Bleeding / Coagulation

No Spontaneous clotting due to smooth wall - glycocalyx coating

Minor cut

↓

Bleeding stops spontaneously.

↓

Reflex vasoconstriction

↓

d/t endothelin.

m/c potent vasoconstrictor - urothelin > endothelin > Angiotensin

Major Cut. Platelet - platelet.

↓

1° Hemostatic plug

↓

platelet activated

Plt < α - V, VIII, fibrinogen - PF-4
β - ADP, Ca^{2+}, Histamine, Serotonin

↓

Clotting Cascade

↓

Fibrin - binds platelet.

↓

Secondary Hemostatic plug.

Coagulation pathway

Intrinsic

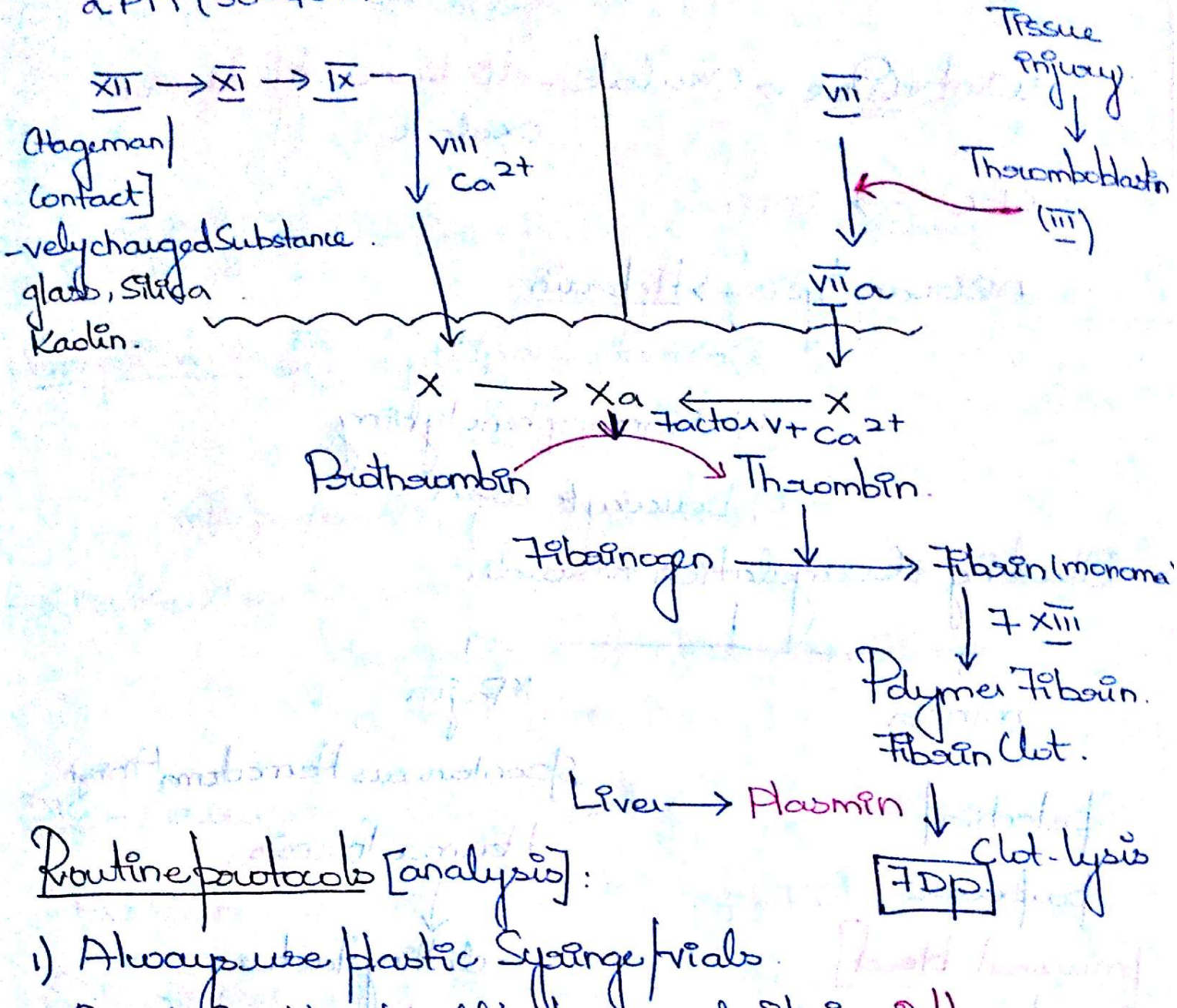
m/c in vitro

aPTT (30-40 s)

Extrinsic

m/c in vivo

PT (11-16 s)



Routine protocols [analysis]:

1) Always use Plastic Syringe/vials.
2) Blood Sample should be processed within 2 Hours
Ideal - 30 mins.
3) Storage Temp - Room temperature (20 - 24°C)
except
1) APLA Bodies.
2) Factor assay. } 2-4°C.

