APPROACH TO BLEEDING DISORDERS

BY:

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LEARNING OBJECTIVES

- To know the function of platelets and the relationship between the platelet count in peripheral blood and the extent of abnormal bleeding.
- To know about the diseases associated with
  1) a failure of platelet production
  2) a shortened platelet lifespan, especially immune thrombocytopenic purpura (ITP).
- To know the principles of investigation of patient suspected of having a haemostatic defect.

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- To understand the role of platelets, blood vessel wall and coagulation factors in normal haemostasis.
- To know the classification of haemostatic defects.
- To know the platelet morphology and life span.
- To know the platelet function and diseases due to platelet function disorders.
- To know the causes of thrombocytopenic purpura and non-thrombocytopenic purpura.

Investigations of Bleeding Disorders

Clinical Features:

- Complaints
- Full Clinical Examinations
- History of Bleeding
- Family History of Bleeding
- If bleeding present, what is the pattern of bleeding episodes

Clinical distinction can frequently be made between bleeding due to platelet defects and (in number or function) and clotting defects (coagulation defects) .

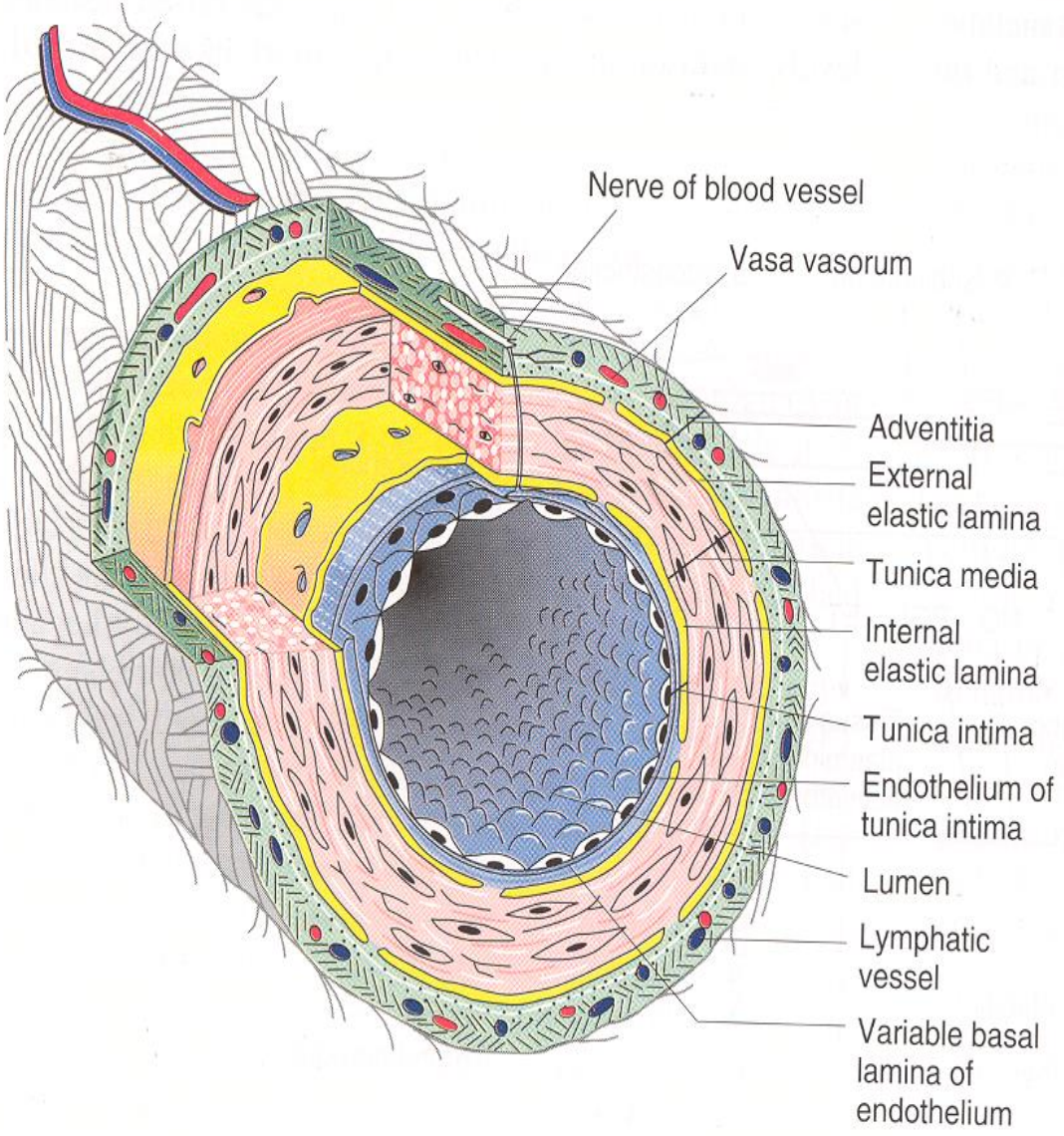
a. Patient with platelets defects or blood vessel wall defects usually present with superficial bleeding into the skin (purpura) and from epithelial surfaces of organs. This is called (*mucocutaneous bleeding*).

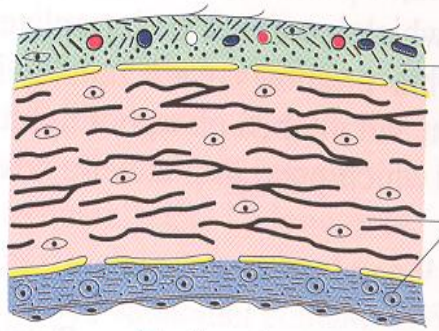
b. Patients with clotting defects (*coagulation factors deficiencies)* usually present with bleeding into deep tissue and muscles (*haematomas*) and joints (*haemarthrosis*) this is called musculoskeletal bleeding.

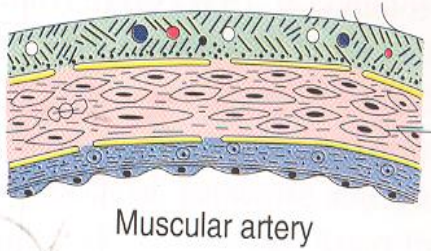
NORMAL HAEMOSTASIS:

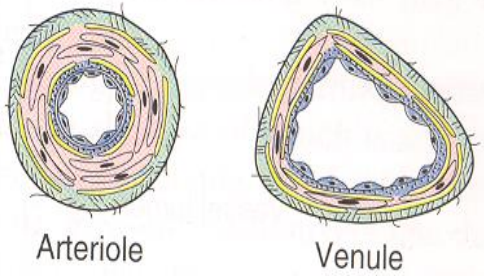
The cessation of bleeding following trauma to blood vessel is result from three processes:

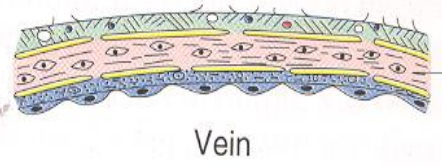
1.) The contractions of vessel walls.
2.) The formation of the platelets plug at the site of the break in the vessel wall.
3.) The formation of a fibrin clot within and around the platelet aggregates.


Nerve of blood vessel
Vasa vasorum
Adventitia
External elastic lamina
Tunica media
Internal elastic lamina
Tunica intima
Endothelium of tunica intima
Lumen
Lymphatic vessel
Variable basal lamina of endothelium

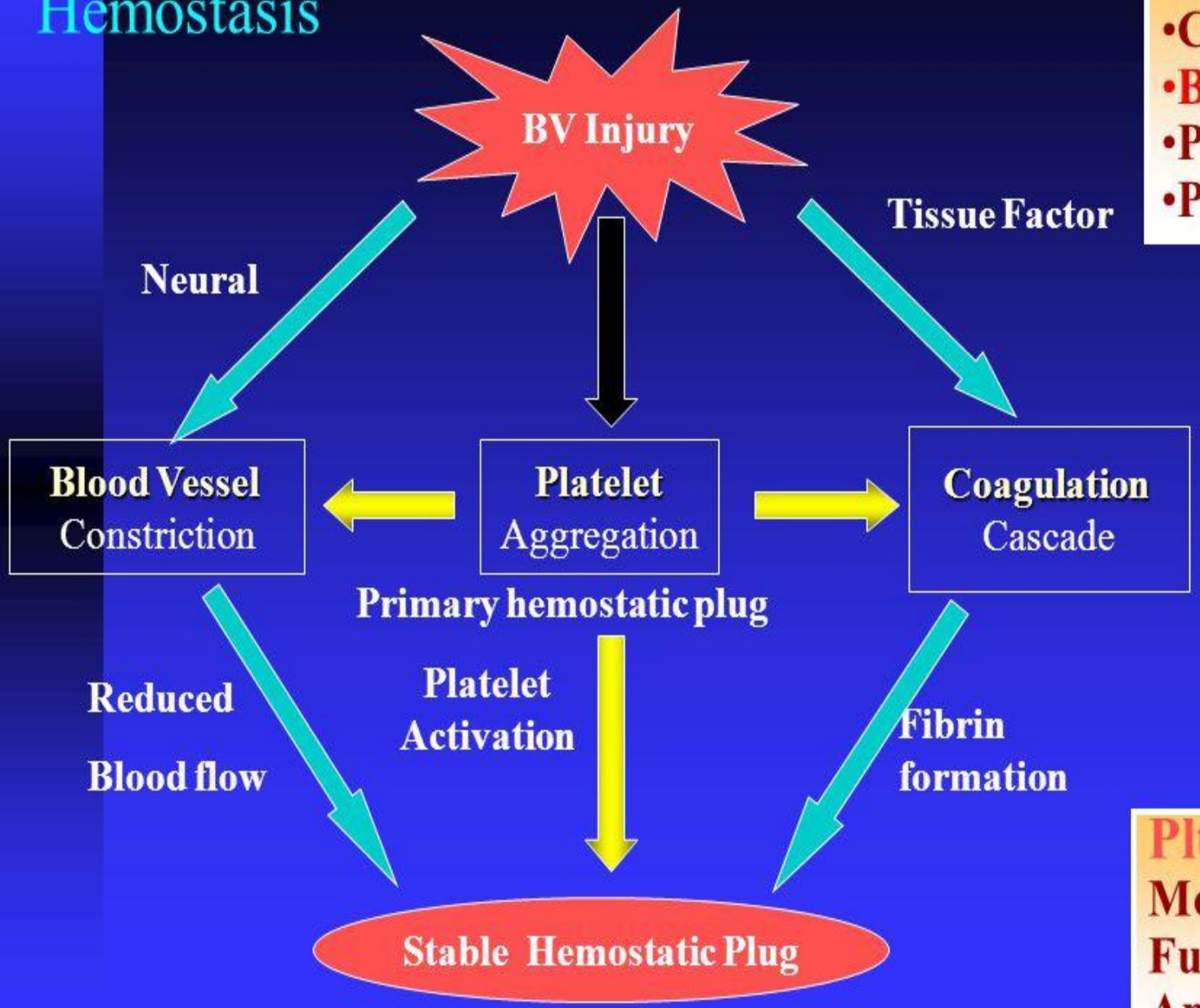

Collagen and elastin fibres in adventitia
Media and intima with elastic lamellae
Elastic artery


Smooth muscle cells in media
Muscular artery


Arteriole
Venule

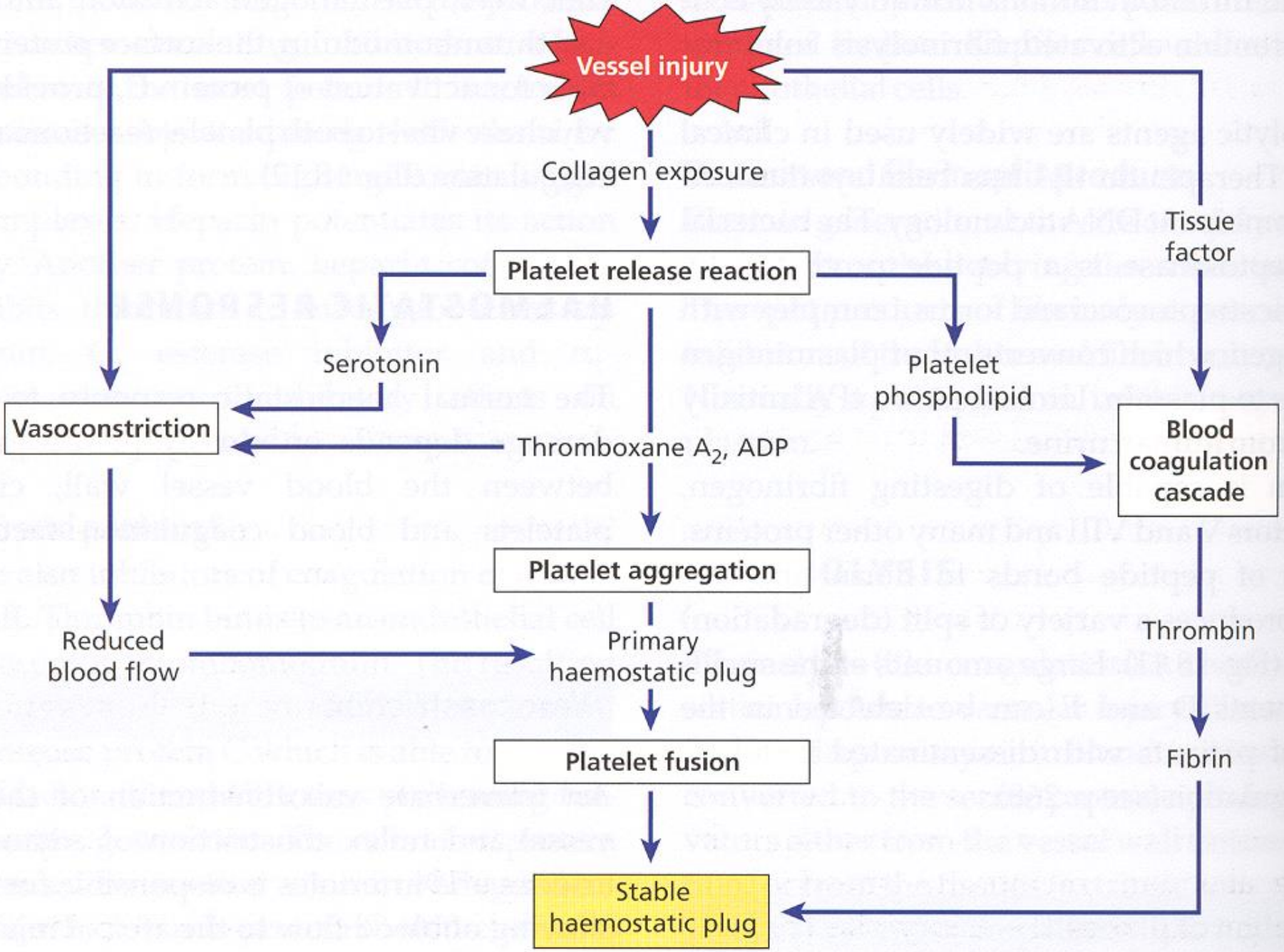

Smooth muscle cells in media
Vein

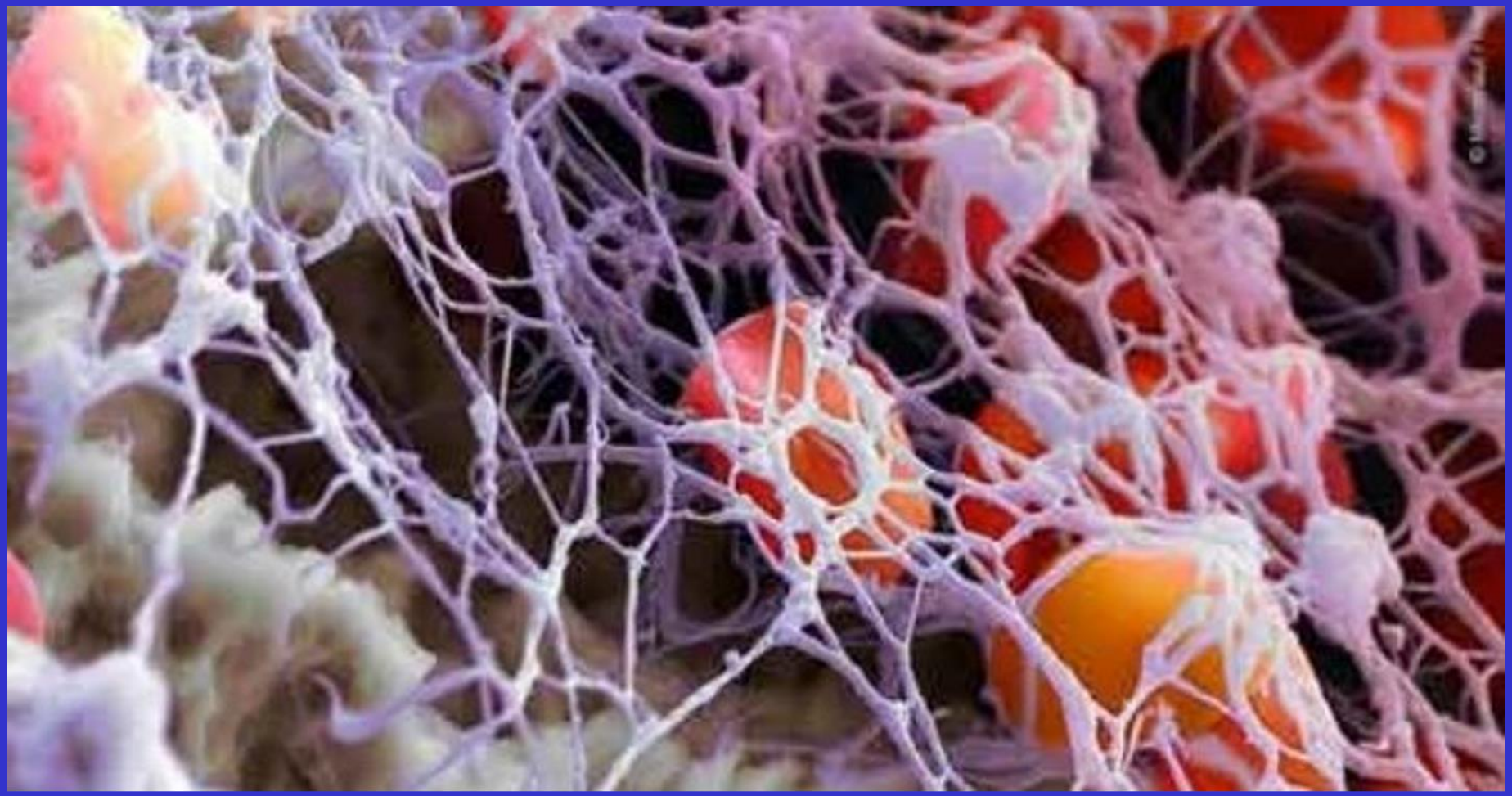
Hemostasis



Lab Tests
- CBC-Plt
- BT,(CT)
- PT
- PTT

Plt Study
- Morphology
- Function
- Antibody


Vessel injury
Collagen exposure
Platelet release reaction
Tissue factor
Serotonin
Platelet phospholipid
Vasoconstriction
Thromboxane A_2, ADP
Blood coagulation cascade
Platelet aggregation
Reduced blood flow
Primary haemostatic plug
Thrombin
Platelet fusion
Fibrin
Stable haemostatic plug



Early platelet fibrin hemostatic plug.

Late platelet fibrin hemostatic plug.

Classification of haemostatic defects

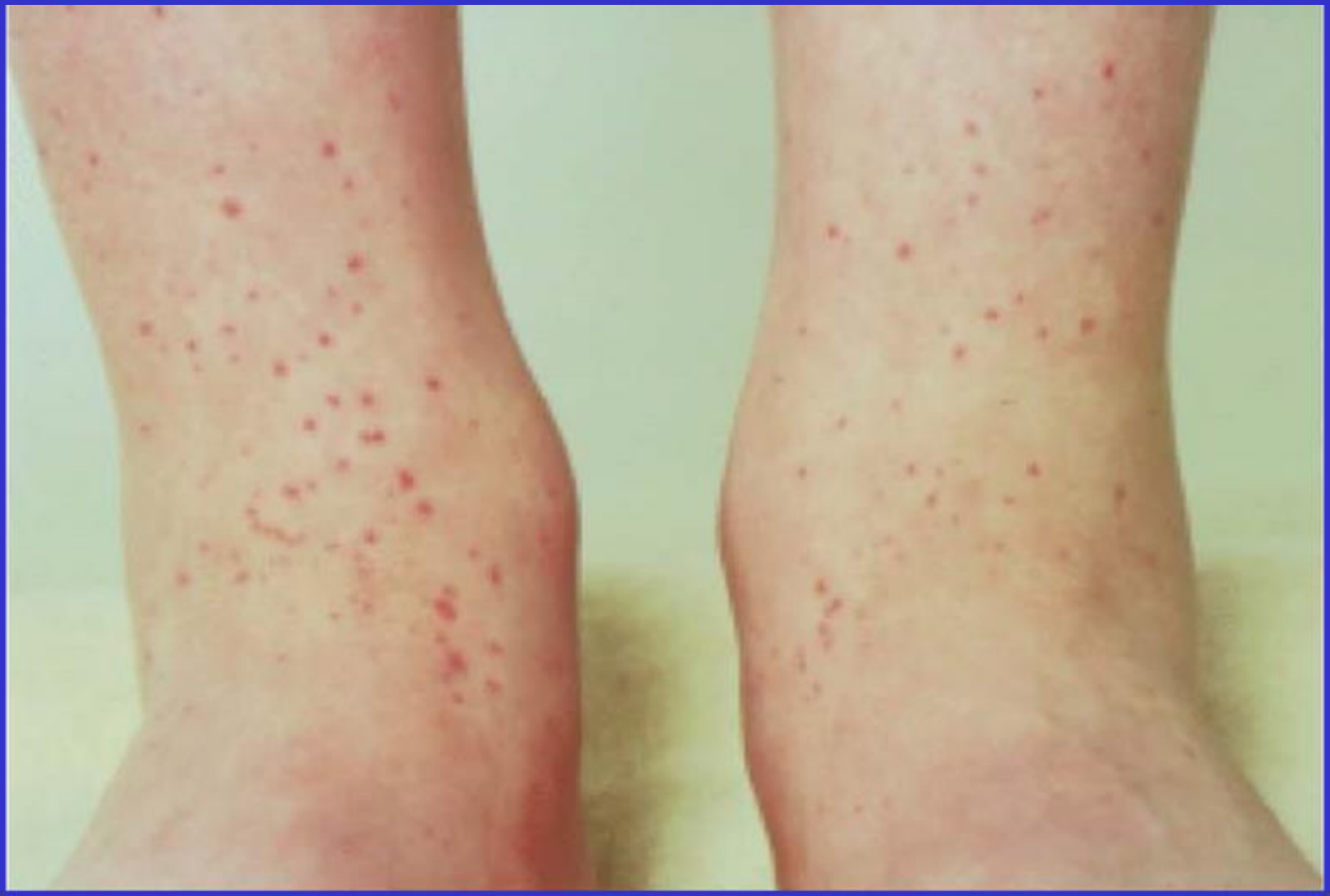
The action of platelets and the clotting mechanism are closely intertwined in the prevention of bleeding. However, bleeding arise from defects in one of the three processes:

1) Thrombocytopenia (a low platelet count) (the commonest cause).
2) Abnormal platelet function.
3) A defect in the clotting mechanism (the second commonest cause).

