

2. **Rivaroxaban, Apixaban, Edoxaban**: inhibit **factor Xa**.

Advantages:

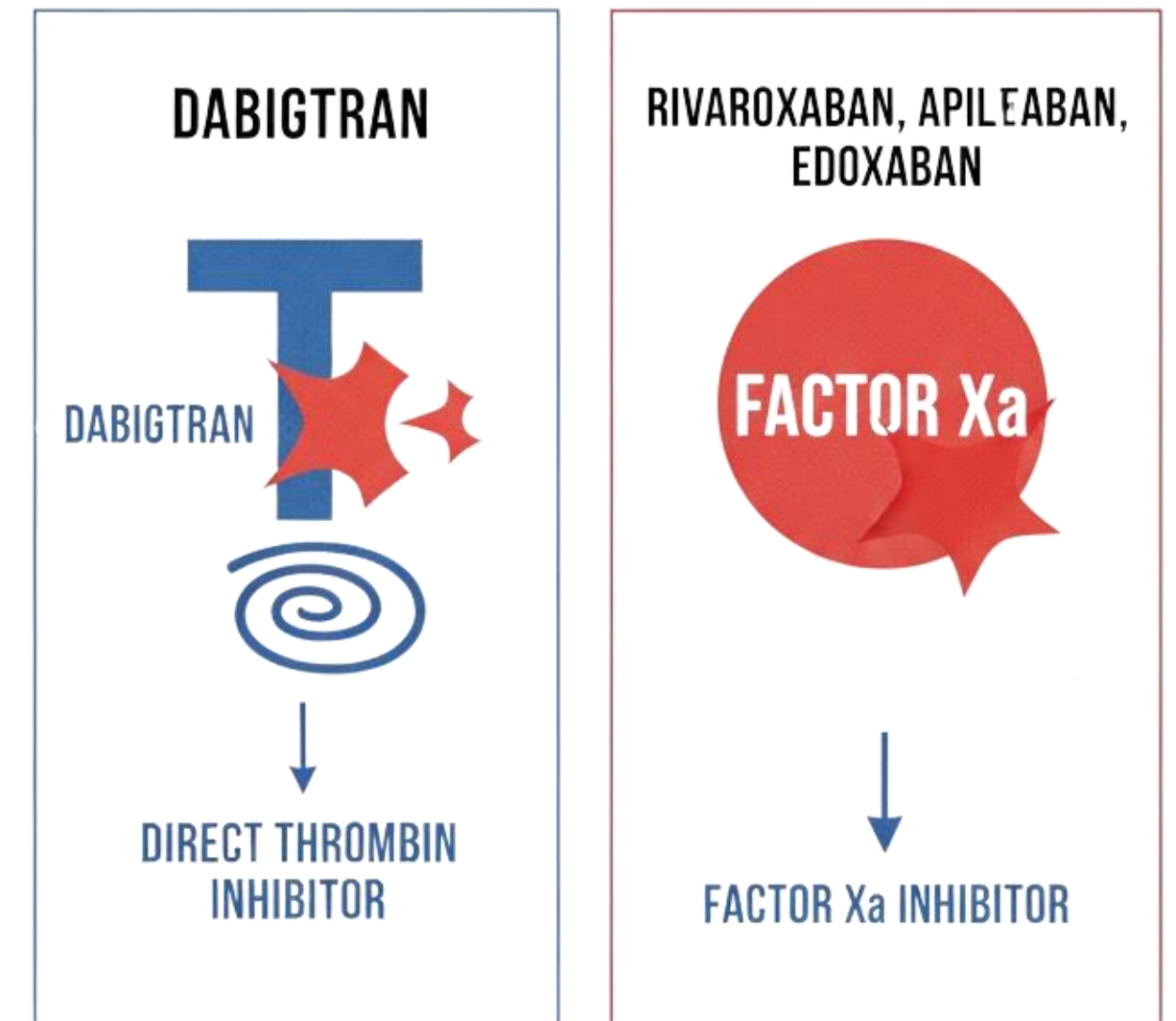
- Fixed dose, no regular blood monitoring needed.
- Rapid onset and offset of action.

Uses:

- Prevention of stroke in atrial fibrillation.
- Prevention of DVT after orthopedic surgery.

Adverse effects:

- Bleeding (no strong antidote for some).
- Expensive.