→ Sample - platelet poor Plasma.

32) Trisodium citrate.

→ ESR - Westergren method - Trisodium citrate.

EDTA.

Wintrobe → Oxalate - disdium, dipotassium oxalate

CBC → EDTA

ABG analysis → Heparin.

a) osmotic fragility

b) Immunophenotyping.

c) Leucoyte defect.

Bleeding & Coagulation Disorder

minor

petechial/purpura.

[mucosal bleed]

↓

Platelet disorders.

↓

1) Plt. count.

↓

2) Bleeding Time (2-9 mins)

Major.

Spontaneous Hematoma/Thigh

Haemarthrosis.

↓

clotting factor

↓

PT

aPTT

Hemophilia A — VIII

B — IX (christmas factor)

X-linked Recessive.

Bleeding times (N)

PT - (N)

aPTT - prolonged.

Todiff - Hemophilia - A, B, C — factor assay

VIII ↓ IX ↓ XI ↓

2-4°C

Hemophilia - C → Autosomal Recessive

→ aPTT - prolonged.

m/c presentation - asymptomatic.

→ Chronic liver disease -

Bleeding time - ↑ - thrombopoeitin ↓

PT ↑; aPTT - ↑.

DIC - Consumptive Coagulopathy.

Plt Count - ↓; BT ↑; PT ↑; aPTT ↑.

Fibrinogen - ↓; FDP - ↑.

m/ Sensitive — FDP ↑

m/ Specific — D-dimers.

Best inv →

Platelet Disorders

Quantitative

- Megakaryocytic
  - Immunogenic
    - Non-Immu.
  - Non-Immu.
    - → BM-abnormal
      - ↓
      - nomegakaryocytes
    - → No platelet.
      - eg- Aplastic Anaemia
      - megaloblastic An.
      - Leukemia/lymphoma.
      - Invading BM.
- Amegakaryocytic

Qualitative

→ Plt-count - (N)

Function - defective.

BT - ↑

- Bernard Soulier
- Glanzmann thrombasthenia
- Von Willebrand disease

Immunogenic

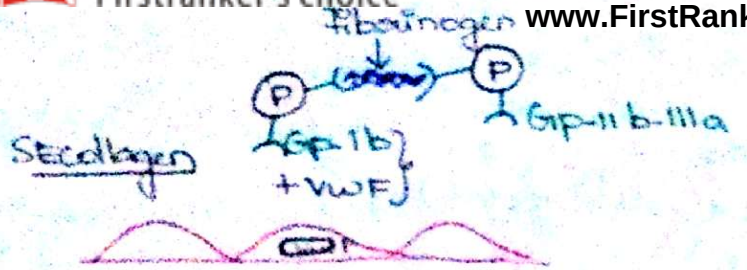
Ab-mediated

- ITP
- autoimmune disorders
- SLE/HIV

Non Immunogenic.

→ HUS

→ TTP.



vwf → von Willebrand factor

Adhesion - platelet with vessel wall Ib-VWF

Aggregation - platelet to platelet aggregation

Platelet aggregation Test ADP, collagen, adrenaline
arachidonic

Ristocetin adhesion Test:

Ristocetin (drug banned for clinical use)

↓

Blood

↓

GpIb + vWF → RIST -ve - Abnormal GpIb vWF absent

↓

adhesion

RIST +ve

↓

normal.

Bernard Soulier

→ AR

→ plt - adhesion deficiency.

Gib-Ib ↓↓↓

Lab - BT ↑

PT } (N)
aPTT }

→ RAT - negative (abnormal)

→ Platelet aggregation Test - T A/C/E - normal

2) VWF i) adhesion

ii) VWF stabilization (of factor VIII)

BT - ↑

PT - N

aPTT - elevated.