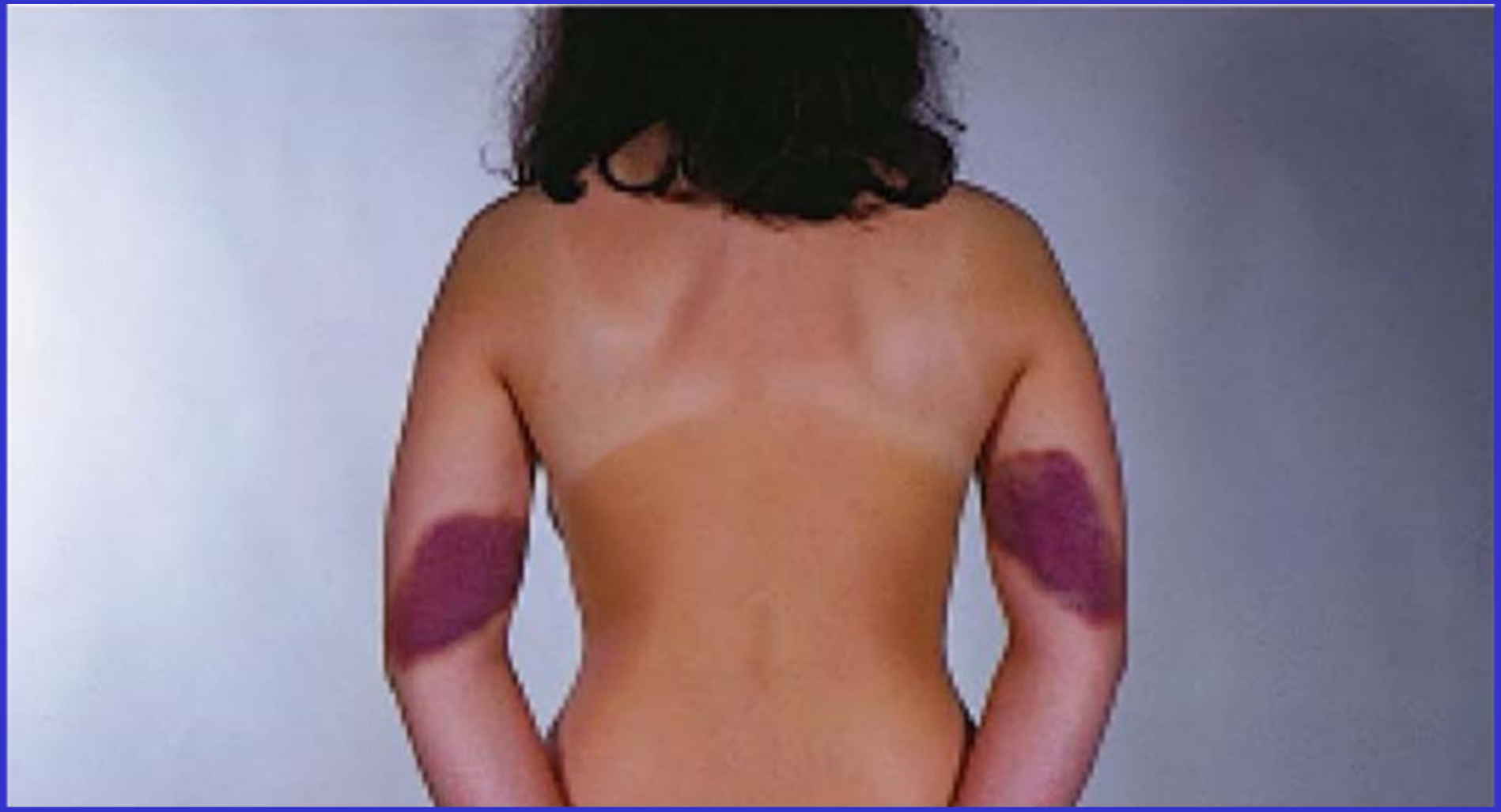
Patients with clotting defects usually present with bleeding into deep tissues; that is, muscles or joints. Patients with a deficiency of platelets usually present with mucocutaneous bleeding; that is, bleeding into the skin and from the epithelial surfaces of the nose, uterus and other organs.

cont'd…

Petechial haemorrhages and ecchymoses and bleeding from other sites may occur when the number of platelets falls below 50 *X* 10^9/L. At levels between 20 and 50 *X* 10^9/L, petechiae, ecchymoses and nose bleeds are the commonest symptoms, but below 20 *X* 10^9/L, gross haemorrhage (melaena, haematemesis, haematuria) becomes increasingly common.



Multiple pin-point haemorrhages (petechiae) on the legs of a patient with idiopathic thrombocytopenic purpura (ITP).

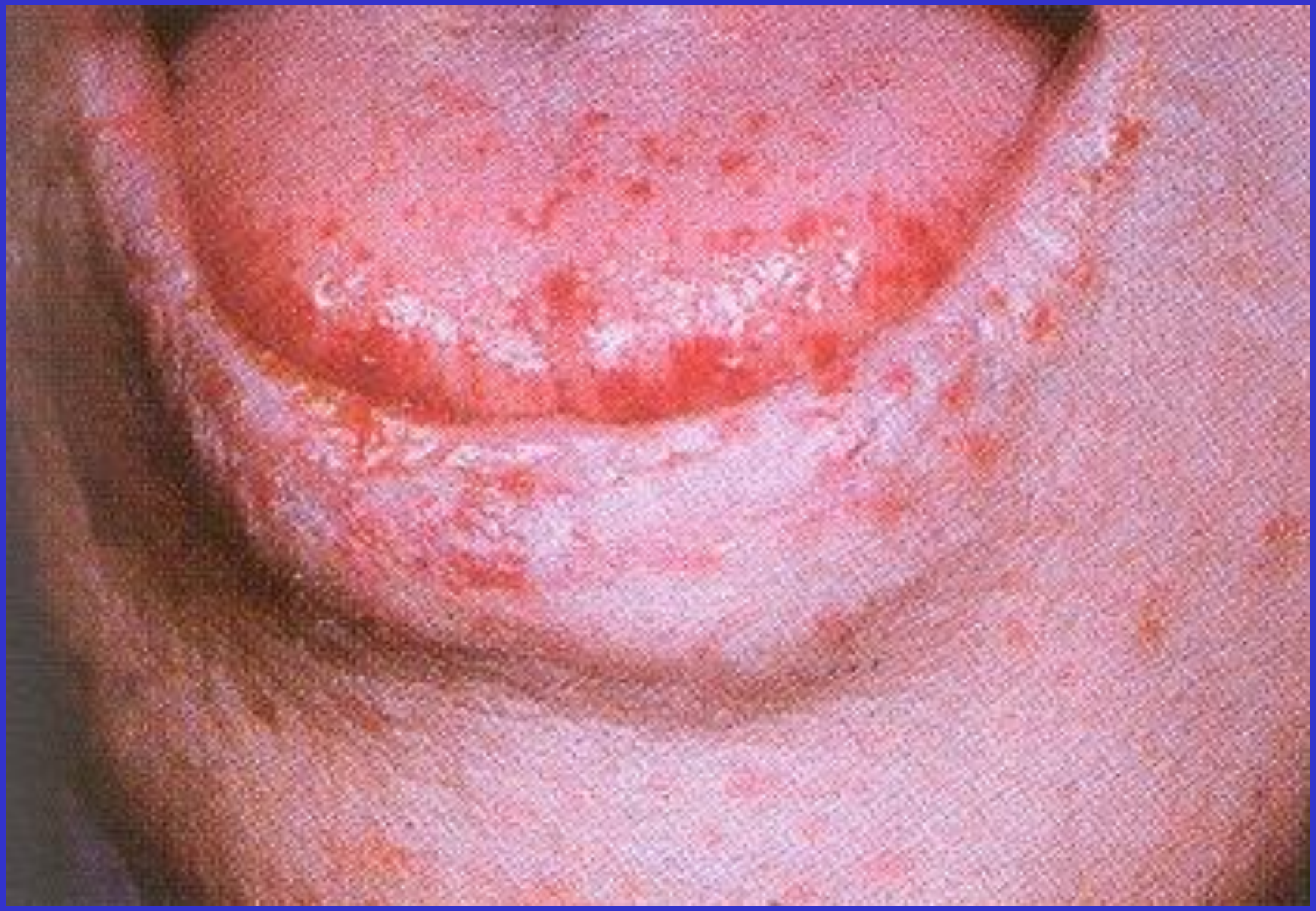


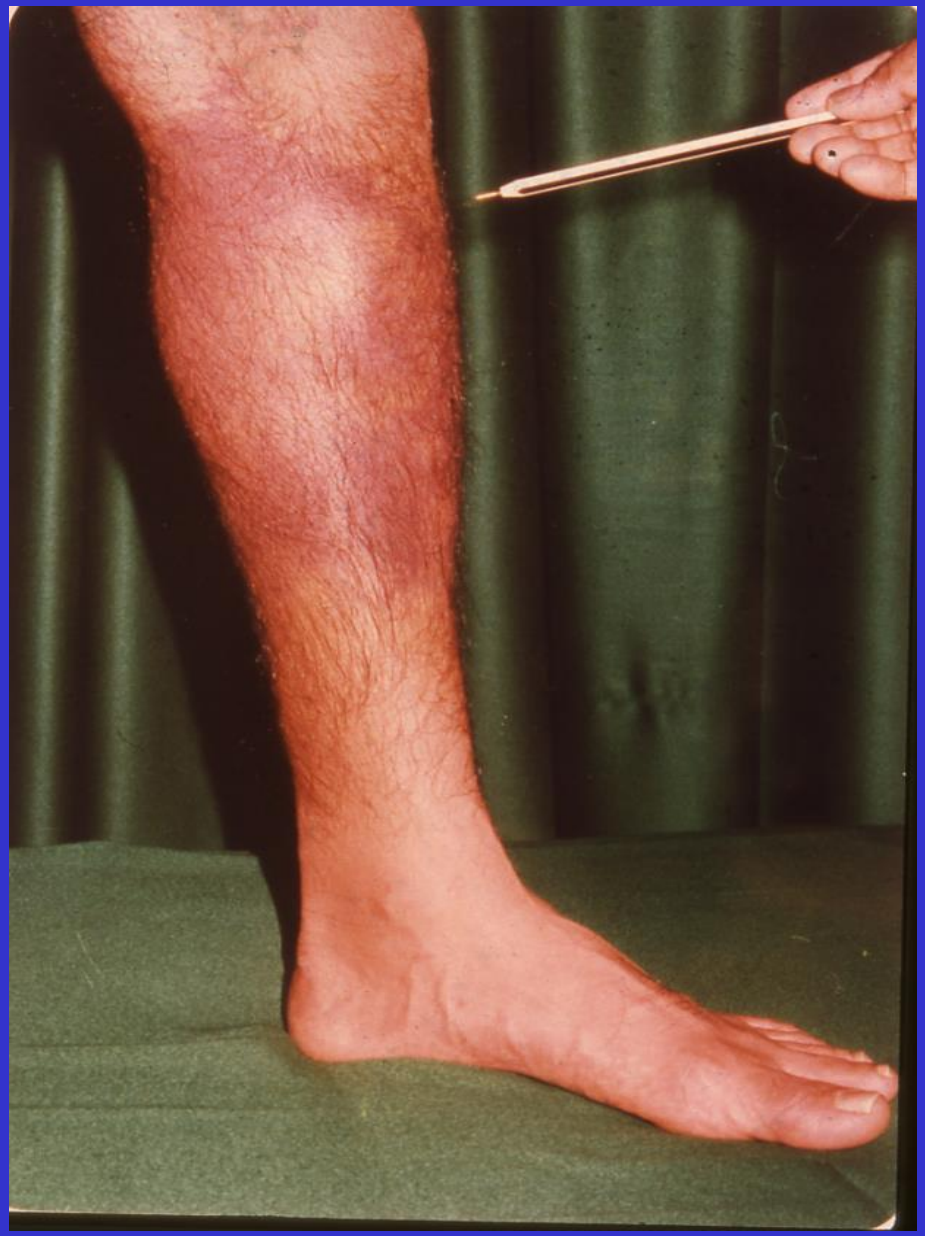
Large ecchymoses on both the upper arms of a woman with ITP.

Hereditary Vascular Disorders

* Hereditary Haemorrhagic Telangiectasia (Rendu-weber-osler syndrome)
* Kasabach-merritt syndrome (Haemangioma – Thrombocytopenia)
* Ehlers-Danlos syndrome
* Pseudoxanthoma elasticum
* Homocystinuria
* Marfan syndrome
- Osteogenesis imperfecta

Hereditary Haemorrhagic Telangiectasia

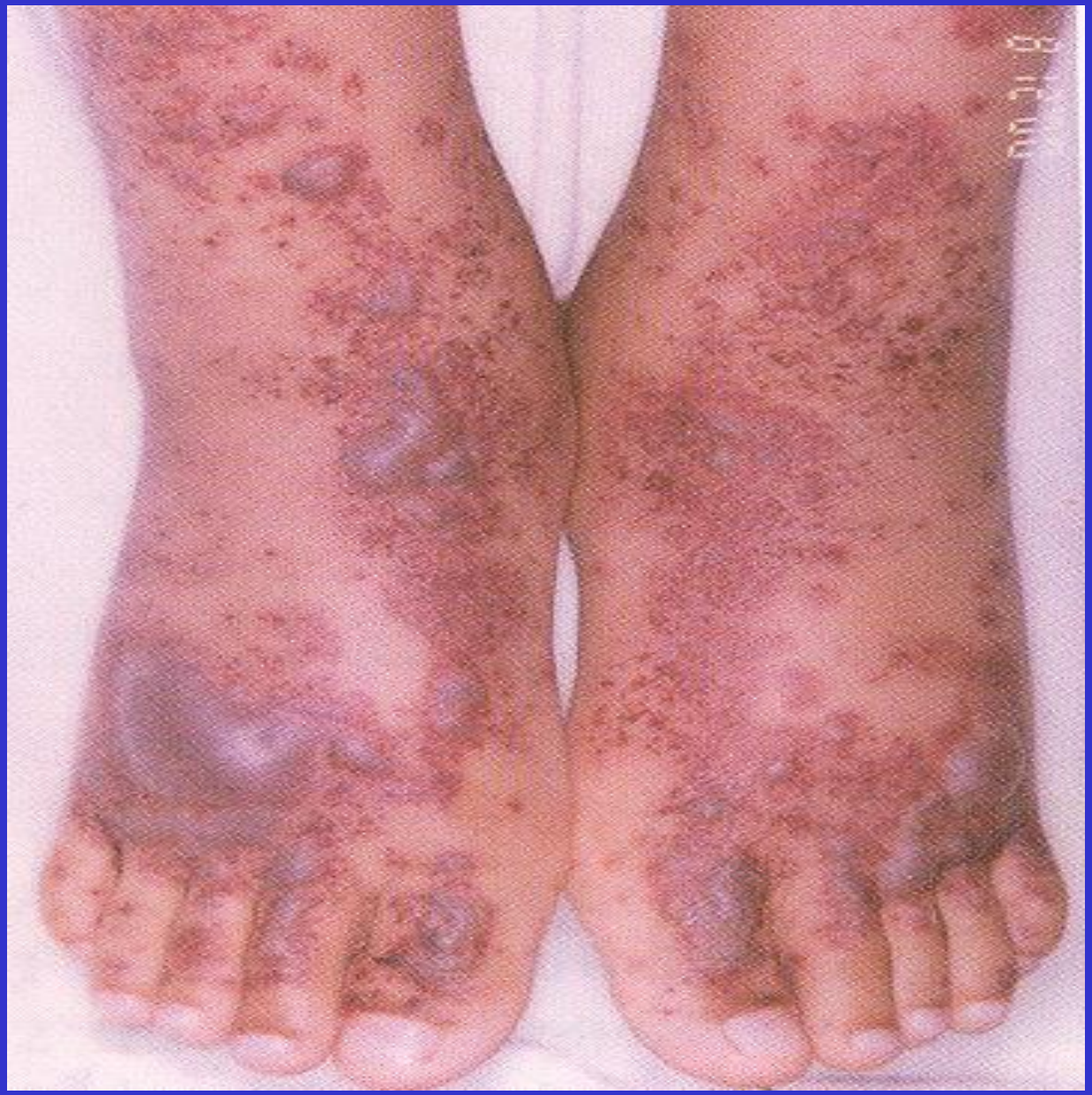




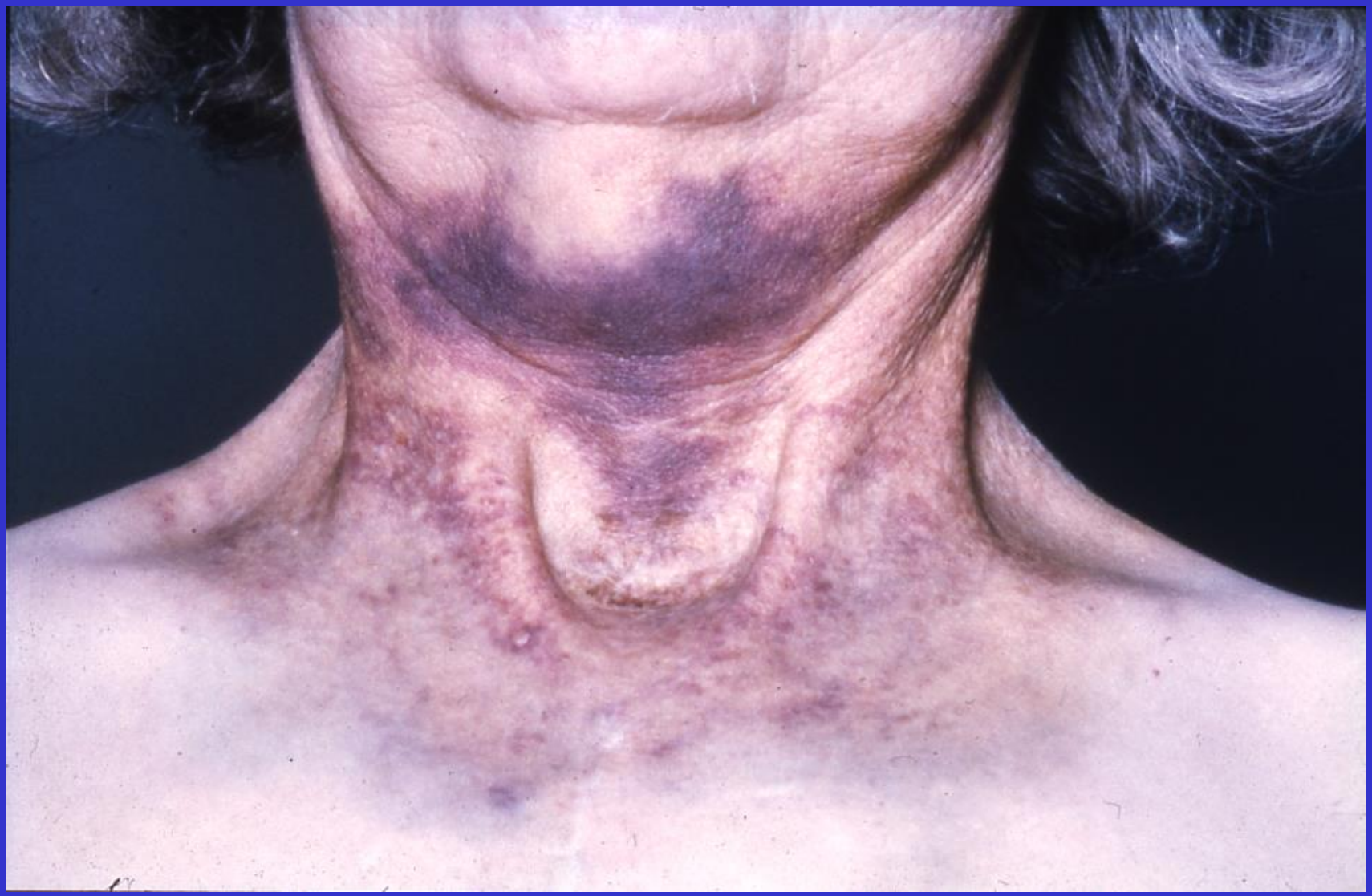
Ehlers-Danlos syndrome

Acquired Vascular Disorders

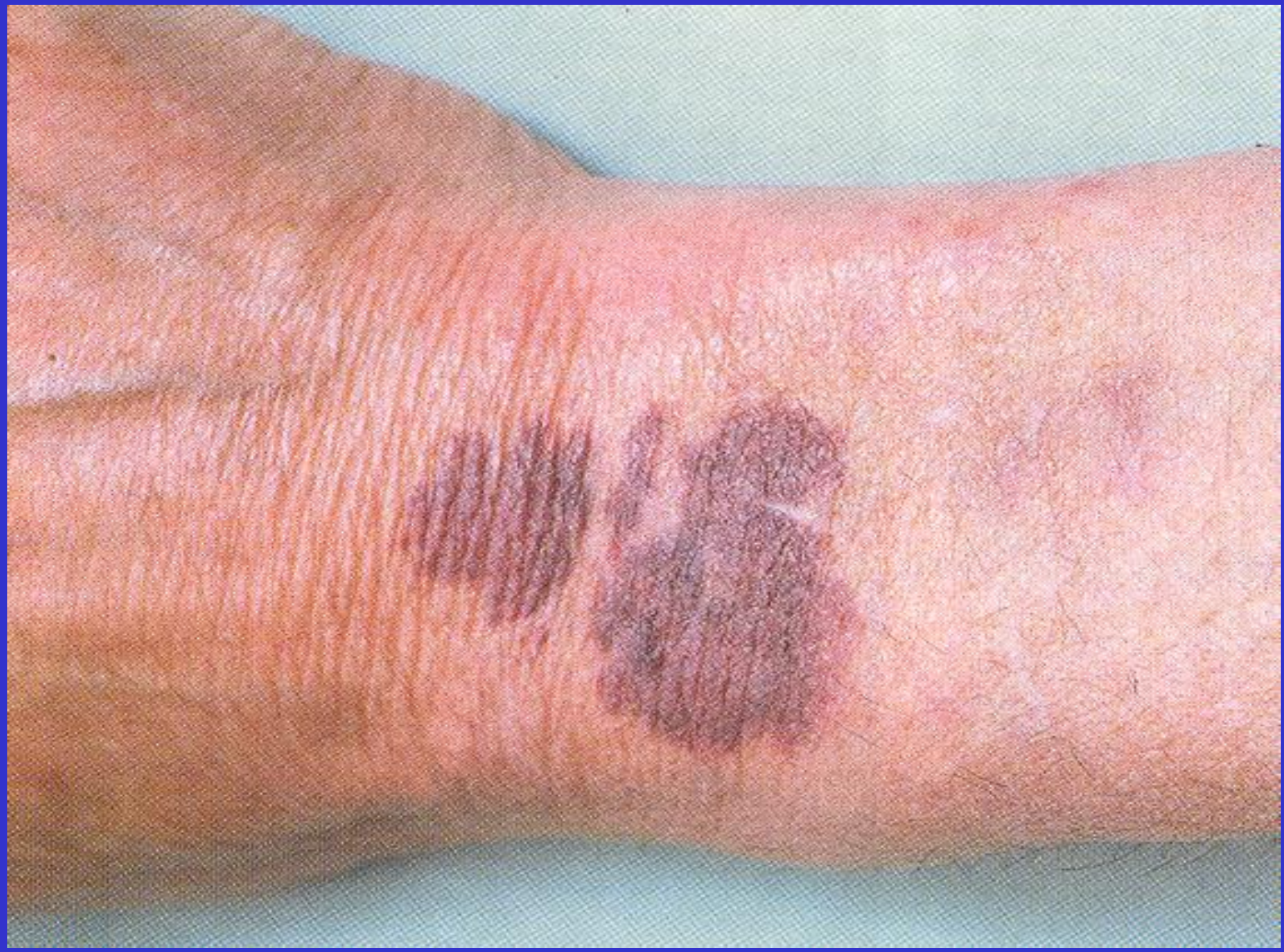
* Allergic purpura (Henoch-Schonlein purpura)
* Paraproteinemia and amyloidosis.
* Senile purpura
* Drug-induced vascular purpuras (Steroid therapy, sulfonamides, iodides, aspirin, digoxin, methyldopa, estrogen, allopurinol, penicillin and other antibiotics).
* Vitamin C Deficiency (Scurvy)
* Purpura simplex (Easy brusability)
* Psychogenic purpura
* Purpura associated with infections.