Antiplatelet Drugs

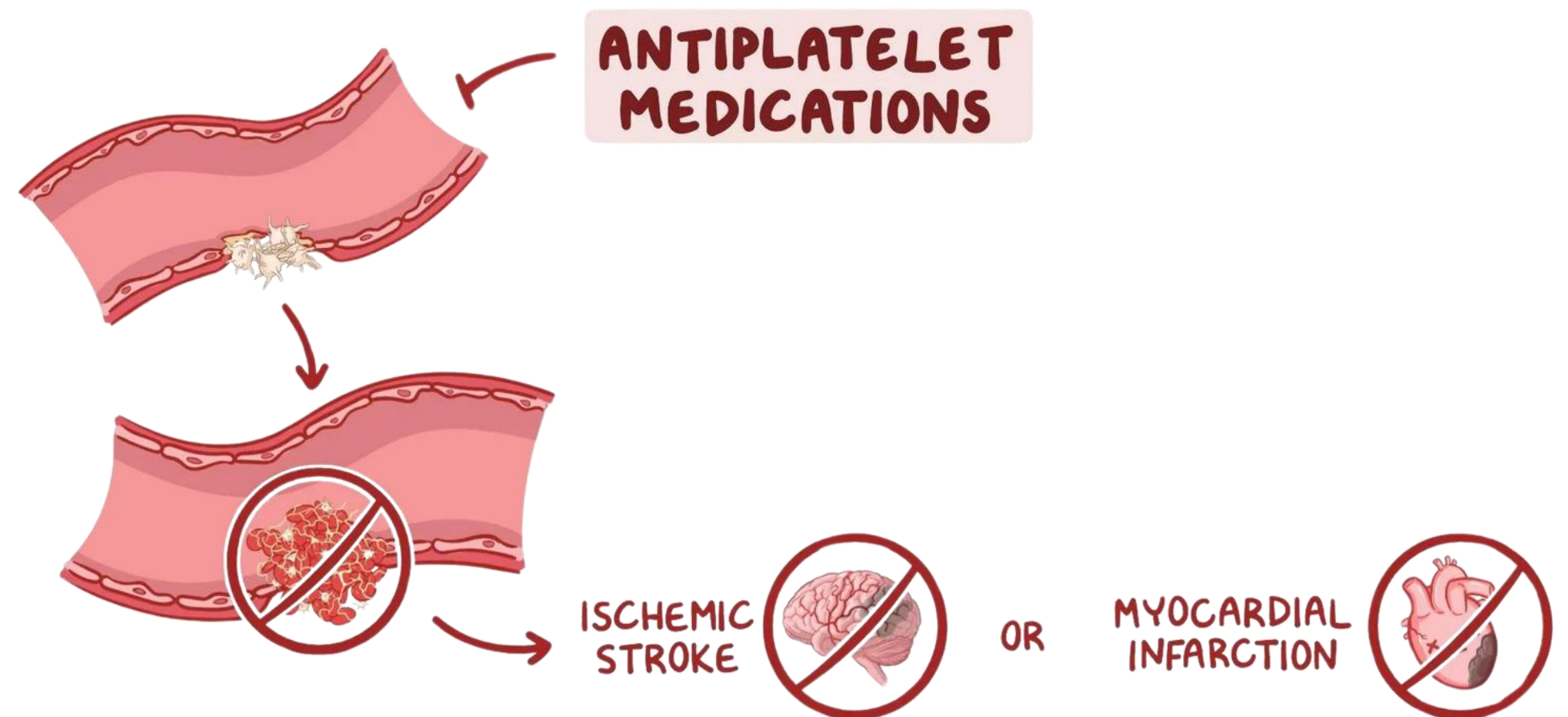
Mechanism of Platelet Aggregation

When a blood vessel is damaged:

1. Platelets attach to the site of injury.
2. They release **ADP, thromboxane A2, and serotonin**, which recruit more platelets.
3. This forms a **platelet plug**.

Antiplatelet drugs interfere with this process.

