

# Chapter-6

## Pharmacology & Toxicology

### D.Pharma 2<sup>nd</sup> Year Notes

#### Chapter- 6

**Drugs Acting on Blood and Blood Forming Organs Definition, classification, pharmacological actions, dose, indications and contraindications of**

1. Hematinic agents
2. Anti-coagulants
3. Anti-platelet agents
4. Thrombolytic drugs

**Chapter-6 | Pharmacology & Toxicology**

**Drugs Acting on Blood and Blood Forming Organs**

**We learn in this Topic:**

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Definition, classification, pharmacological actions, dose, indications and contraindications of

- Hematinic agents
- Anti-coagulants
- Anti-platelet agents
- Thrombolytic drugs

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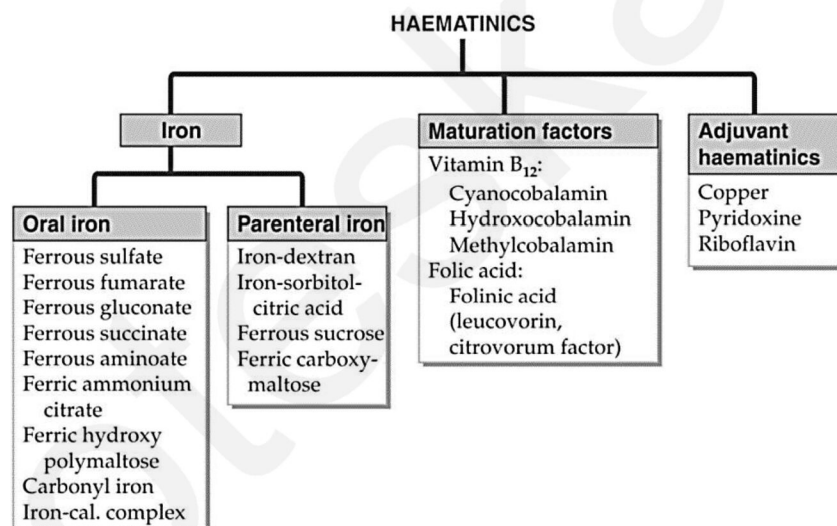
## Drugs Acting on Blood and Blood Forming Organs

- Blood is a fluid connective tissue that transports oxygen, nutrients and growth factors to individual cells of the body.
- The main components of blood are cell (like RBCs, WBCs, platelets), proteins (like coagulation factors, amino acids, growth factors, factors of the complement system), monosaccharide (ribose, glucose), minerals (Na<sup>+</sup>, K<sup>+</sup>, Cl<sup>-</sup>, HCO<sub>3</sub><sup>-</sup>), and water.

### 1. Hematinic agents:

- This medication is an iron supplement used to treat or prevent low blood levels of iron (such as those caused by anemia or pregnancy).

#### Classification:



### Anaemia

- Anaemia is the decrease in number of red blood cells or hemoglobin content caused by blood loss, deficient erythropoiesis, excessive hemolysis, or combination of these changes. Iron deficiency anaemia is probably the most common nutritional deficiency in the world.
- Infants and young children have higher iron requirement.
- Adult women have higher iron requirement because of menstrual losses. During pregnancy it is not necessary to have extra iron in the diet because absorption increases and menstruation stops.

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- The fetus is likely to get enough iron even if its mother has low stores, but mother becomes anaemic.

## Iron:

- Iron helps red blood cells carry oxygen from the lungs to cells all over the body. Iron also plays a role in many important functions in the body.
- The body iron is distributed mainly in two forms, one as haem in hemoglobin and cytochrome oxidase enzyme and other as iron bound to protein as storage compounds ferritin and hemosiderin, and as transport iron bound to transferrin.
- The total iron in human adult is approximately 3.5g.

## Pharmacological actions

Iron is necessary for the production of hemoglobin. Iron-deficiency can lead to decreased production of hemoglobin and a microcytic, hypochromic anemia.

## Dose:

Dose of Iron	
Children	7-12 months   11 mg/day
	1-3 years   7 mg/day
	4-8 years   10 mg/day
	9-13 years   8 mg/day
Males	14-18 years   11 mg/day
	19 years and up   8 mg/day
Females	19-50 years   18 mg/day
	51 years and over   8 mg/day
	Pregnant   27 mg/day
	Breastfeeding   Under 19 years: 10 mg/day 19 years and over: 9 mg/day

## Indications

- Used in preventing and treating iron-deficiency anemia.
- Used in treatment of Fatigue

## Contraindications:

- Stomach upset, Nausea, Vomiting.

## 2. Coagulants and Anticoagulants

### Coagulants:

- Thrombogenesis is an abnormal state of haemostasis leading to the formation of arterial and venous **thrombus, also known as white and red thrombus respectively.**
- **Haemostasis is the** spontaneous arrest of bleeding from the damaged blood vessels.