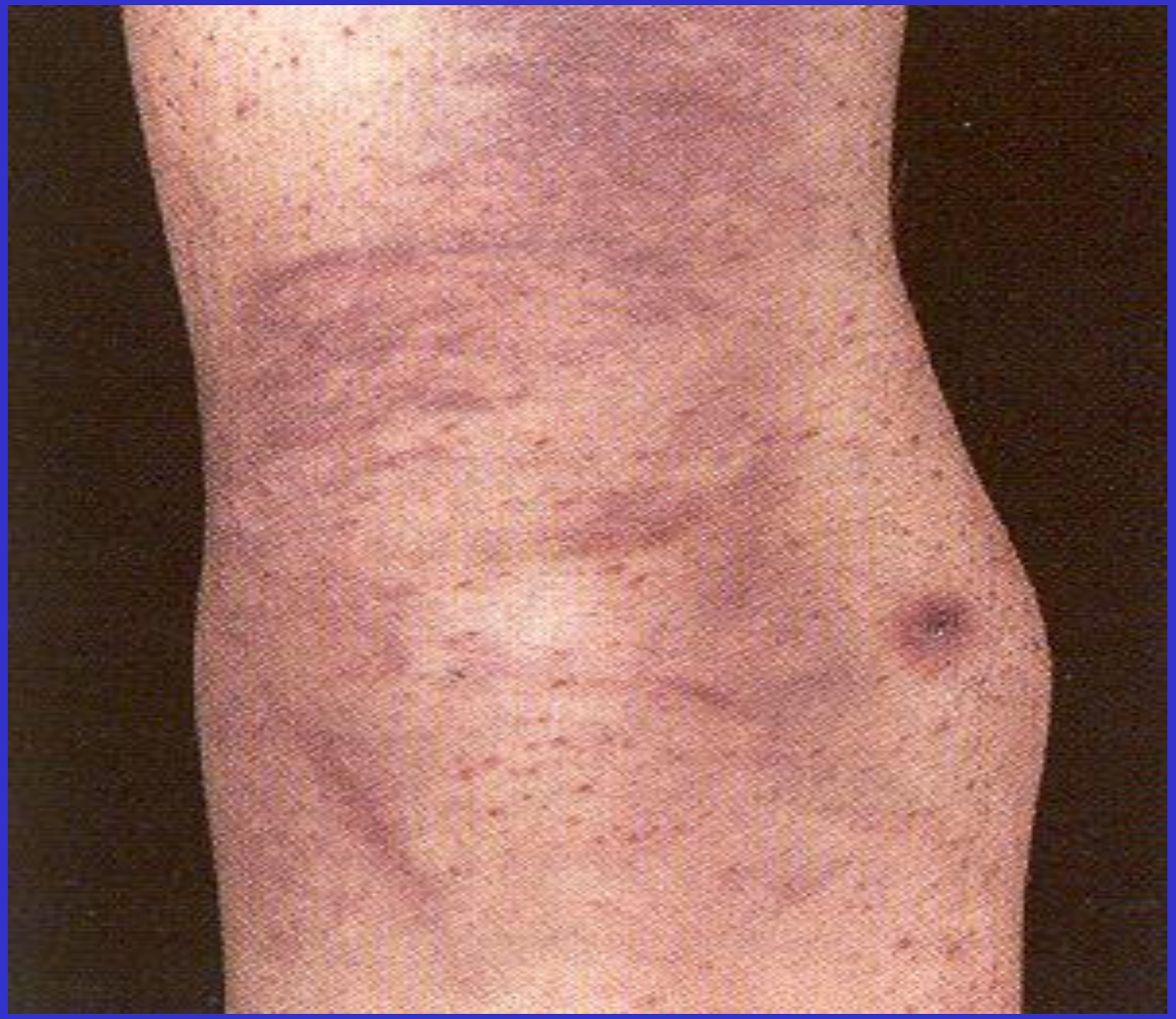
Allergic purpura (Henoch-Schonlein purpura)



Paraproteinemia and amyloidosis



Senile purpura

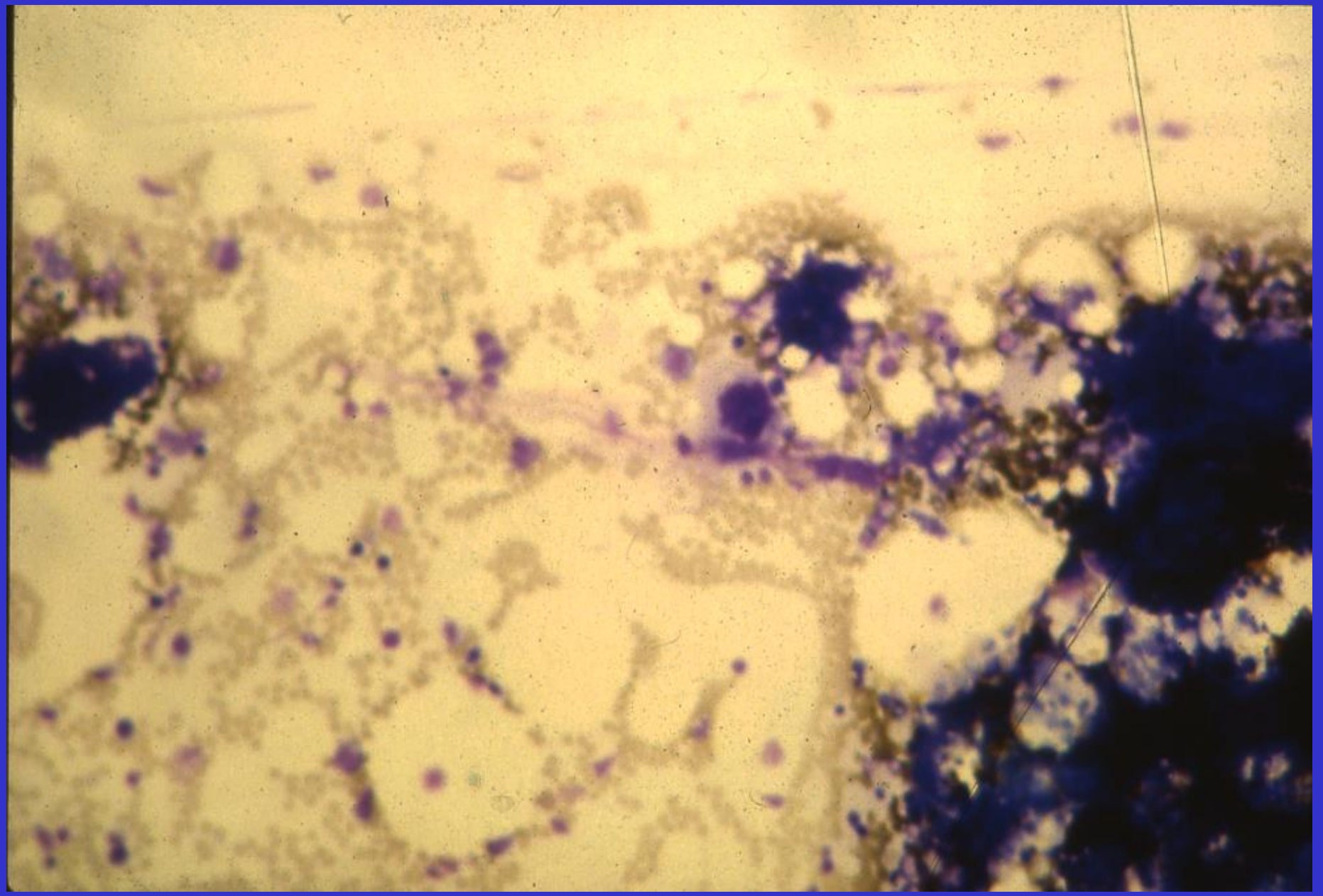


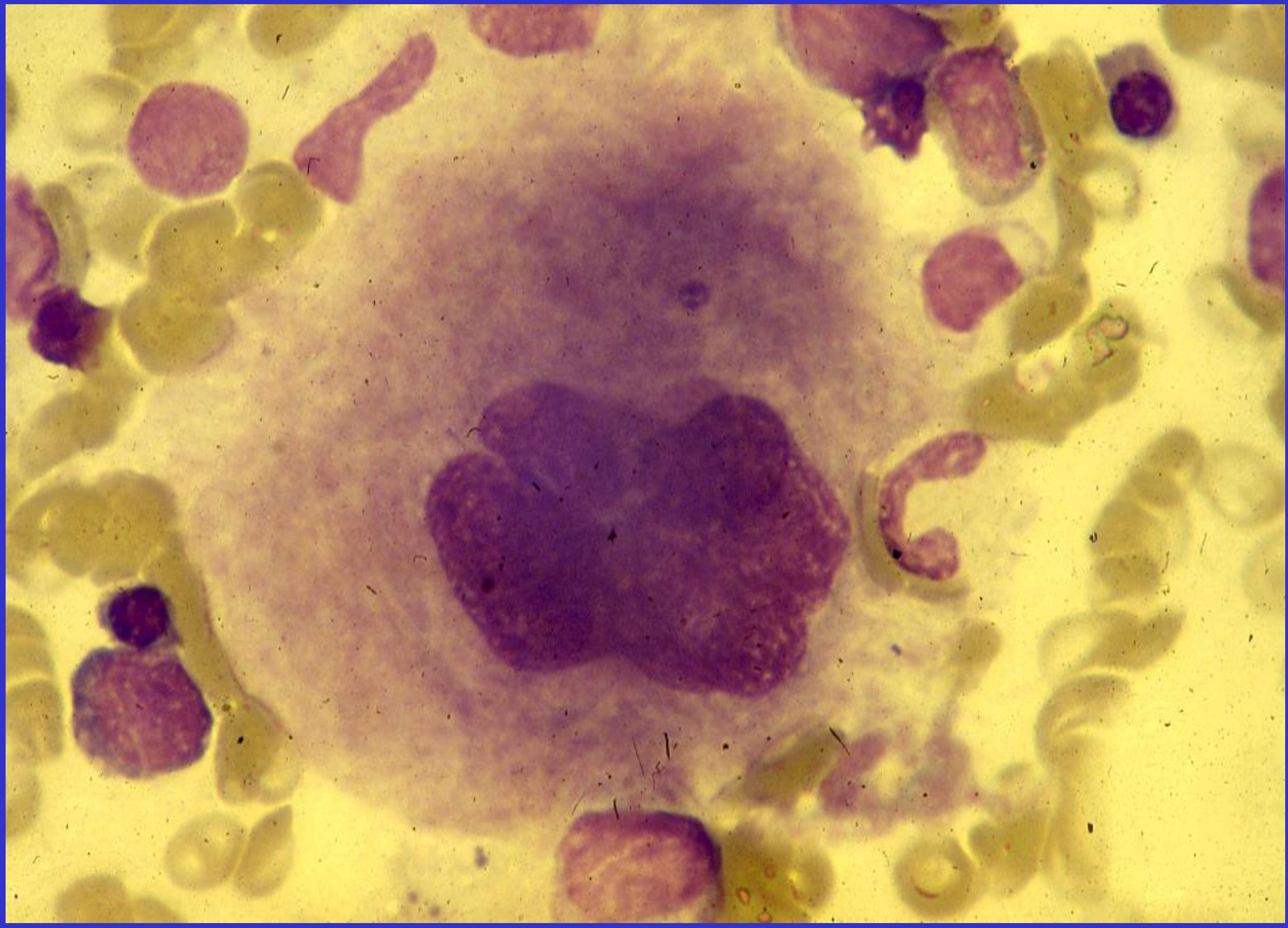
Vitamin C deficiency (Scurvy)

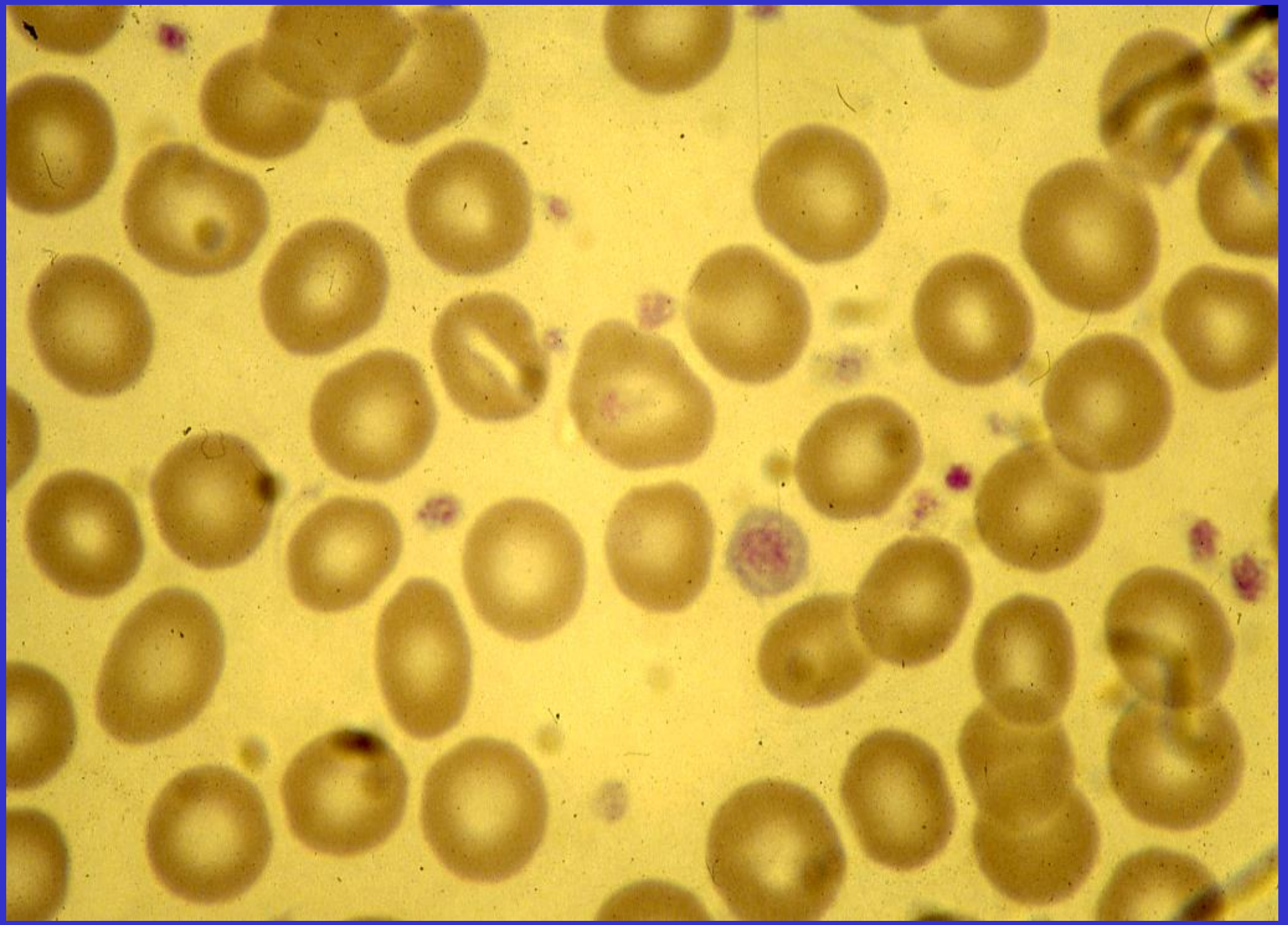
THE PLATELETS

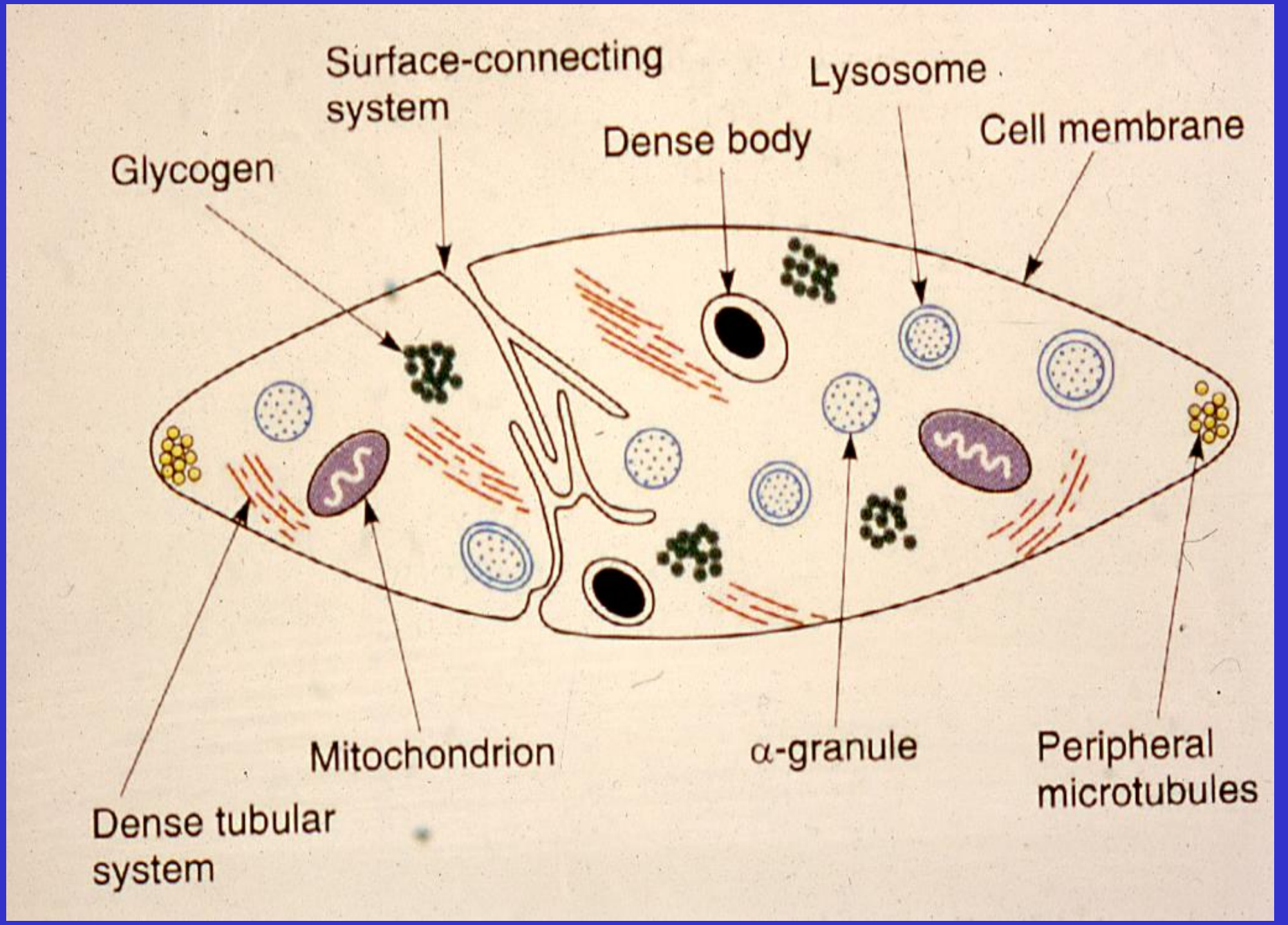
- **NORMAL PLATELET COUNT = 150-450x10^9/L**
- **NORMAL PLATELET SIZE MPV 7.2-11.1 fl**
- **NORMAL PLATELET DIAMETER 1-3 µ**
- **NORMAL PLATELET LIFE SPAN 7-10 days**