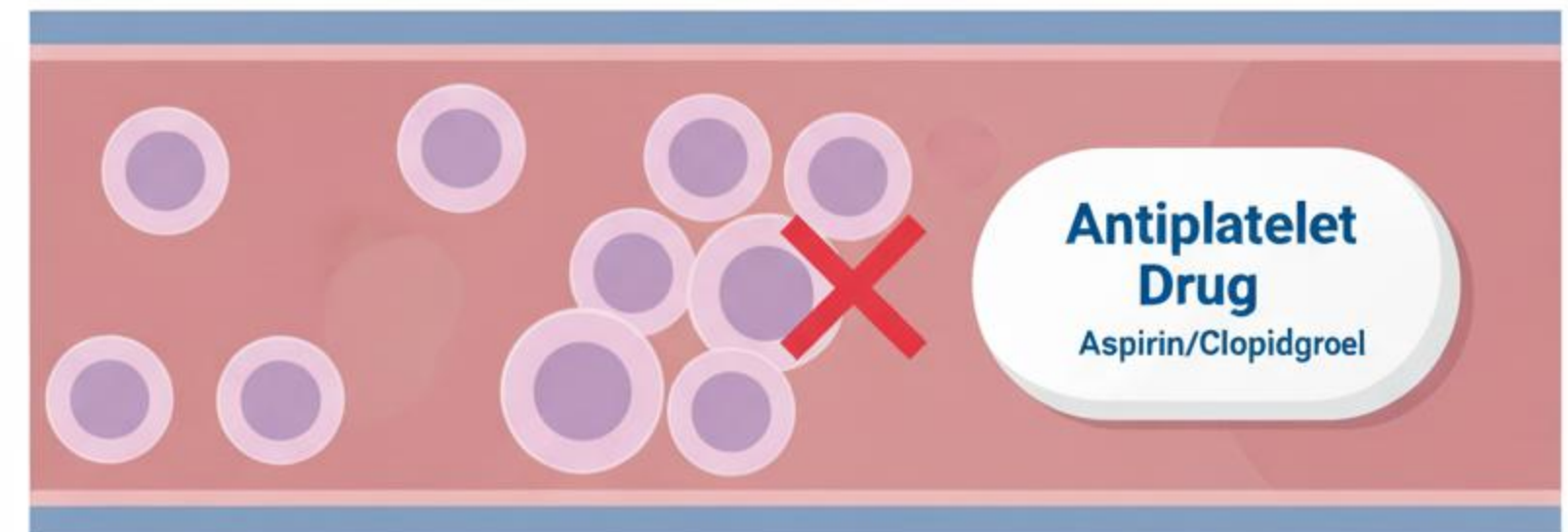
✓ Use to prevent strokes and myocardial infarction



Classification of Antiplatelet Drugs

1. **Cyclooxygenase (COX) inhibitors:**
 - *Aspirin (Acetylsalicylic acid)*
2. **ADP receptor inhibitors (P2Y₁₂ inhibitors):**
 - *Clopidogrel, Prasugrel*
3. **Glycoprotein IIb/IIIa inhibitors:**
 - *Abciximab, Eptifibatide*
4. **Phosphodiesterase inhibitors:**
 - *Dipyridamole*

Antiplatelet drugs prevent platelet aggregation.



Classification of Antiplatelet Drugs

1. Aspirin

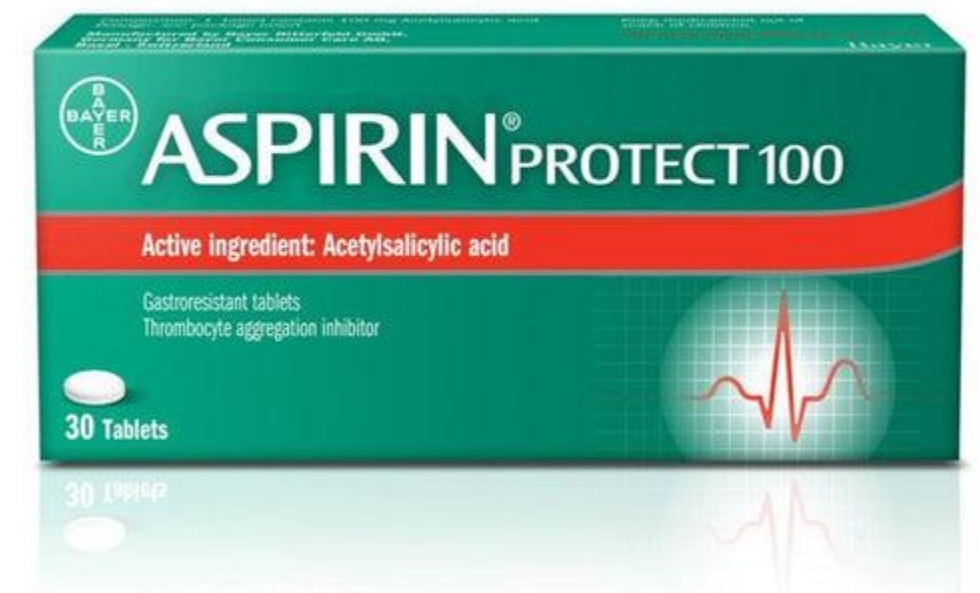
Irreversibly inhibits **COX-1 enzyme**, blocking **thromboxane A2** synthesis.
Prevents platelet aggregation for the life of the platelet (7–10 days).

Uses:

Prevention of myocardial infarction (heart attack).
After cardiac or vascular surgery.
Prevention of stroke.

Adverse effects:

Gastric irritation and ulcer.
Bleeding tendency.
Allergic reactions (rare).