### Three basic measures taken by the body to reduce and stop blood loss are:

1. Vascular spasm.
2. Platelet plugs formation.
3. Clotting or coagulation.

### Clotting:

- Coagulation, also known as clotting, is the process by which blood changes from a liquid to a gel, forming a blood clot. It potentially results in hemostasis.
- Normally, blood remains liquid as long as it is flowing within intact smooth blood vessels. But on damage to the blood vessel and/or if blood is extracted from the blood vessel.

### Factor of Clotting:

- Fibrinogen
- Prothrombin
- Thromboplastin
- Plasma thromboplastin component
- Hageman factor

**These are the agents that promote coagulation and are mainly used in any haemorrhagic condition.**

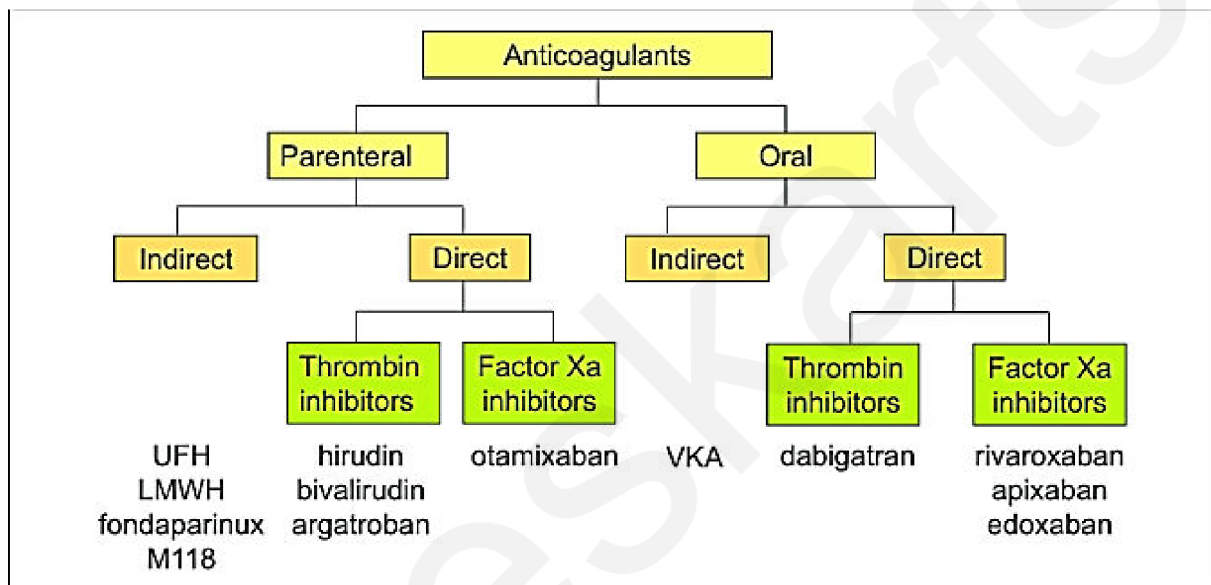
- Vitamin K



## Anticoagulants:

- These are the drugs used to reduce the coagulability of blood clots.
- They're given to people at a high risk of getting clots, to reduce their chances of developing serious conditions such as strokes and heart attacks.
- The most important anticoagulants is heparin.

## Classification:



## Heparin:

Heparin, also known as unfractionated heparin (UFH), is a medication and naturally occurring glycosaminoglycan.

## Pharmacological Action of Heparin:

- Heparin is a sulfated polysaccharide with a molecular weight range of 3000 to 30 000 Da (mean, 15000 Da).
- It produces its major anticoagulant effect by inactivating thrombin and activated factor X (factor Xa) through an antithrombin (AT)-dependent mechanism.
- Heparin binds to AT through a high-affinity pentasaccharide, which is present on about a third of heparin molecules.
- For inhibition of thrombin, heparin must bind to both the coagulation enzyme and AT.



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## Dose:

### Intermittent IV injection

- 8000-10,000 units IV initially, THEN 50-70 units/kg (5000-10,000 units) q4-6hr

### Continuous IV infusion

- 5000 units IV injection, followed by continuous IV infusion of 20,000-40,000 units/24 hr

## Indicated:

- Bleeding
- Pain
- Low blood platelets.
- Thrombocytopenia.
- Greater care is needed in those with poor kidney function.