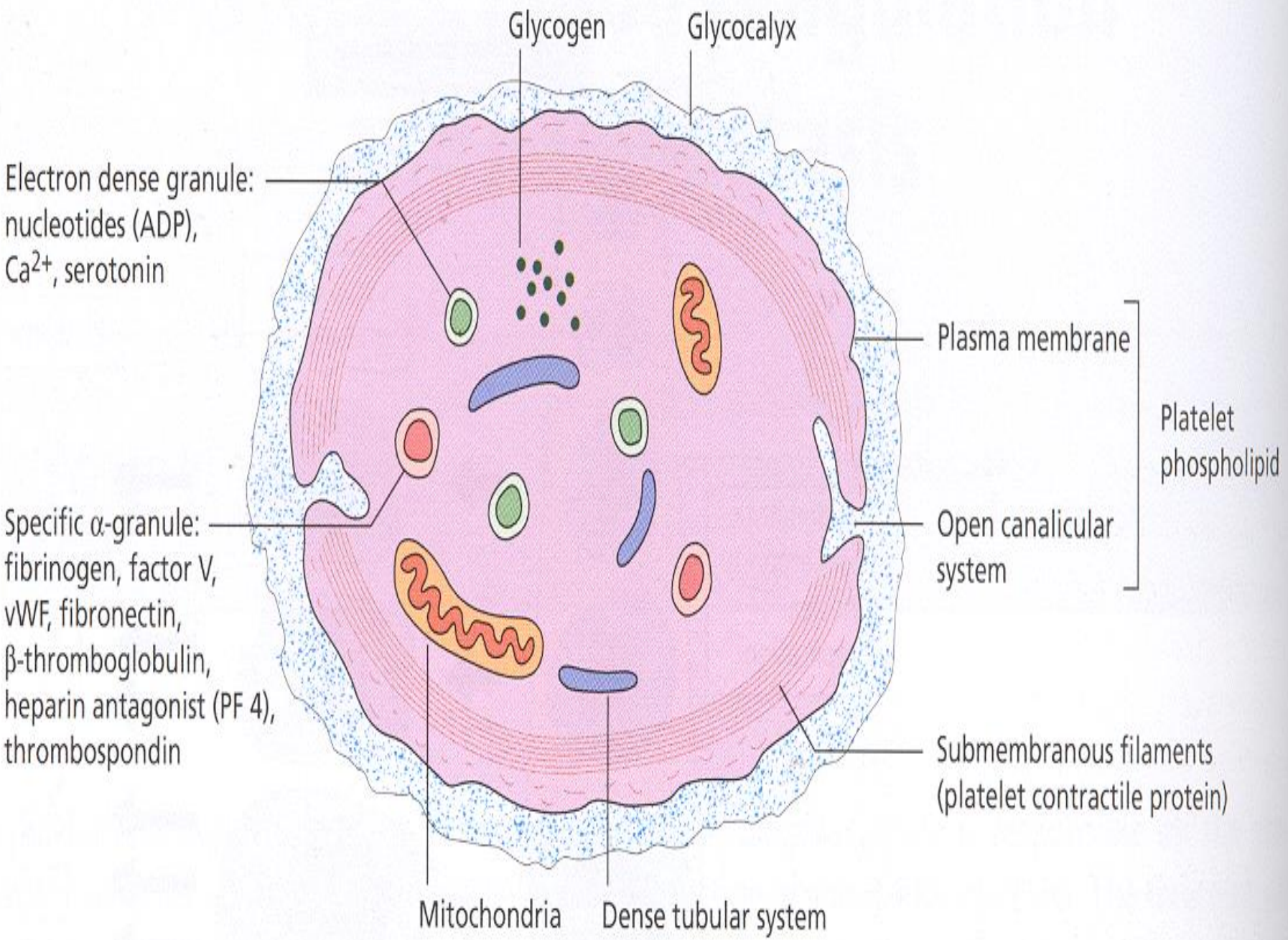
- **PLATELET FORMATION IS BY SEGMENTATION OF THE CYTOPLASM OF THE MEGAKARYOCYTE IN THE BONE MARROW.**

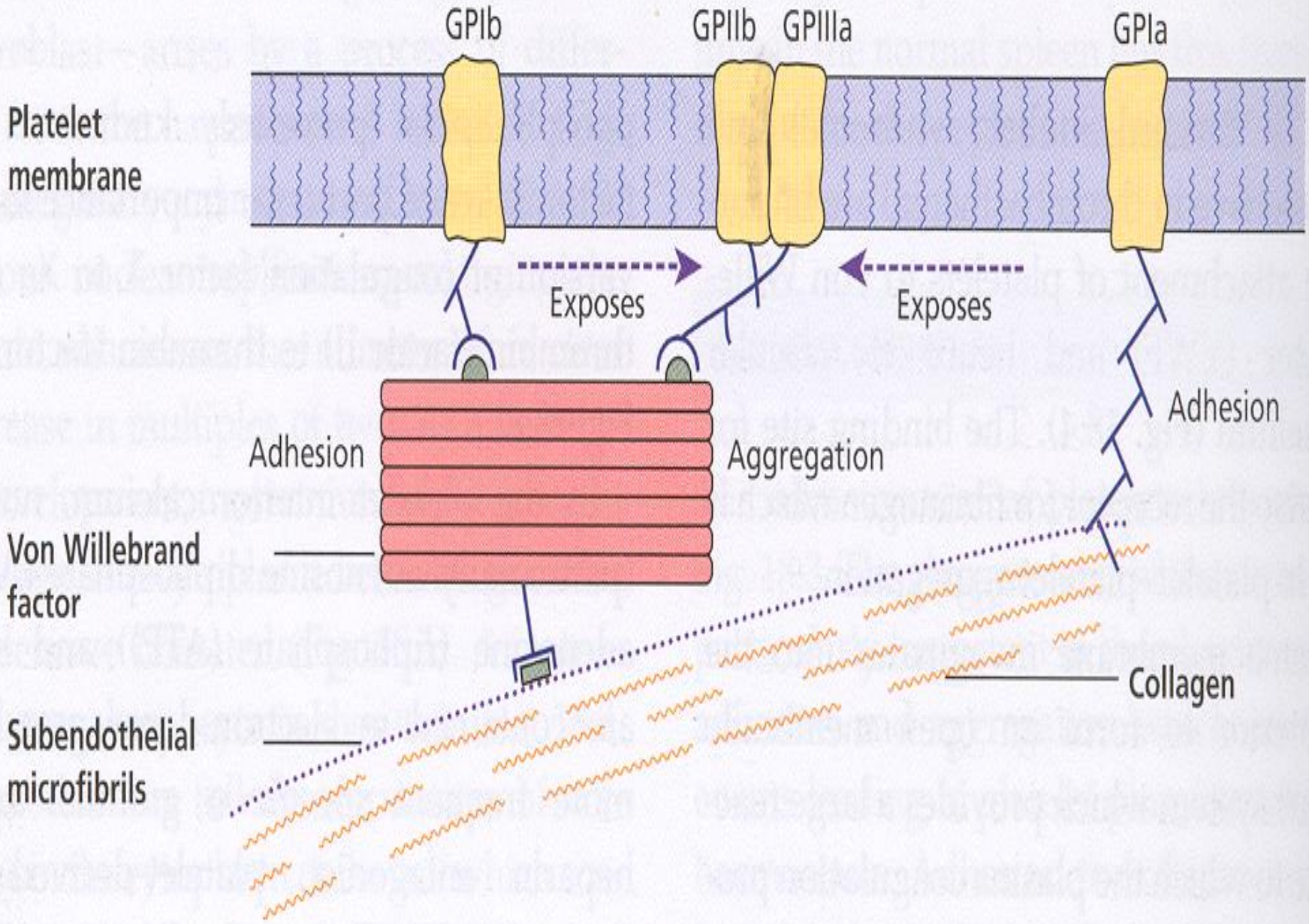


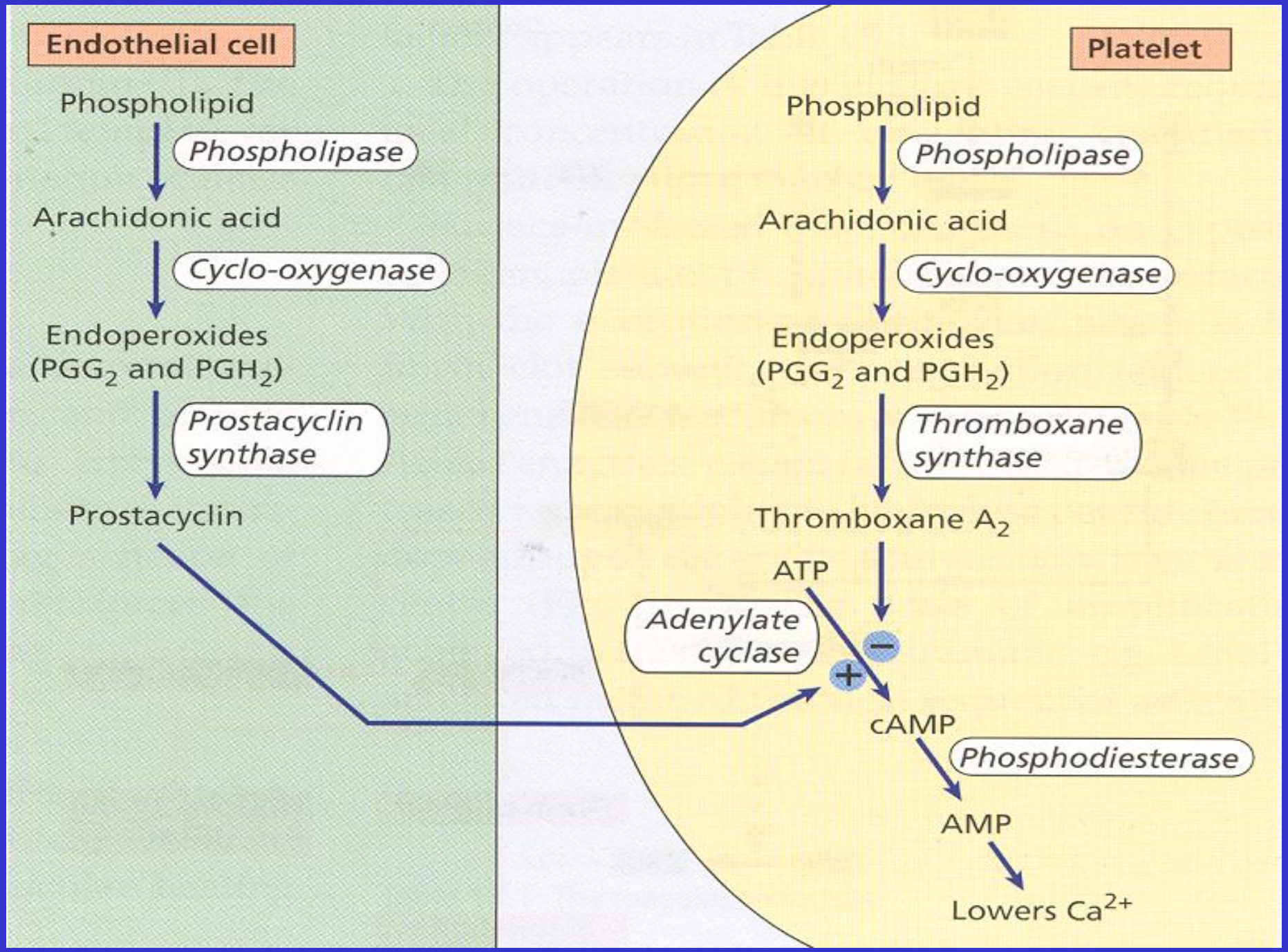


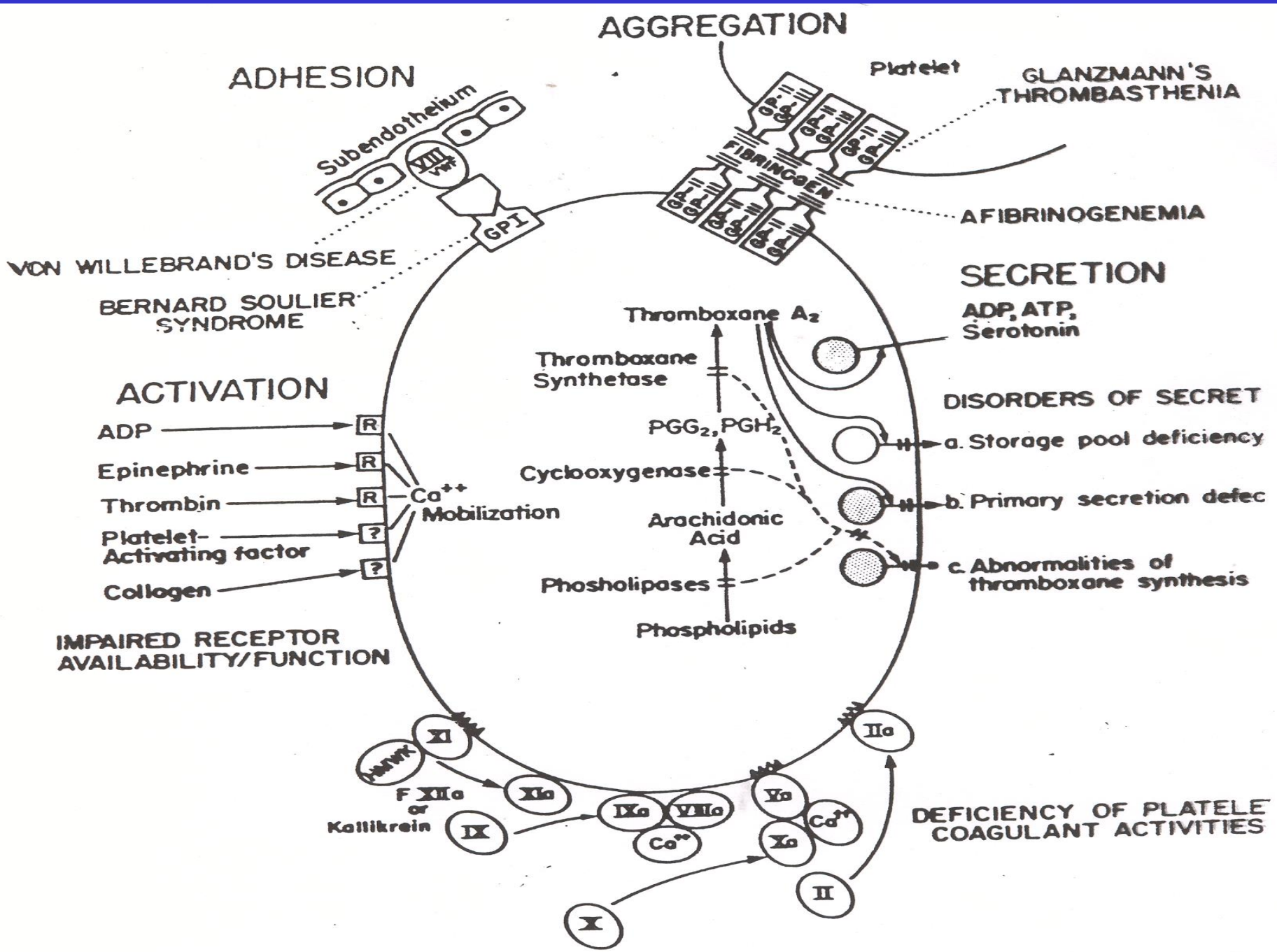


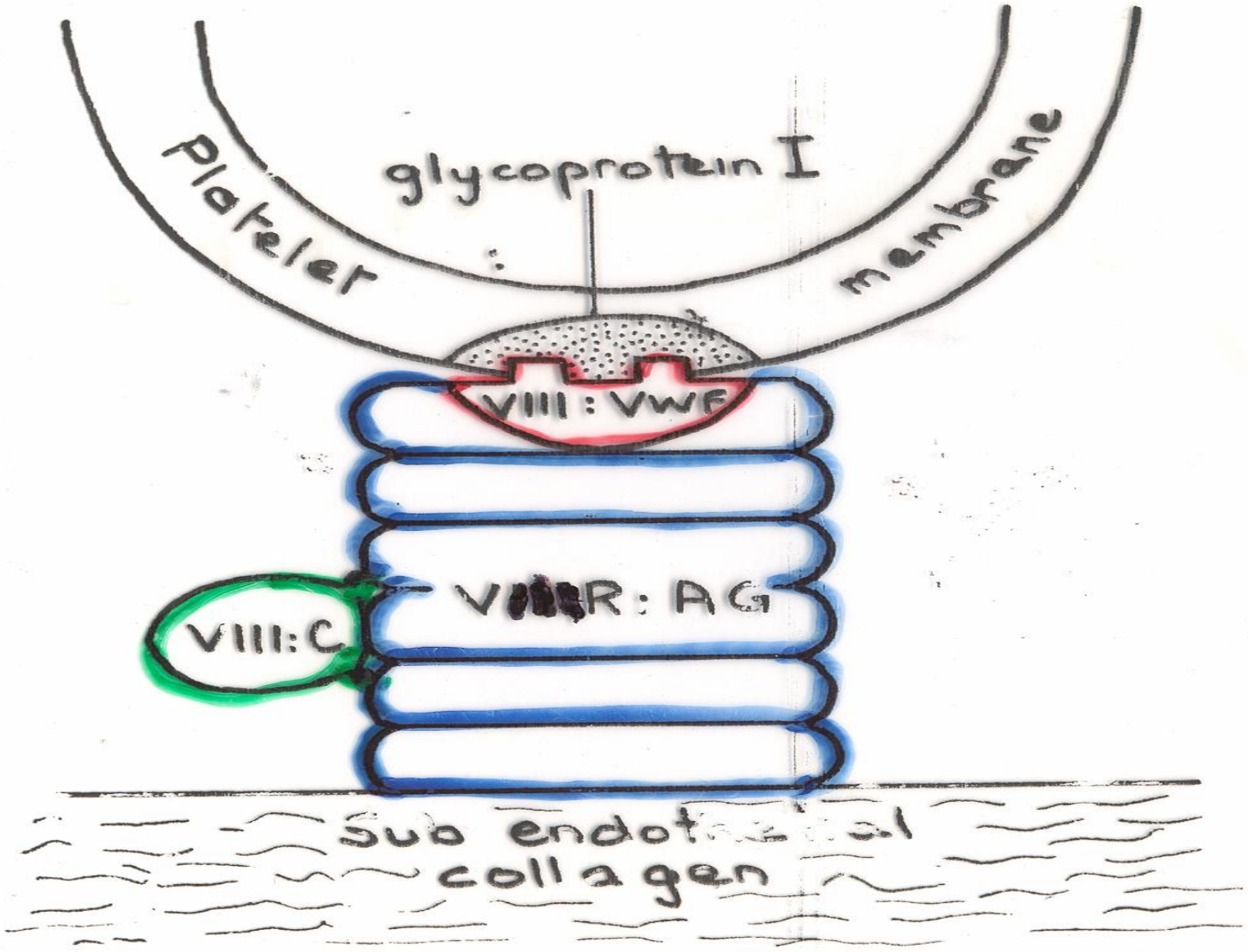

Surface-connecting system
Lysosome
Dense body
Cell membrane
Glycogen
Mitochondrion
α-granule
Peripheral microtubules
Dense tubular system

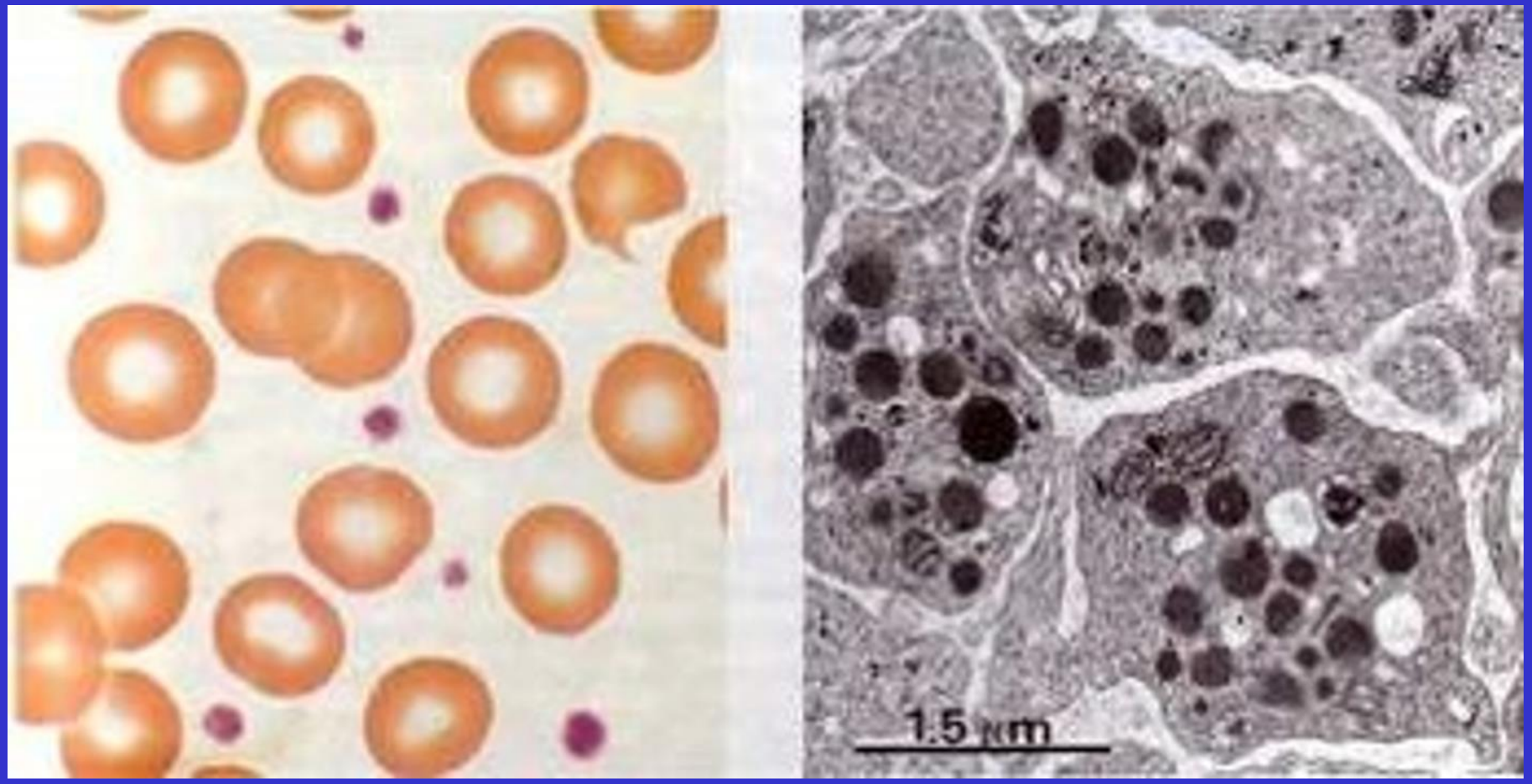

Glycogen
Glycocalyx
Electron dense granule:
nucleotides (ADP),
Ca2+, serotonin
Plasma membrane
Platelet
phospholipid
Specific α-granule:
fibrinogen, factor V,
vWF, fibronectin,
β-thromboglobulin,
heparin antagonist (PF 4),
thrombospondin
Open canalicular
system
Submembranous filaments
(platelet contractile protein)
Mitochondria
Dense tubular system