Classification of Antiplatelet Drugs

2.Clopidogrel

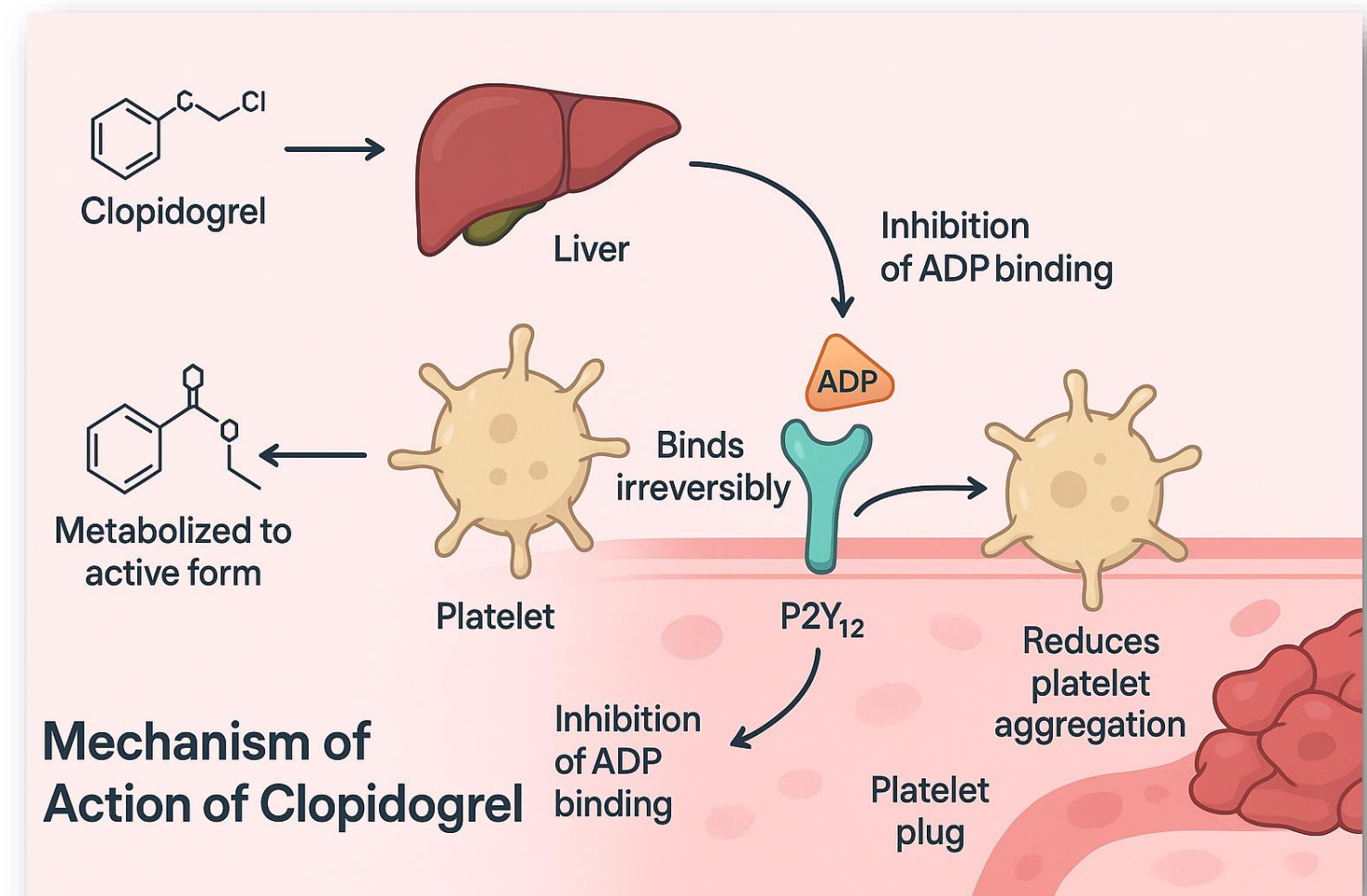
- Blocks the **ADP receptor** on platelets.
- Prevents platelet activation and aggregation.
- Effect lasts 5–7 days after stopping the drug.

Uses:

- Used with aspirin in patients after stent placement.
- Prevention of heart attack and stroke.

Adverse effects:

- Bleeding, rash, diarrhea, rarely neutropenia.



Clinical Importance

- Surgery increases the risk of **thrombosis**, but anticoagulants increase **bleeding risk**.
- must know which patients are taking these drugs, when to stop them, and how to manage bleeding.
- **Examples:**
 - Heparin is stopped **6 hours before surgery**.
 - Warfarin is stopped **3–5 days before**.
 - **Aspirin** is usually continued for cardiac patients unless contraindicated.