## Contraindicated:

- Increase the risk of bleeding
- Uncontrolled blood pressure
- Liver disease
- Stroke
- Hypertension
- Chest pain
- Irregular heartbeats
- Shortness of breath
- Dizziness

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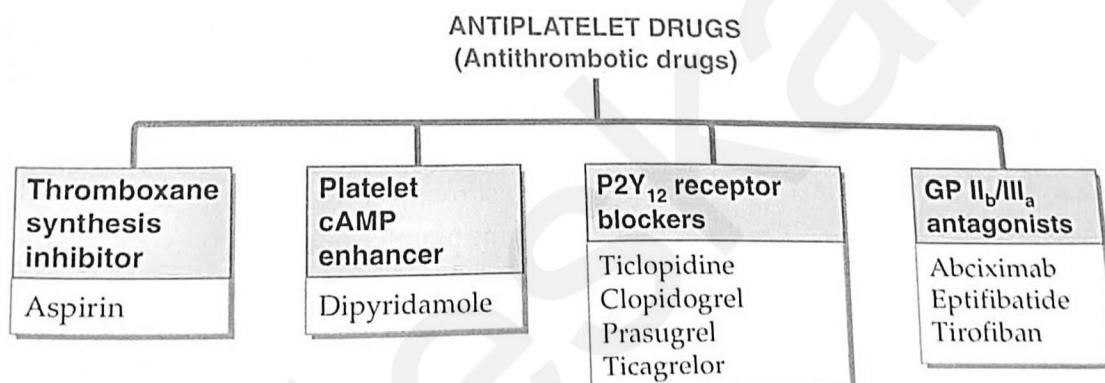
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### 3. Antiplatelet Agent (Antithrombotic drugs):-

- These are drugs which interfere with platelet function and are useful in the prophylaxis of thromboembolic disorders.
- Antiplatelet agents, also known as platelet aggregation inhibitors, are a class of drugs that prevent blood clots by making platelets less sticky.
- Platelets are small blood cells that help form clots and stop bleeding, but if they stick together too much or there are too many of them, they can lead to dangerous clots in the heart or blood vessels.
- These clots can block circulation and cause strokes or heart attacks.

### Classification of Antiplatelet Drugs:



### Aspirin

- Aspirin reduces the risk of serious vascular events in patients at high risk of such an event by about a quarter and is recommended as the first-line antiplatelet drug.

### Pharmacological Action:

- Aspirin (acetylsalicylic acid) irreversibly inhibits prostaglandin H synthase (cyclooxygenase) in platelets and megakaryocytes, and thereby blocks the formation of thromboxane a potent vasoconstrictor and platelet aggregation).
- It is only the parent form, acetylsalicylic acid, which has any significant effect on platelet function. Because platelets are unable to regenerate cyclooxygenase, the immediate antithrombotic effect of aspirin remains for the lifespan of the platelet (8–10 days).

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- As, after stopping aspirin therapy, normal haemostasis may be regained when about 20% of platelets have normal cyclooxygenase activity, daily aspirin intake is recommended.

## Dose of Aspirin:

### Tablet

- 81 mg
- 325 mg
- 500 mg

### Indication

- Pain, fever, and inflammation.
- ASA is also indicated for various other purposes, due to its ability to inhibit platelet aggregation.
- Reducing the risk of cardiovascular death in suspected cases of myocardial infarction.
- For decreasing platelet to platelet adhesion following carotid endarterectomy, aiding in the prevention of transient ischemic attacks.

### Contraindications:

- Hypertension.
- Upset stomach.
- Heartburn.
- Drowsiness.
- Mild headache.
- Severe nausea, vomiting, or stomach pain.
- Bloody or tarry stools, coughing up blood or vomit that looks like coffee grounds.
- Fever lasting longer than 3 days.
- Swelling, or pain lasting longer than 10 days.

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## 4. Thrombolytic Drugs:

- Thrombolysis, also called fibrinolytic therapy, is the breakdown of blood clots formed in blood vessels, using medication.
- It is used in ST elevation myocardial infarction, stroke, and in cases of severe venous thromboembolism.

### Pharmacological actions:

- Thrombolytic work by dissolving a major clot quickly.
- This helps restart blood flow to the heart and helps prevent damage to the heart muscle.
- Thrombolytic can stop a heart attack that would otherwise be larger or potentially deadly.

### Classification of thrombolytic drugs

1. Non-fibrin specific
  - Streptokinase
  - Anistreplase
  - Urokinase
2. Fibrin specific
  - **Tissue plasminogen Activators (t-PA)**
    - Alteplase
    - Reteplase
    - Tenecteplase

### Dose:

Thrombolytic drug	Trial doses <sup>15,33,34,36</sup>
Streptokinase	
Load (30 minutes infusion)	1000–3000 U/kg
Maintenance	1000–2000 U/kg/hour
Alteplase	
Load (30 minutes to 1 hour infusion)	0.05–0.5 mg/kg/hour
Maintenance	0.1–0.25 mg/kg/hour
Urokinase	
Loading dose (bolus)	30,000–100,000 U
Maintenance	10,000–50,000 U/hour

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### Indication:

- Acute myocardial infarction (AMI)
- Deep vein thrombosis (DVT)
- Pulmonary embolism (PE)
- Acute ischemic stroke (AIS)
- Acute peripheral arterial occlusion.
- Occlusion of indwelling catheters.
- Intracardiac thrombus formation.

### Contraindications:

- Bleeding
- Intracranial neoplasm.
- Ischemic stroke within three months.
- Possible aortic dissection.
- Active bleeding or bleeding diathesis (excluding menses)

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