GPIb
GPIIb
GPIIIa
GPIa
Platelet membrane
Exposes
Exposes
Adhesion
Adhesion
Aggregation
Von Willebrand factor
Collagen
Subendothelial microfibrils


Endothelial cell
Phospholipid
Phospholipase
Arachidonic acid
Cyclo-oxygenase
Endoperoxides
(PGG2 and PGH2)
Prostacyclin synthase
Prostacyclin
Platelet
Phospholipid
Phospholipase
Arachidonic acid
Cyclo-oxygenase
Endoperoxides
(PGG2 and PGH2)
Thromboxane synthase
Thromboxane A2
ATP
Adenylate cyclase
cAMP
Phosphodiesterase
AMP
Lowers Ca2+


AGGREGATION
ADHESION
Platelet
GLANZMANN'S THROMBASTHENIA
Subendothelium
FIBRINOGEN
AFIBRINOGENEMIA
GPI
VON WILLEBRAND'S DISEASE
BERNARD SOULIER SYNDROME
SECRETION
ADP, ATP, Serotonin
Thromboxane A2
Thromboxane Synthetase
ACTIVATION
DISORDERS OF SECRET
ADP
Epinephrine
Thrombin
Platelet-Activating factor
Collagen
Ca++ Mobilization
PGG2, PGH2
Cyclooxygenase
Arachidonic Acid
Phosholipases
Phospholipids
a. Storage pool deficiency
b. Primary secretion defec
c. Abnormalities of thromboxane synthesis
IMPAIRED RECEPTOR AVAILABILITY/FUNCTION
F XIIa or Kallikrein
DEFICIENCY OF PLATELE COAGULANT ACTIVITIES


Platelet
glycoprotein I
membrane
VIII : VWF
VIII:C
R : AG
Sub endothelial
collagen



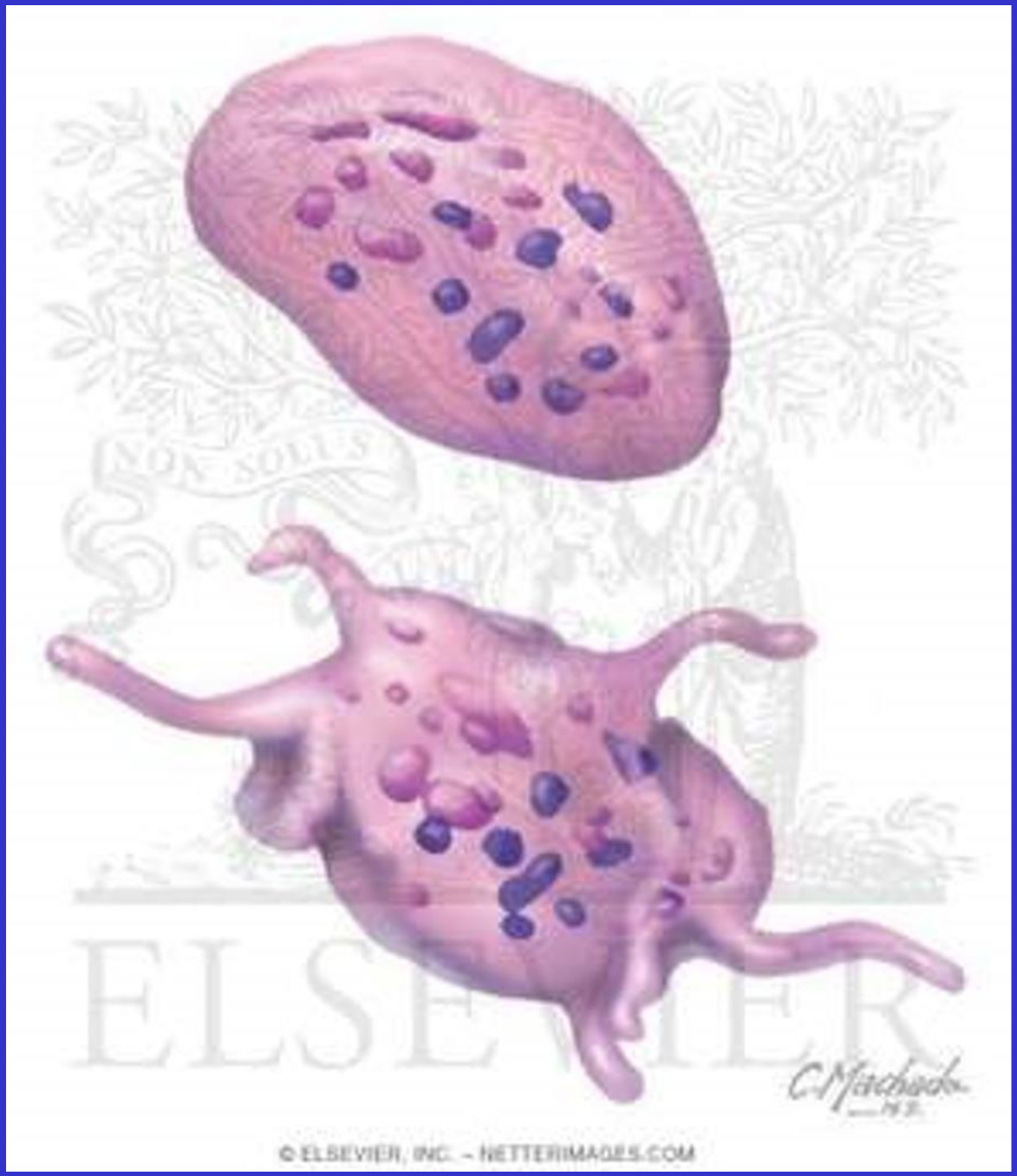
Platelet in static forms.

Physiology

- The main function of platelets is the formation of a haemostatic plug at sites of damage to vascular endothelium.
- The platelets are also stimulated to produce the prostaglandin, thromboxane A_2 from arachidonic acid derived from the cell membrane. The release of ADP and thromboxane A_2 causes an interaction of other platelets with the adherent platelets and with each other (secondary platelet aggregation), thus leading to the formation of a platelet plug (primary haemostasis).
- At the site of injury, tissue factor (TF) is expressed and the TF-VIIa complex initiates the formation of a fibrin clot within and around the platelet plug (secondary haemostasis)
- Platelets are also responsible for the contraction of the fibrin clot once it has been formed.

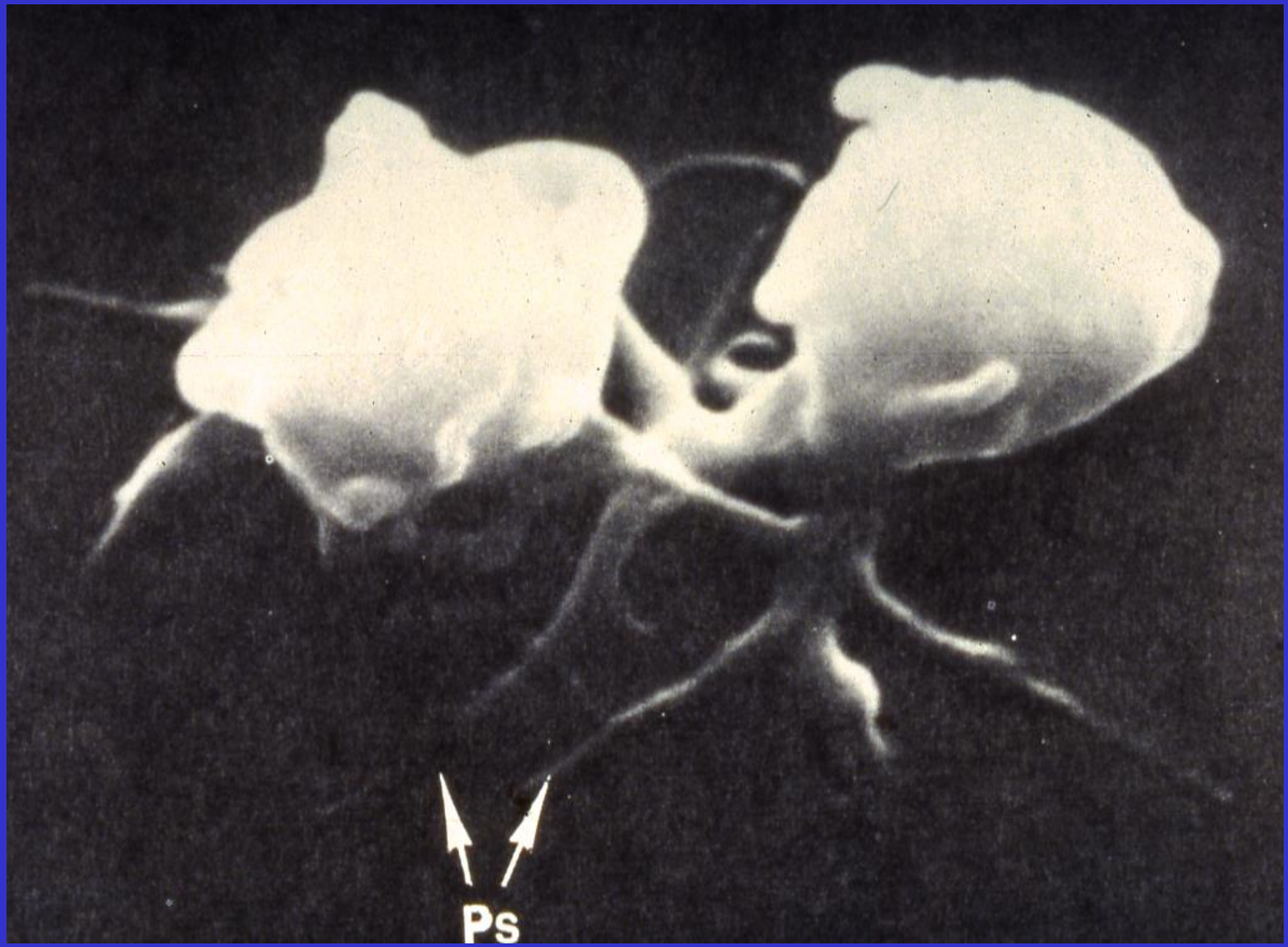
Platelet Activation

- Stickiness
- Shape Change
- Internal Contraction
- Secretion



Platelet in static form.

Platelet in activated form.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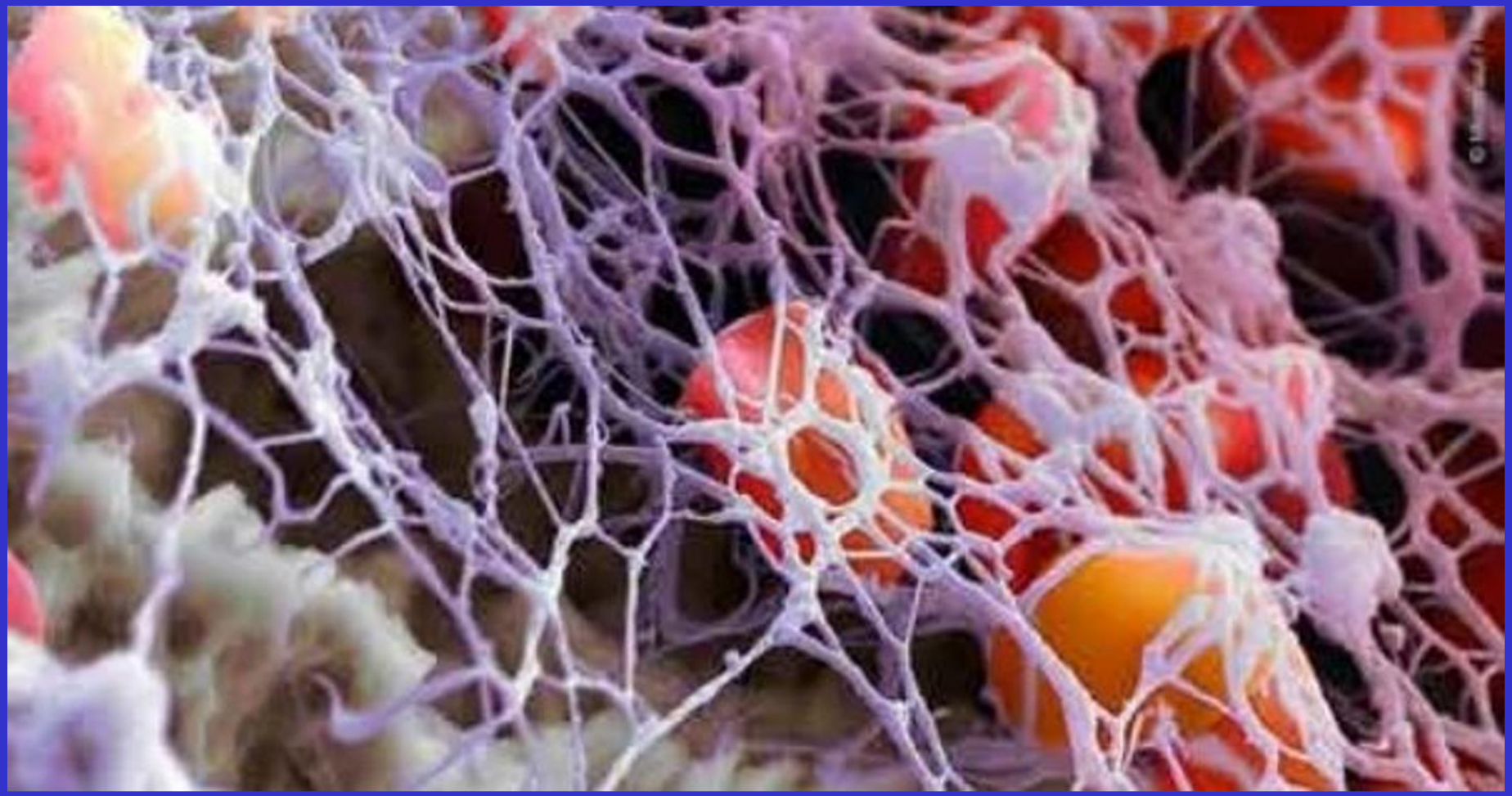
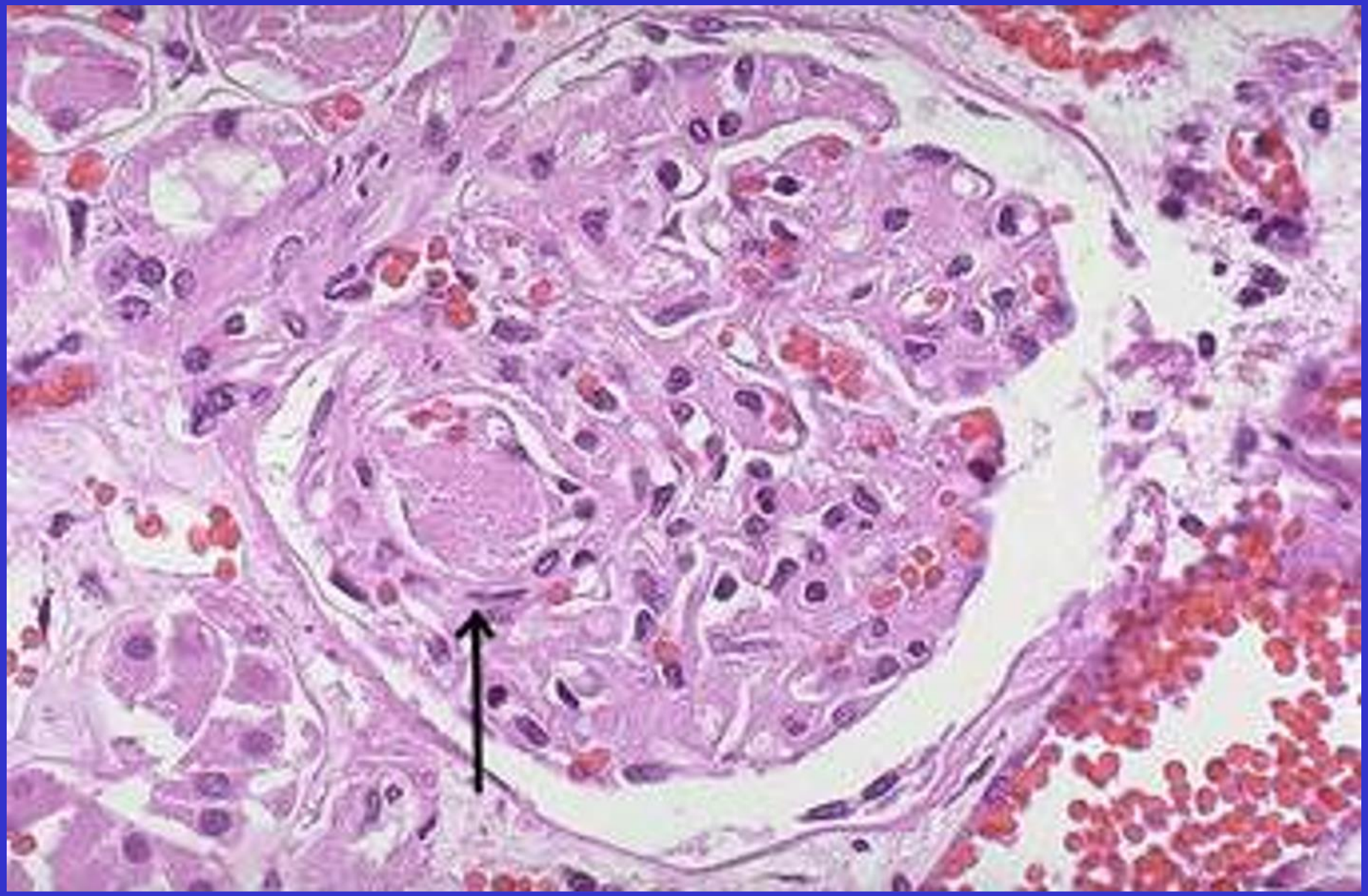


Early platelet fibrin hemostatic plug.

Late platelet fibrin hemostatic plug.



Organized hemostatic plug.

Measurements of Platelet Function

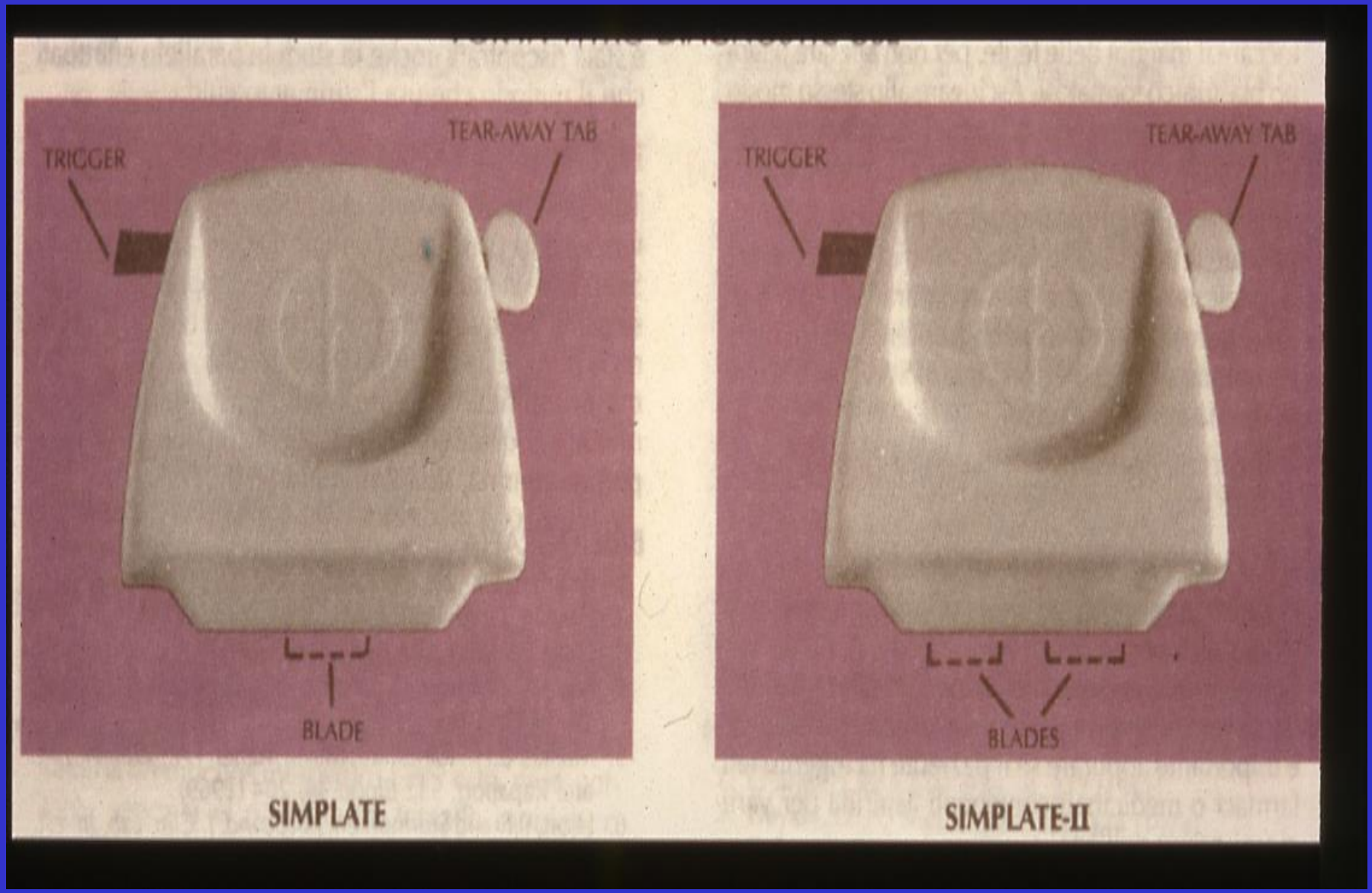
Tests of platelet function
Bleeding time

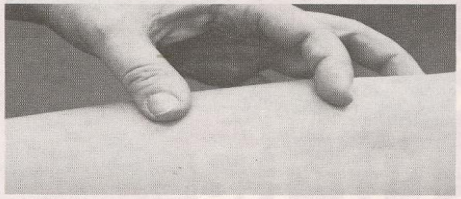
The bleeding time is estimated by making small wounds in the skin of the forearm after applying a blood pressure cuff to the upper arm and inflating it to 40mmHg; the average time that elapses until bleeding ceases is then measured.