RAT - negative.

PAT - normal

VWF: 20 subtypes.

Type I VWD (m/c)

m/c — AD inheritance

Glanzmann's thrombasthenia:

→ AR.

→ Gb 2b/III a.

→ Newborn baby with umblical cord stump bleeding.

→ PT, aPTT - N

∴ umblical cord stump bleeding - GT > factor XIII

GT - 1 in 1 lac

| factor - XIII
| PT, aPTT - (N)
| m/c - asymptomatic
| Bleeding from stump - Rare
| Incidence - ↓ - 1 in 35 lac

Lab: Bleeding time - ↑

PT, aPTT - (N)

RAT - positive - (N)

Platelet aggregation Study with ADP - Defective.

TTP

ADAMTS 13 ↓ (Flowcytometry)

VWF - metalloprotease.

No degradation of VWF

↓

Plt aggregation → thrombosis

c/F:

i) Platelet ↓

ii) Microangiopathic hemolytic anaemia -

iii) Renal failure

iv) CNS - Neurological

v) Fever

HUS

(N)

Typical (D+)
<2 yrs
- infective.
↓
diarrhoea.
m/c) E. coli.
O157 : H7.
Verotoxin
Shigella
Rare - Streptococcal pneumoniae lung infections

Atypical D-ve
adult
non infective.
no diarrhoea
m/c Cause - complement factor def
factor H
→ pregnant female
- a/w: Autoimmune, Disseminated malignancy

Pentad of TTP

Blood group banking

ABO blood group - Chromosome - 9

Co-Dominance

H - gene

↓

Fucosyl Transferase.

↓

Fucose + Glycolipid.

↓

H - Substance

N - acetylgalactosamine	galactose	Both	H - 'ag'
↓	↓		
'A' antigen.	B-antigen	AB	No A/B
↓			
Group A.	'B' group.	AB.	O
Sa. Ab } anti-B	anti-A	No Ab	Both anti A, anti-B.

ABH Antigens → RBC, Serum, Saliva, Semen, Urine, gastric Juice.

Secretors except CSF

Bombay Blood group Ch → 19

→ No 'H' gene.

→ AR pattern - hh

→ Resembles - O Blood group - ∴ Oh.

∵ No h gene → No, A, B, H antigen on RBC surface.

Serum / Antibodies - Anti-A, Anti-B, Anti-H

→ Non-Secretors.

Bombay Blood group → Transfusion → Same group only

	Storage	Shelf life
Whole Blood	2-6°C	42 days
RBCs		
Platelets	Room Temperature + continuous agitation	5 days
FFP	-18°C / lower	1 year
Cryoprecipitate		

Components of WB

→ WB
→ PRBC } Start within 30 minutes. [↑ Bacterial contamination]
within 4 Hours.

Size of needle - 18-19 Gauge

Transfusion sets (filter size) - 170nm

Infection Transmitted by all blood components

∵ Malaria Trophozoites are very strong

→ Multiple clot factor deficiency → FFP

Cryoprecipitate - VWD, Hemophilia A, Afibrinogenemia

Components -

→ VWF
→ VIII
→ Fibrinogen
→ XIII

m/c Transfusion Reaction ⇒ Febrile non-Hemolytic Transfusion Reaction.

Leucocytes ⟶ cytokines.

m/c Cause of Death: - TRALI

- within 6 Hours of Blood Transfusion

Q m/c a/w TRALI - plasma > FFP

Massive Blood Transfusion: 1) Transfusion of > 1 Blood volume within 24 Hours.

2) > 50% Blood volume within 4 Hours Q

Massive Citrate → HCO_3^- ↑ (liver) → Metabolic alkalosis

ii) Hypocalcemia [Citrate complex with Ca^{2+}]

iii) Hypothermia

iv) Hypokalemia

m/c Cause of death - massive Transfusion - Dilutional Coagulopathy

1) Acid Citrate Dextrose [ACD] - 21 days

2) CPDA → 21 days. Phosphate act as buffer

3) CPD-A → 35 days

4) SAGM - Saline, adenine, Glucose, mannitol - 42 days
(m/c used) ↓ nutrition.

Citrate - Ca^{2+} chelator; Prevents clot formation.

Adenine → ATP : RBC membrane Stabilization, ↑ Shelf life of RBC.

Saline → To maintain isotonicity of RBC.

Platelet - most prone for Bacterial Contamination.