PFA - 100 / PFA - 200

The bleeding time has largely been replaced by an *in vitro* estimation of primary haemostasis using a machine called a PFA-100.

BLEEDING TIME

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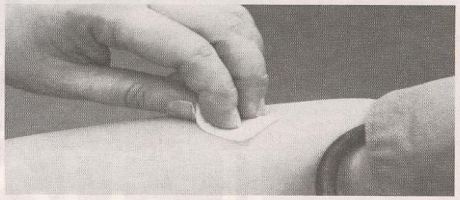
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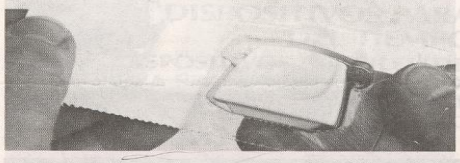
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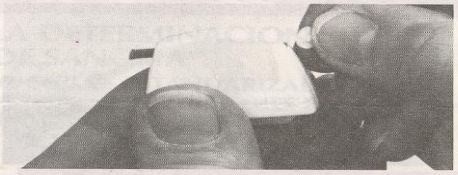
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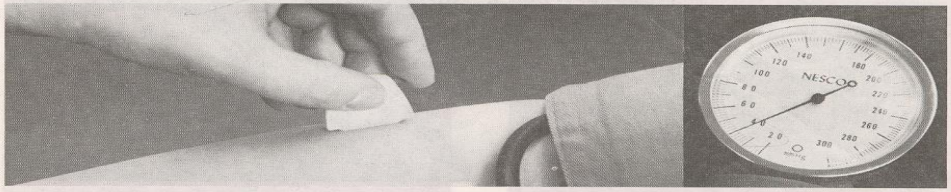

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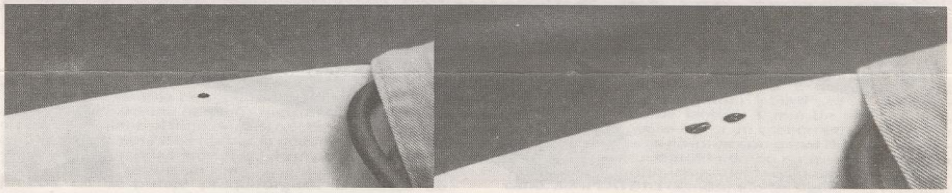
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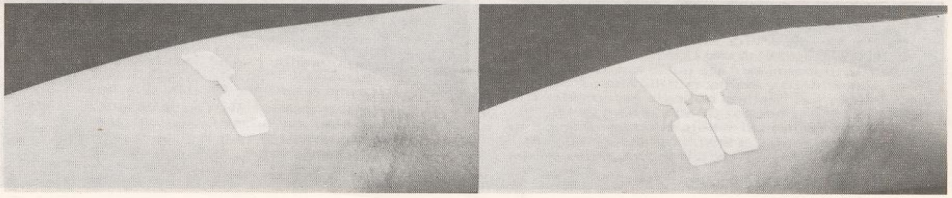
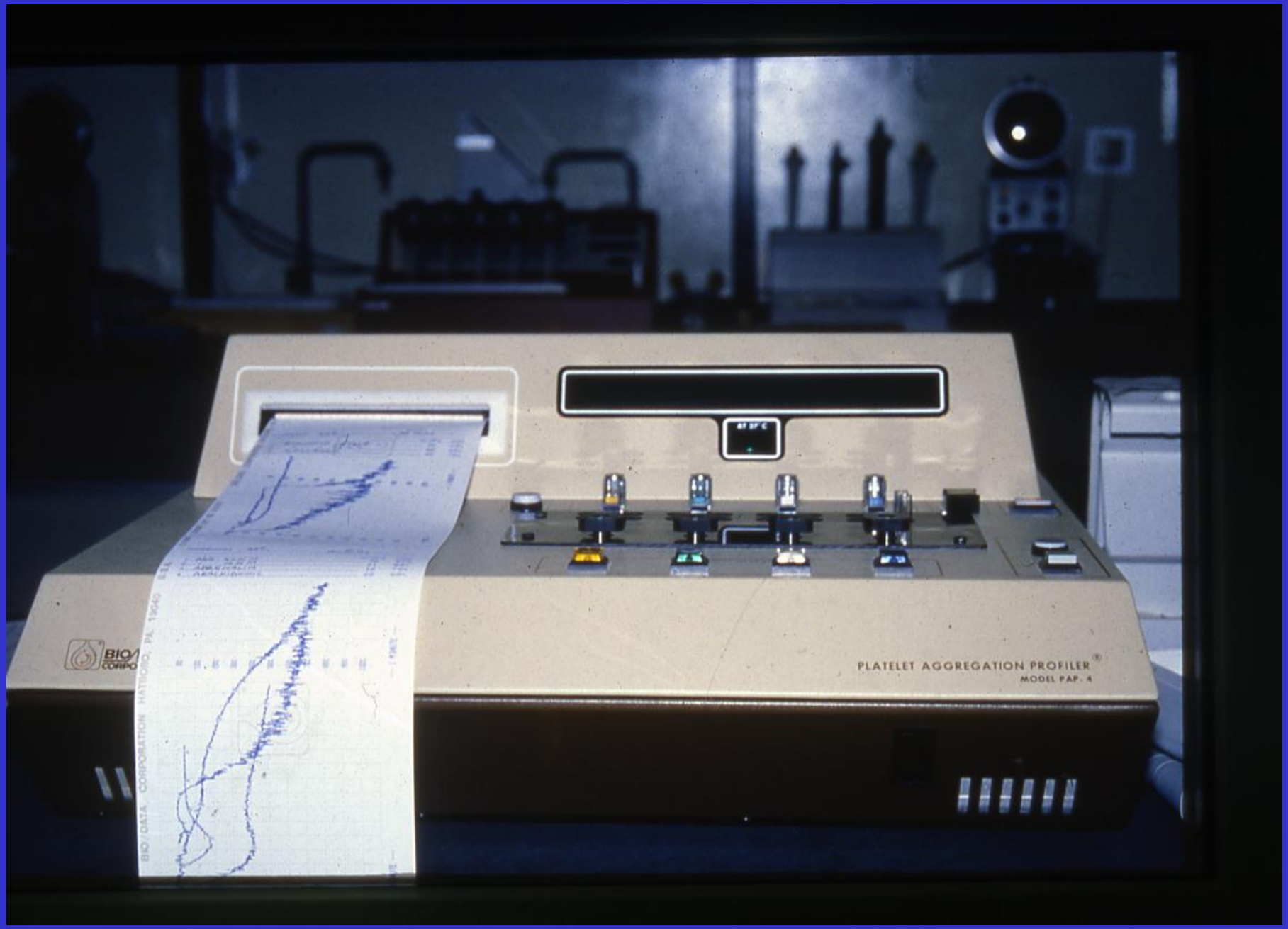

9

PFA - 200

Platelet Aggregation

Platelet aggregation studies

The most common is light transmission aggregometry, whereby the aggregation of platelets is studied following the addition of substances such as ADP, epinephrine, arachidonate, collagen and ristocetin to platelet-rich plasma. Aggregation causes an increase in the light transmitted through the sample and the test is performed using special equipment capable of continuously recording light transmission.


PLATELET AGGREGATION PROFILER®
MODEL PAP-4

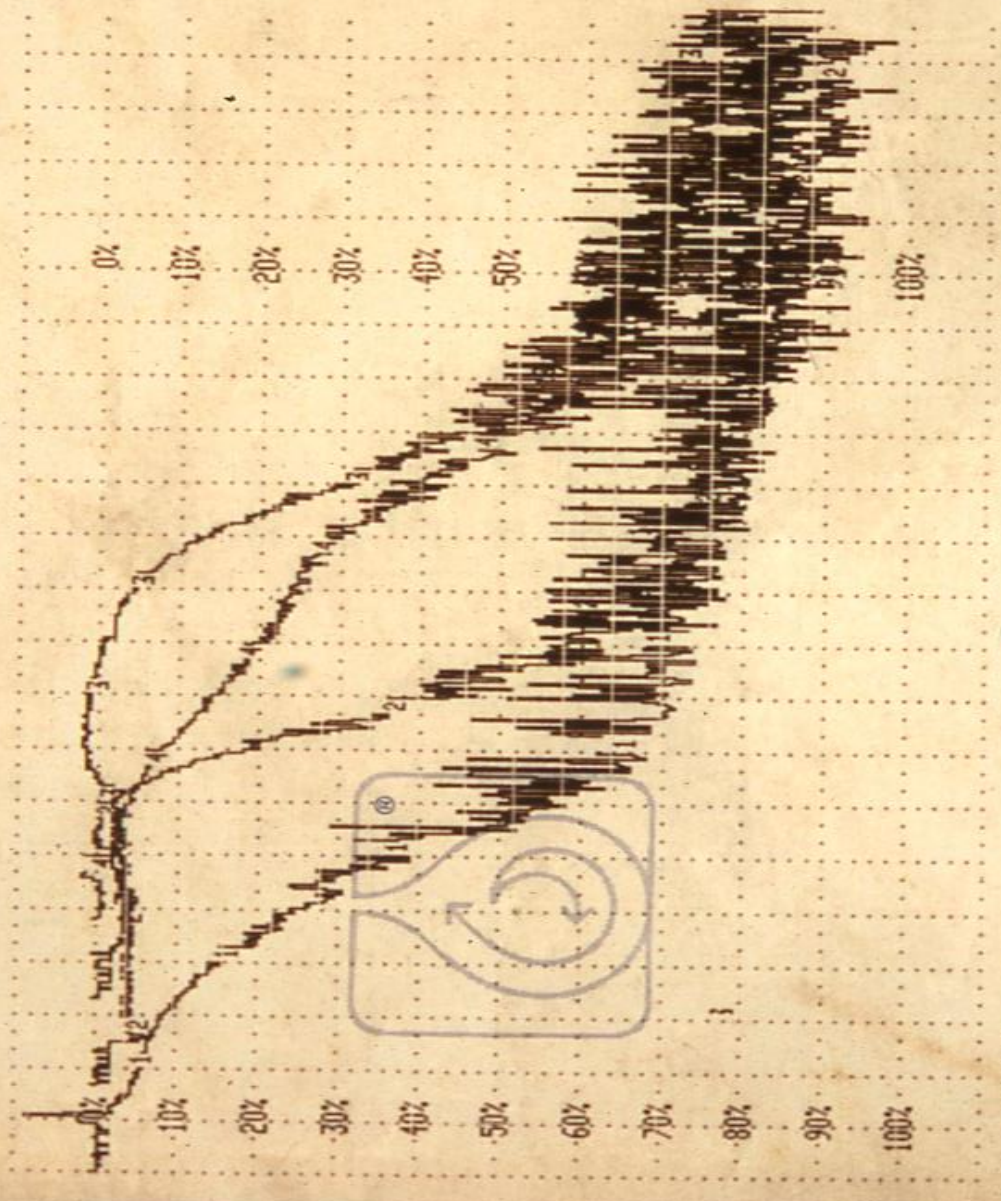
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
--- 1 MINUTE ---
--- 1 MINUTE ---
SLOPE AGG
1 ADP 2x10^-5 M 42 80%
2 Arachidonic Acid 34 80%
3 Collagen 10 µg/ml 42 80%
4 Epinephrine 1x10^-4 M 26 77%

Dr. Shihab Almashkadani

DATE: 4/9/12
8/8/12

COMMENTS: _____

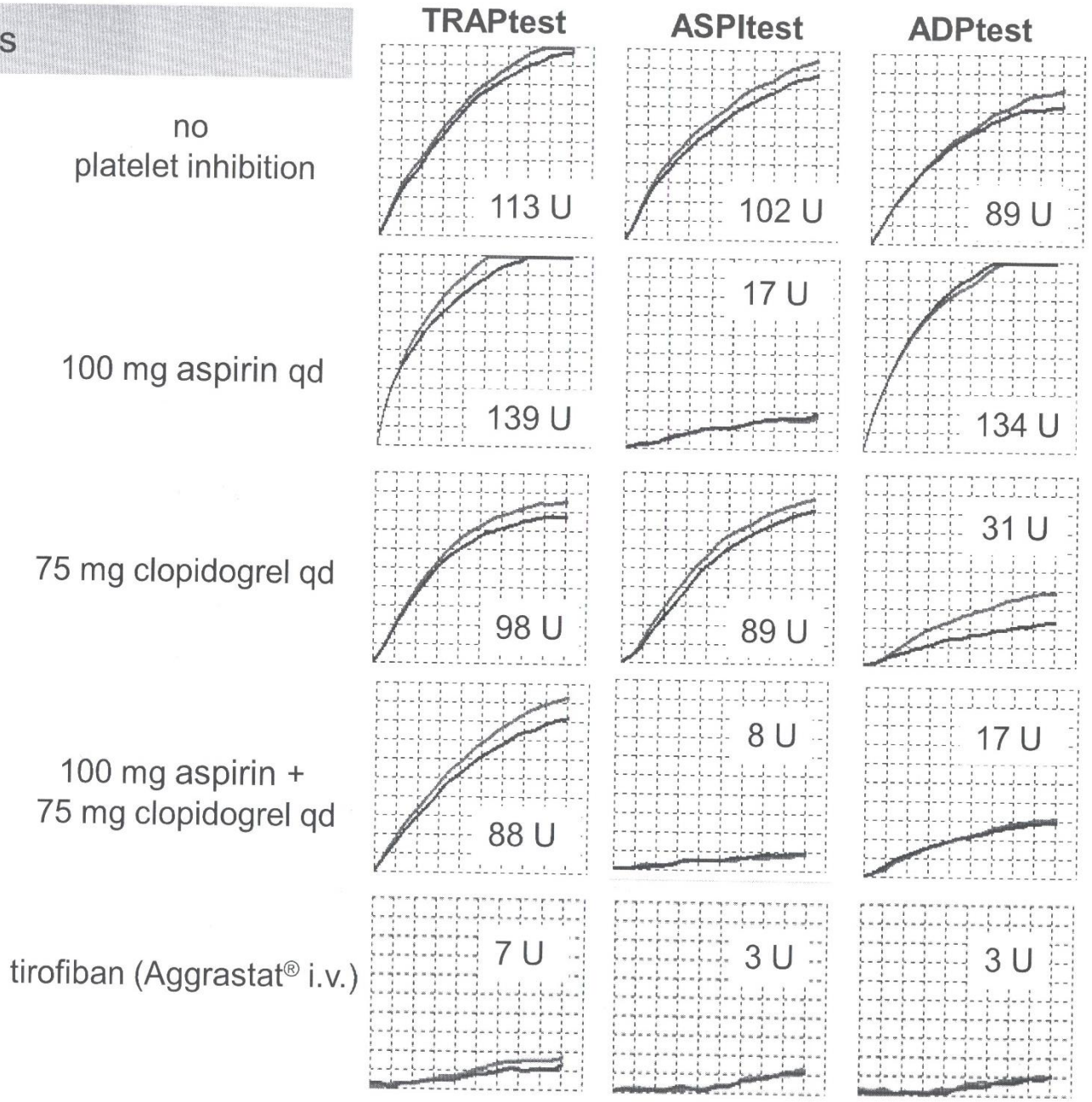
		SLOPE	AGG
1	Ristocetin : 1.5	31	80%
2	Collagen "S" 0.19 mg/ml	45	91%
3	Collagen "D" 0.19 mg/ml	30	76%
4	Epinephrine 1x10⁻⁴M	26	81%



MULTIPLATE

Multiple Electrode Aggregometer

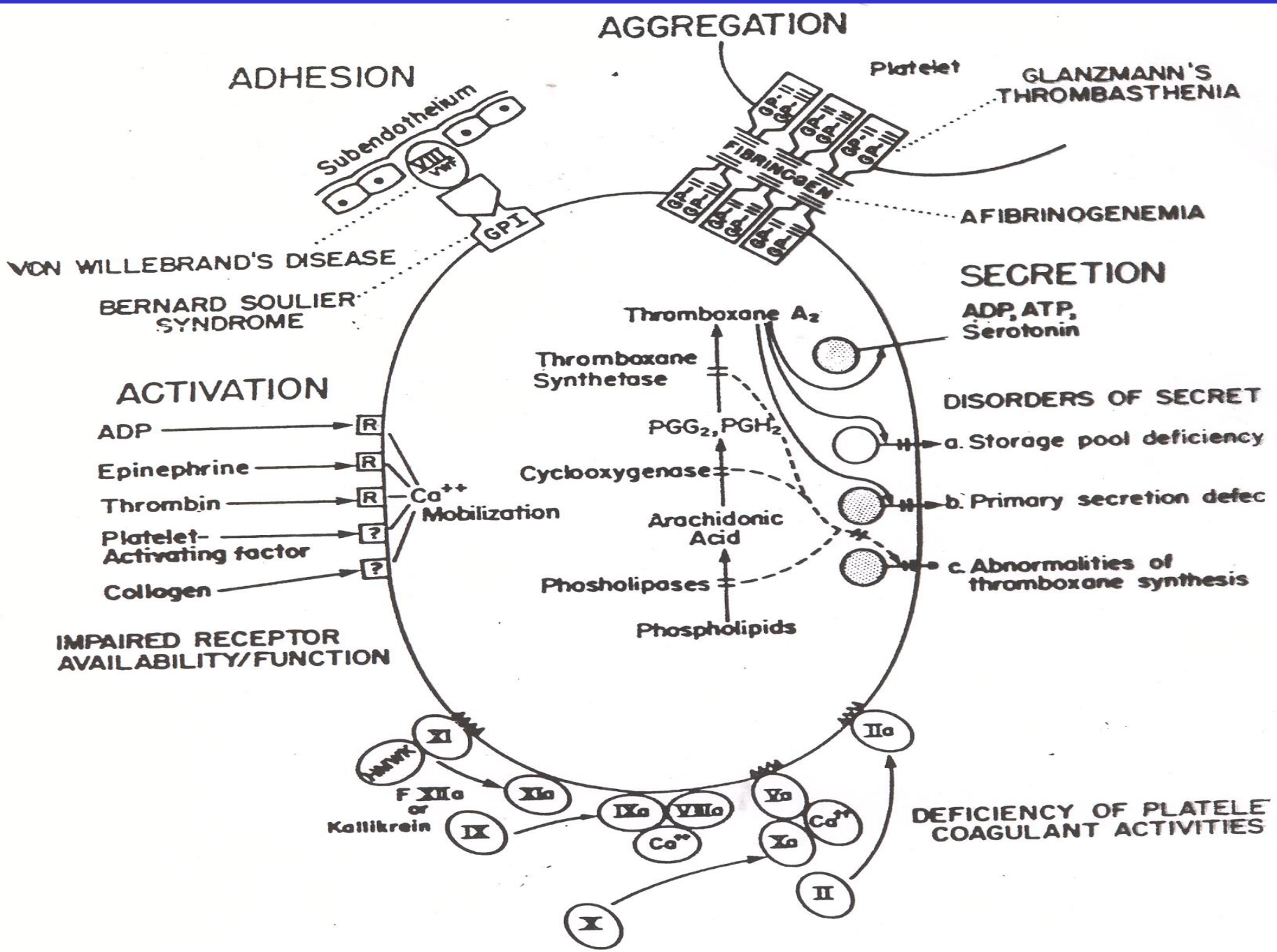
► examples

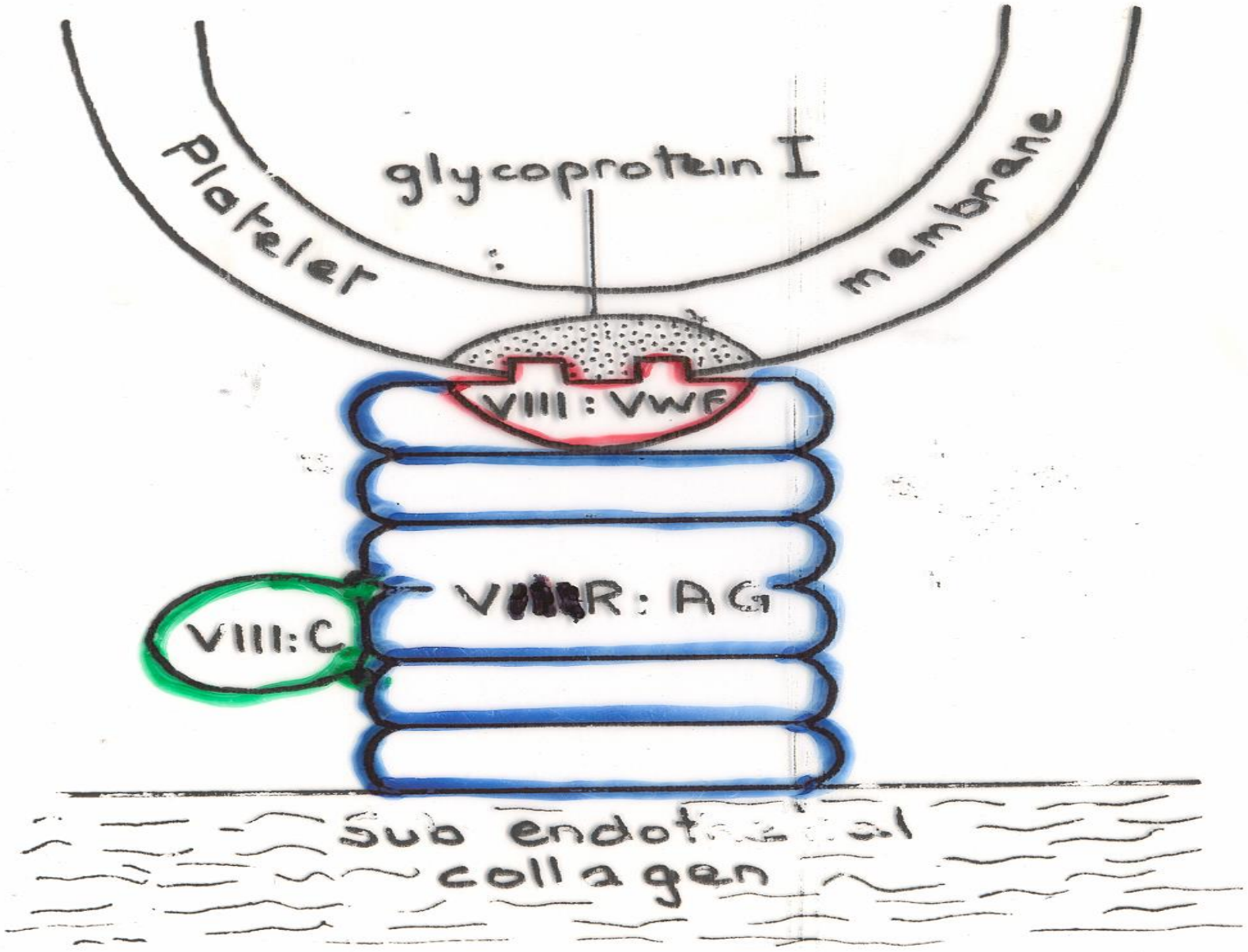

TRAPtest
ASPItest
ADPtest
no platelet inhibition
113 U
102 U
89 U
100 mg aspirin qd
139 U
17 U
134 U
75 mg clopidogrel qd
98 U
89 U
31 U
100 mg aspirin + 75 mg clopidogrel qd
88 U
8 U
17 U
tirofiban (Aggrastat® i.v.)
7 U
3 U
3 U

HEREDITARY PLATELET DISORDERS

Inherited disorders of platelet function

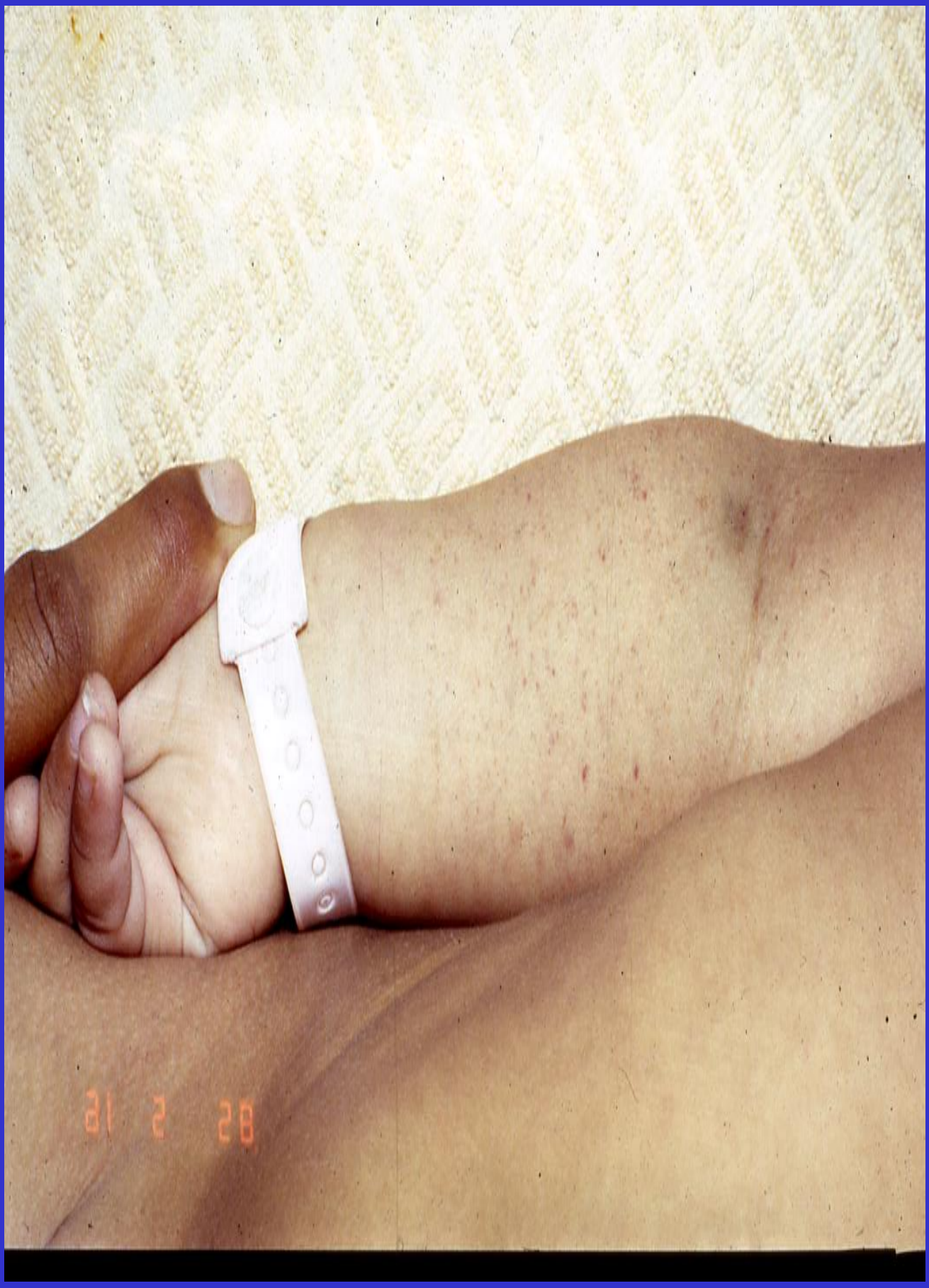
- **Membrane abnormalities**
  - Bernard – Soluier syndrome
  - Thrombasthenia (Glanzmann's Disease)
  - Platelet factor – 3 deficiency
- **Intracellular abnormalities**
- **Storage-pool (dense body) deficiency**
  - Hermansky – Pudlak syndrome
  - Wiskott – Aldrich syndrome
  - Chediak – Higashi syndrome
  - Thrombocytopenia with absent radii
  - Idiopathic storage – pool disease
- **Storage-pool (α- granule) deficiency**
  - Gray platelet syndrome
  - Combined deficiency of dense bodies and α granules
- Defects of thromboxane synthesis
  - Cyclo-oxygenase deficiency
  - Thromboxane synthetase Deficiency
  - Defective response to thromboxane
- **Miscellaneous**
  - Epstein's syndrome
  - May-Hegglin anomaly

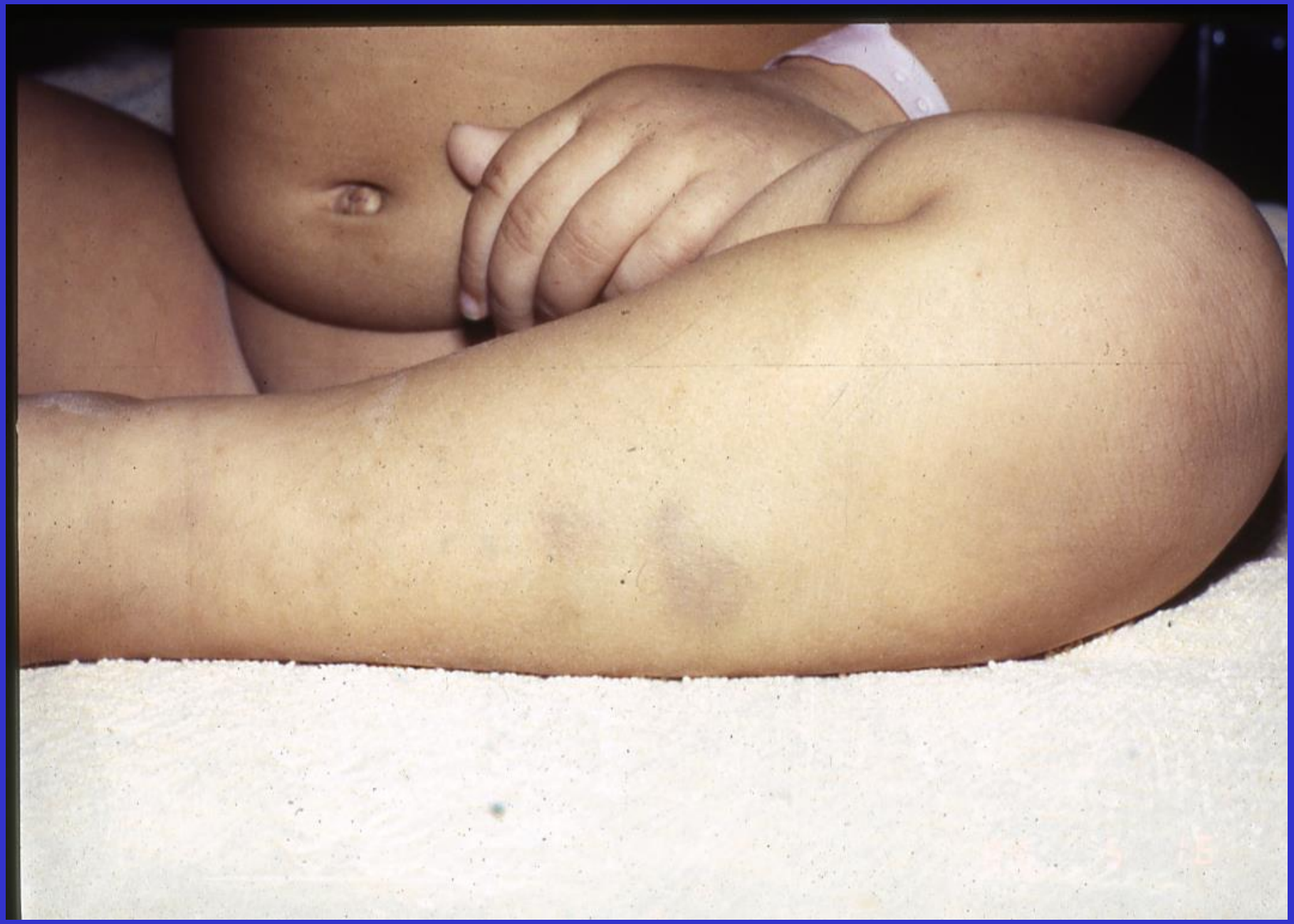

AGGREGATION
ADHESION
Platelet
GLANZMANN'S THROMBASTHENIA
Subendothelium
FIBRINOGEN
AFIBRINOGENEMIA
GPI
VON WILLEBRAND'S DISEASE
BERNARD SOULIER SYNDROME
SECRETION
ADP, ATP, Serotonin
Thromboxane A2
Thromboxane Synthetase
ACTIVATION
DISORDERS OF SECRET
ADP
Epinephrine
Thrombin
Platelet-Activating factor
Collagen
Ca++ Mobilization
PGG2, PGH2
Cyclooxygenase
Arachidonic Acid
Phosholipases
Phospholipids
a. Storage pool deficiency
b. Primary secretion defec
c. Abnormalities of thromboxane synthesis
IMPAIRED RECEPTOR AVAILABILITY/FUNCTION
F XIIa or Kallikrein
DEFICIENCY OF PLATELE COAGULANT ACTIVITIES

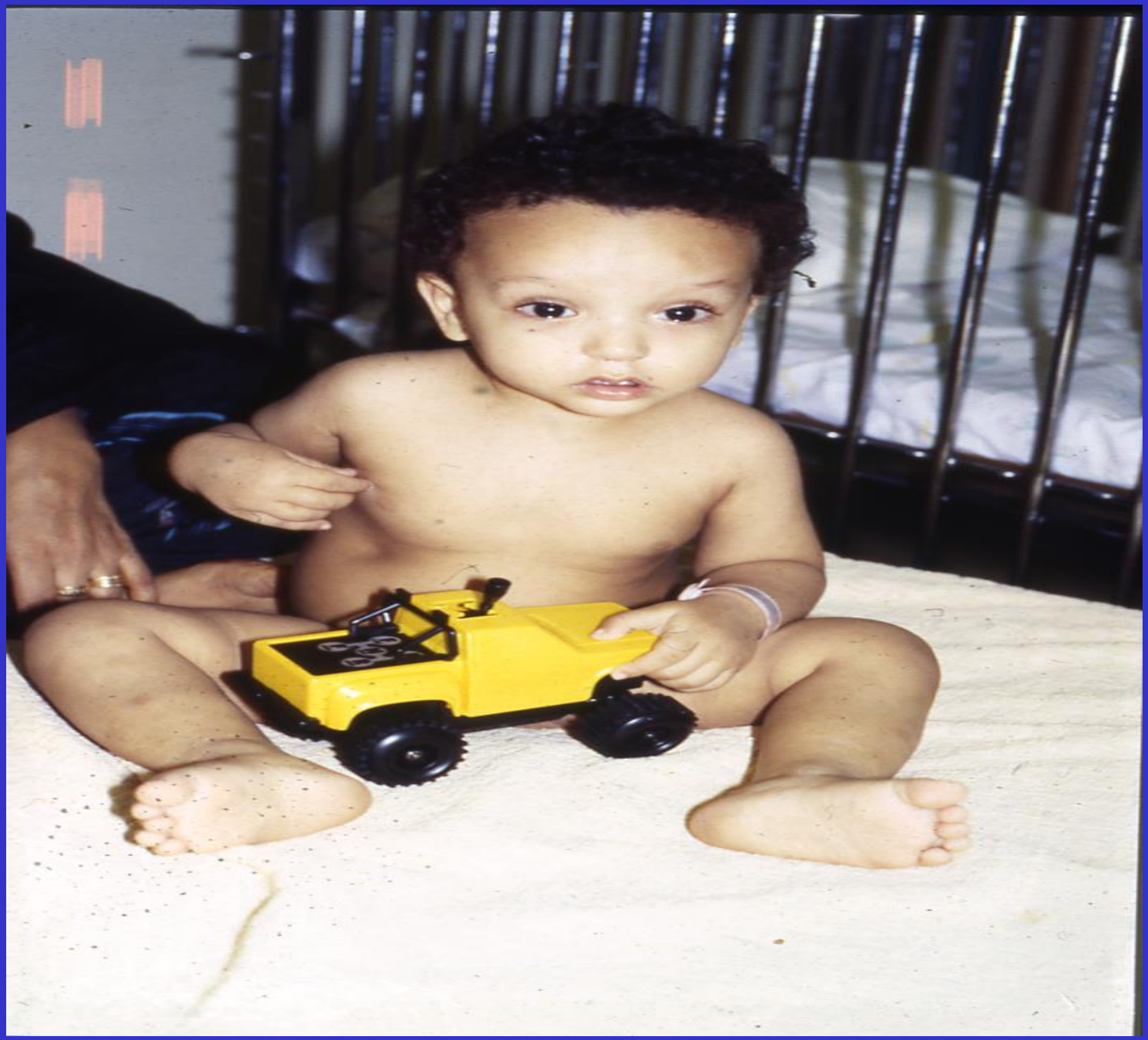

Platelet
glycoprotein I
membrane
VIII : VWF
VIII:C
R : AG
Sub endothelial
collagen

Inherited
Glanzmann's disease

This is a rare but severe platelet disorder caused by a lack of glycoprotein IIb/IIIa receptors. Inheritance is autosomal recessive and platelets are normal in morphology and number.


28 2 18

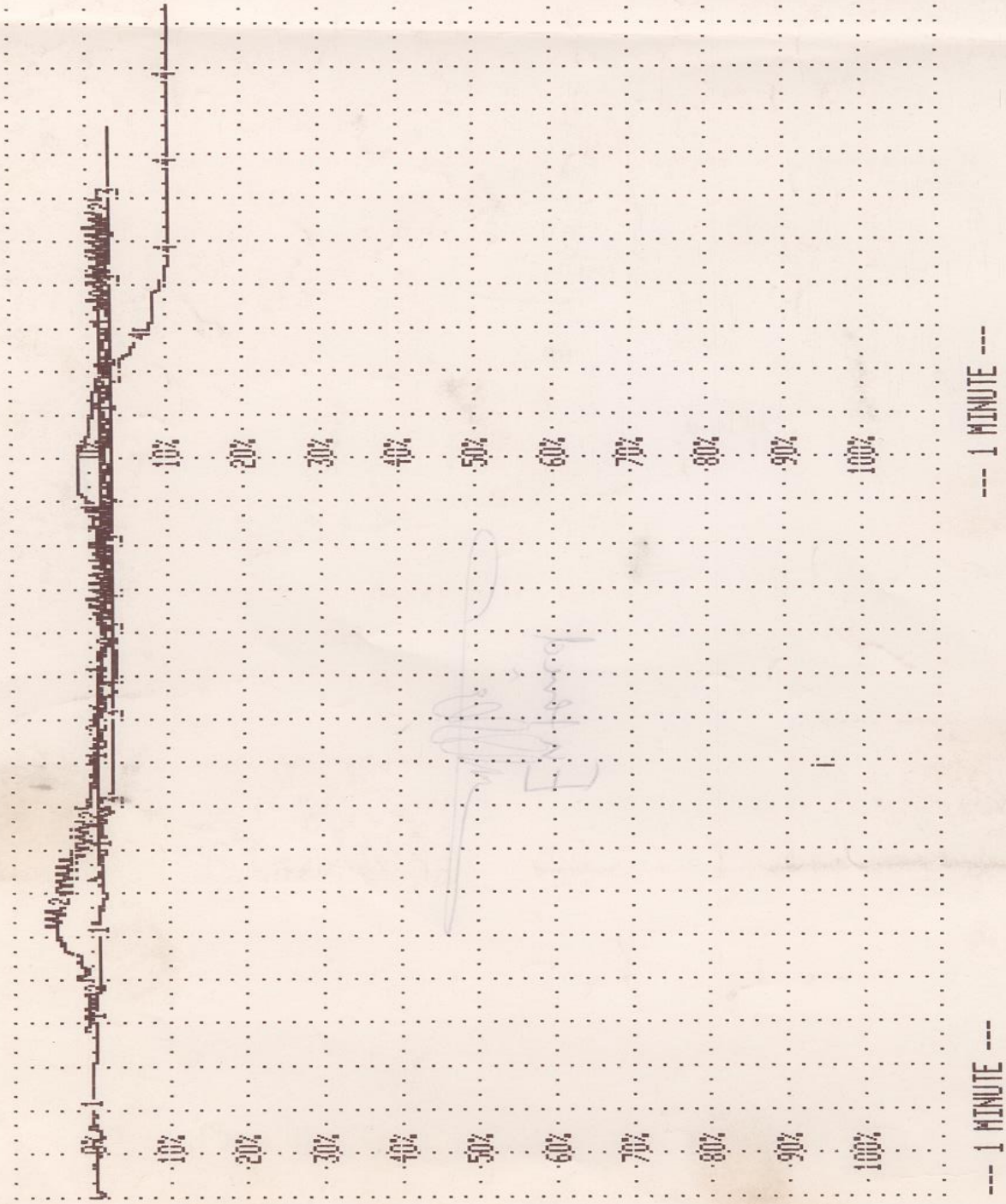




DATE: _____

COMMENTS: 81-35-33

		SLOPE	AGG
1	ADP BIO/DATA	03	02%
2	ARACHIDONIC	04	03%
3	ADRENALINE	04	03%
4	COLLAGEN	09	10%



Al Rahman

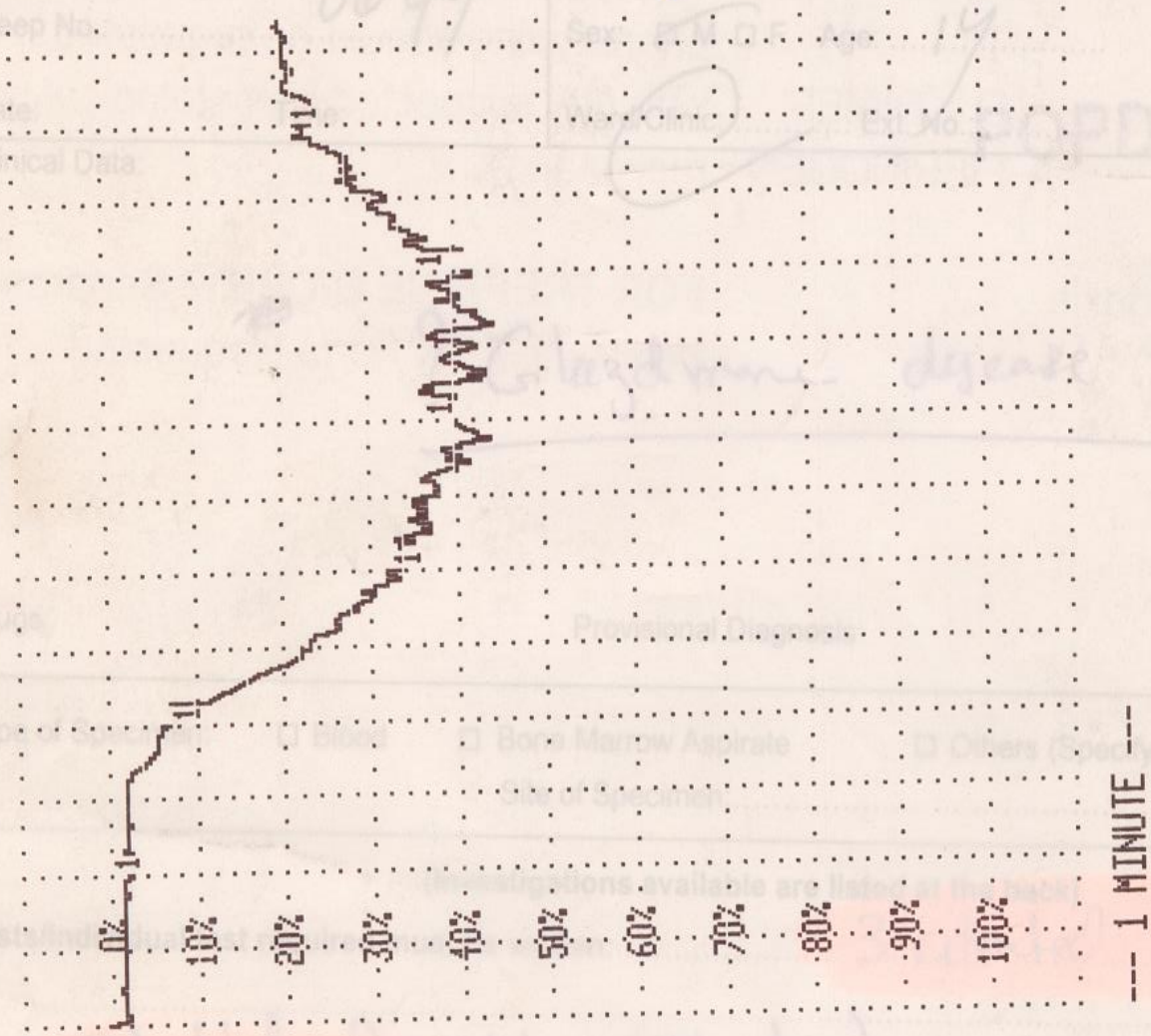
Lab #

KKUH

000358

COMMENTS: 81-35-33

		SLOPE	AGG
1	RISTO. 1.5 mg/ml	28	20%



Bernard-Soulier disease

This is a platelet disorder caused by a lack of glycoprotein Ib receptors. Inheritance is autosomal recessive. Platelets are larger than normal and usually the platelet count is reduced.

BIO/DATA CORPORATION, HATBORO, PA. 19040 U.S.A.

PRINT FROM MEMORY

DATE: 5/24

COMMENTS: NORMAL PLATELETS

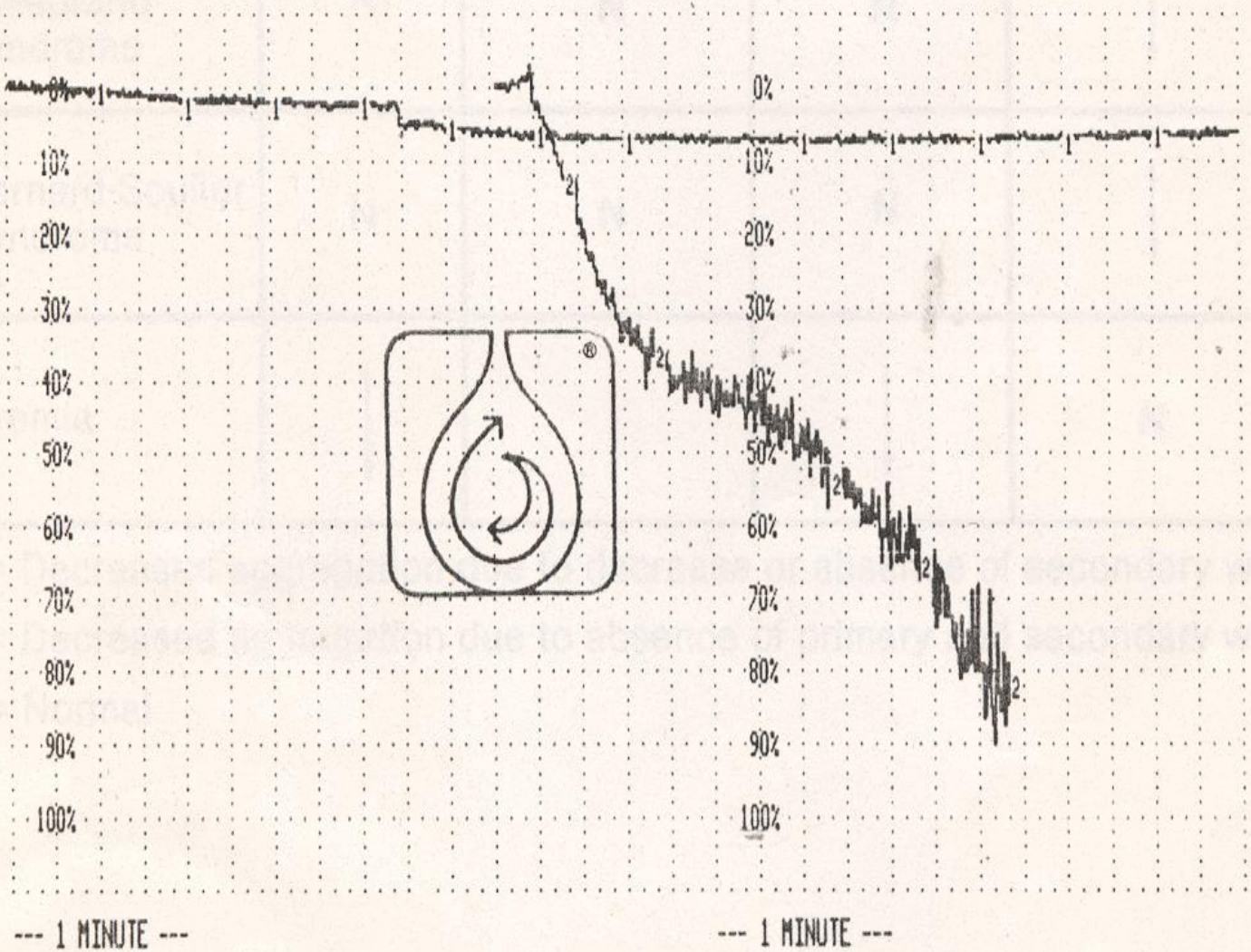
	SLOPE	AGG
1 ADP 2x10⁻⁶M	58	99%
2 ARACHIDONIC ACID	52	86%
3 COLLAGEN 1.9 mg/ml	62	89%
4 EPINEPHRINE 10⁻³M	30	95%

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

--- 1 MINUTE ---

--- 1 MINUTE ---

BIO/DATA CORPORATION, HATBORO, PA. 19040 U.S.A.



PRINT FROM MEMORY

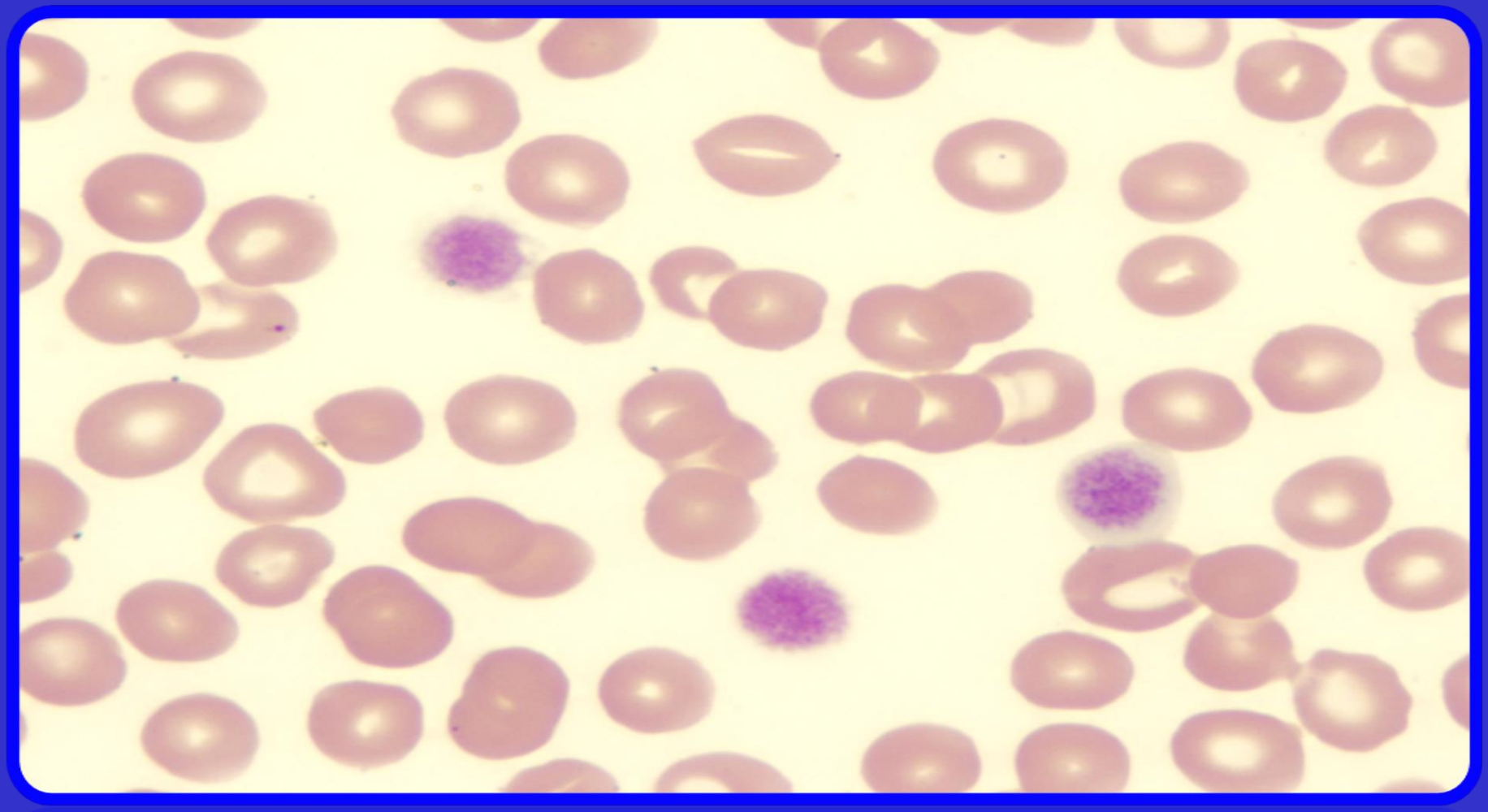
DATE: 5/84

COMMENTS: Ristocetin, 1.25 mg/kg

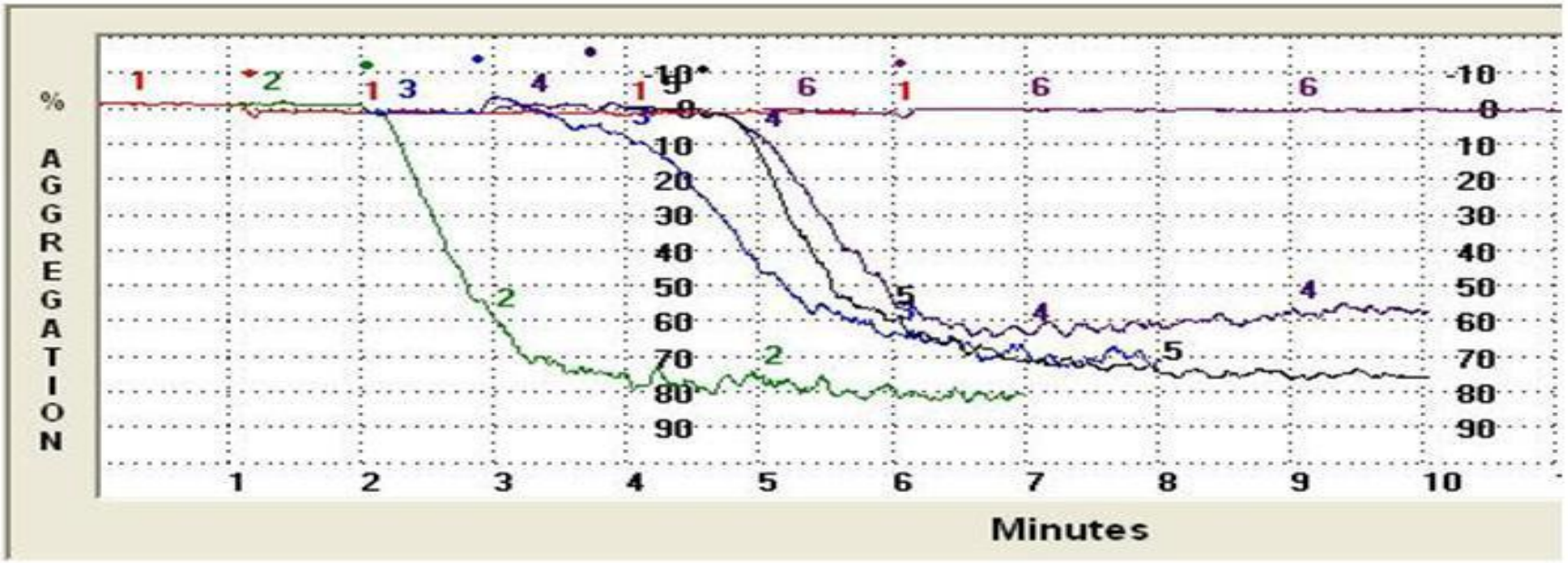
	SLOPE	AGG
1 Von Willebrand Patient	04	07%
2 Normal Control	31	85%

Test	**Patient**	**Reference Range**
PT	**12.8s**	**11.5 -13.2s**
APTT	**27s**	**26-32s**
Fibrinogen (Clauss)	**2.9g/L**	**2-4 g/L**
Platelets	**45 x 10^9/L**	**150-450 x 10^9/L**

Haemostatic profile from a patient with Bernard-Soulier syndrome.



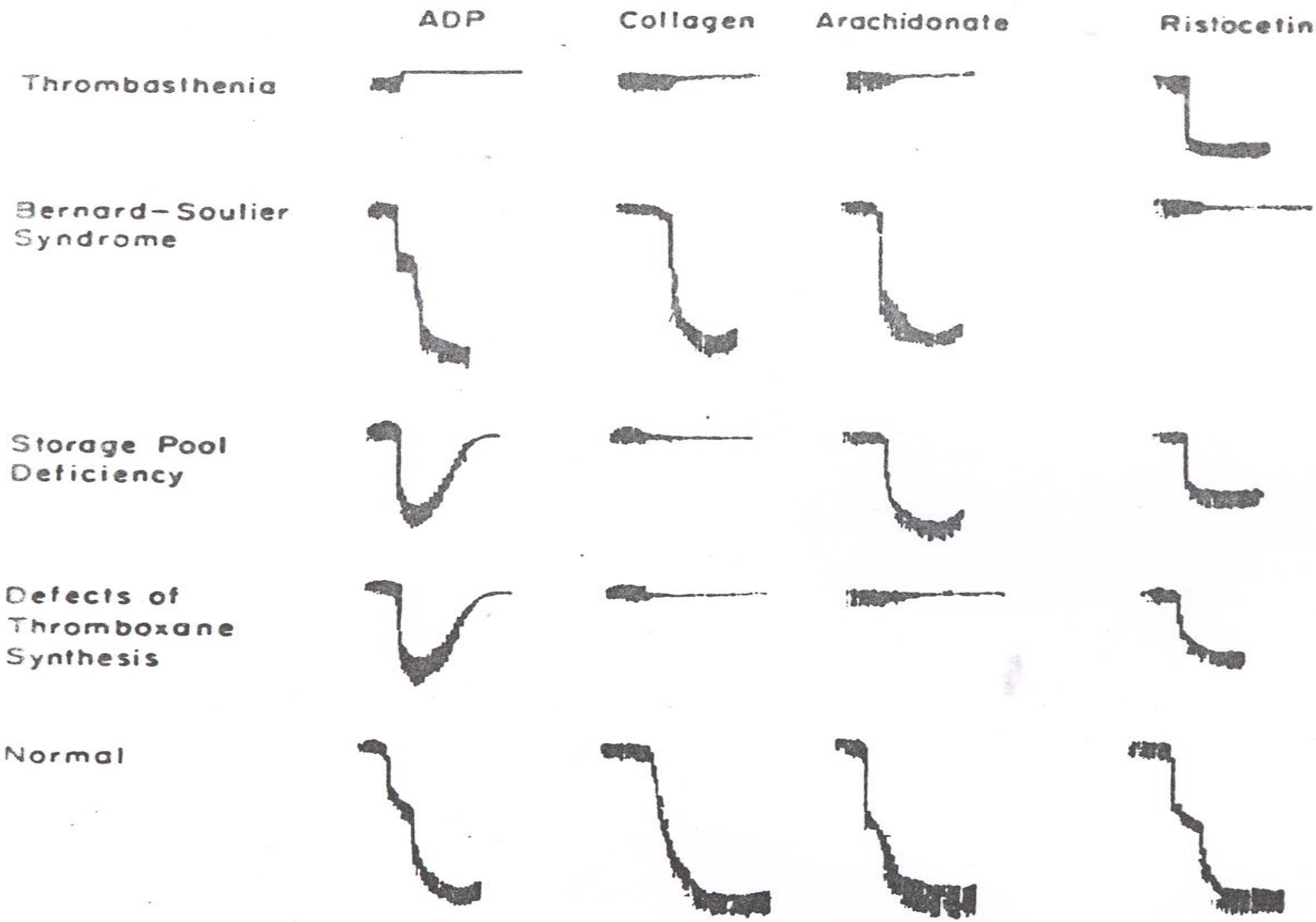
Blood film picture from a patient with Bernard-Soulier syndrome showing very large platelets (giant platelets).



The results of platelet aggregation tests in a patient with Bernard-Soulier syndrome.

Storage pool diseases

These are inherited conditions resulting in defective platelet granules (α granules or dense body granules or both).



Aggregation patterns in platelet disorders.

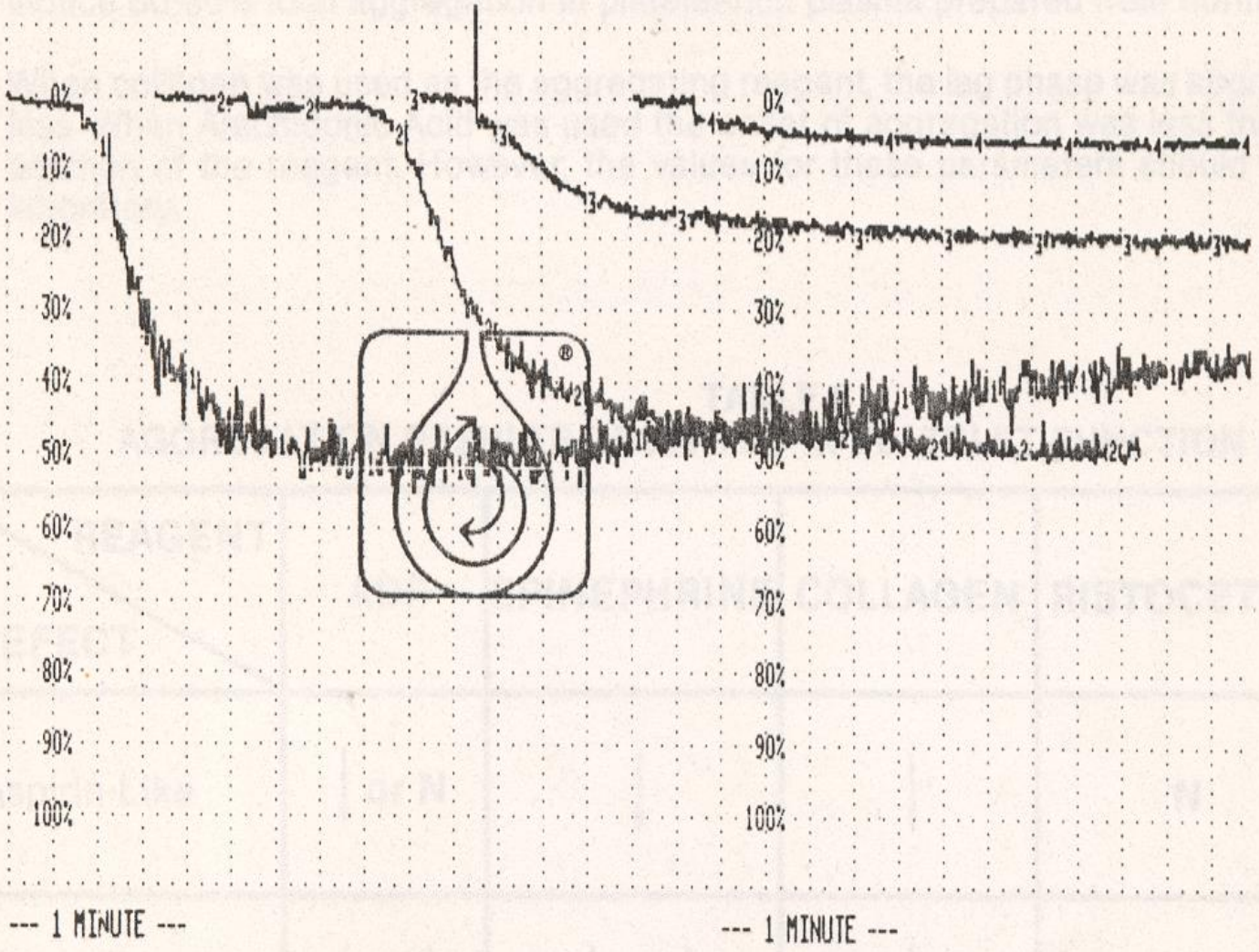
Causes of Acquired Platelet Dysfunction

- Uraemia
- Myeloproliferative Disorders
- Acute Leukaemias and Myelodysplastic Syndrome
- Paraproteinaemias
- Chronic Hypoglycemia
- Liver Disease
- Valvular and Congenital Heart Disease
- Severe Burns
- Scurvy
- Drugs (aspirin etc.)

Acquired Abnormalities of platelet function

- An acquired defect of platelet function is found after ingestion of aspirin and other antiplatelet drugs.
- Other causes of an acquired abnormality of platelet function include chronic myeloproliferative disorders, myelodysplastic syndromes, paraproteinaemias (e.g. myeloma or Waldenström's macroglobulinaemia) and uraemia.

BIO/DATA CORPORATION, HATBORO, PA. 19040 U.S.A.



PRINT FROM MEMORY

DATE: 5/82

COMMENTS: Abnormal Platelets
Aspirin ingestion

		SLOPE	AGG
1	ADP 2X10-5M	42	33%
2	Collagen .1% ml	27	48%
3	Epinephrine 10-5M	09	20%
4	Arachidonic Acid	07	06%

Figure 9

THROMBOCYTOPENIA

Causes of thrombocytopenia

Bone Marrow Failure

- **Bone Marrow failure of platelet production**
  - **Selective megakaryocyte depression in the bone marrow**
    rare congenital defects (amegakaryocytic aplasia)
  - **drugs, chemicals, viral infections**
  - **Part of general bone marrow failure**
  - **cytotoxic drugs**
  - **radiotherapy**
  - **aplastic anaemia**
  - **leukaemia**
  - **myelodysplastic syndromes**
  - **myelofibrosis**
  - **marrow infiltration e.g. carcinoma, lymphoma**
  - **multiple myeloma**
  - **megaloblastic anaemia**
  - **HIV infection**

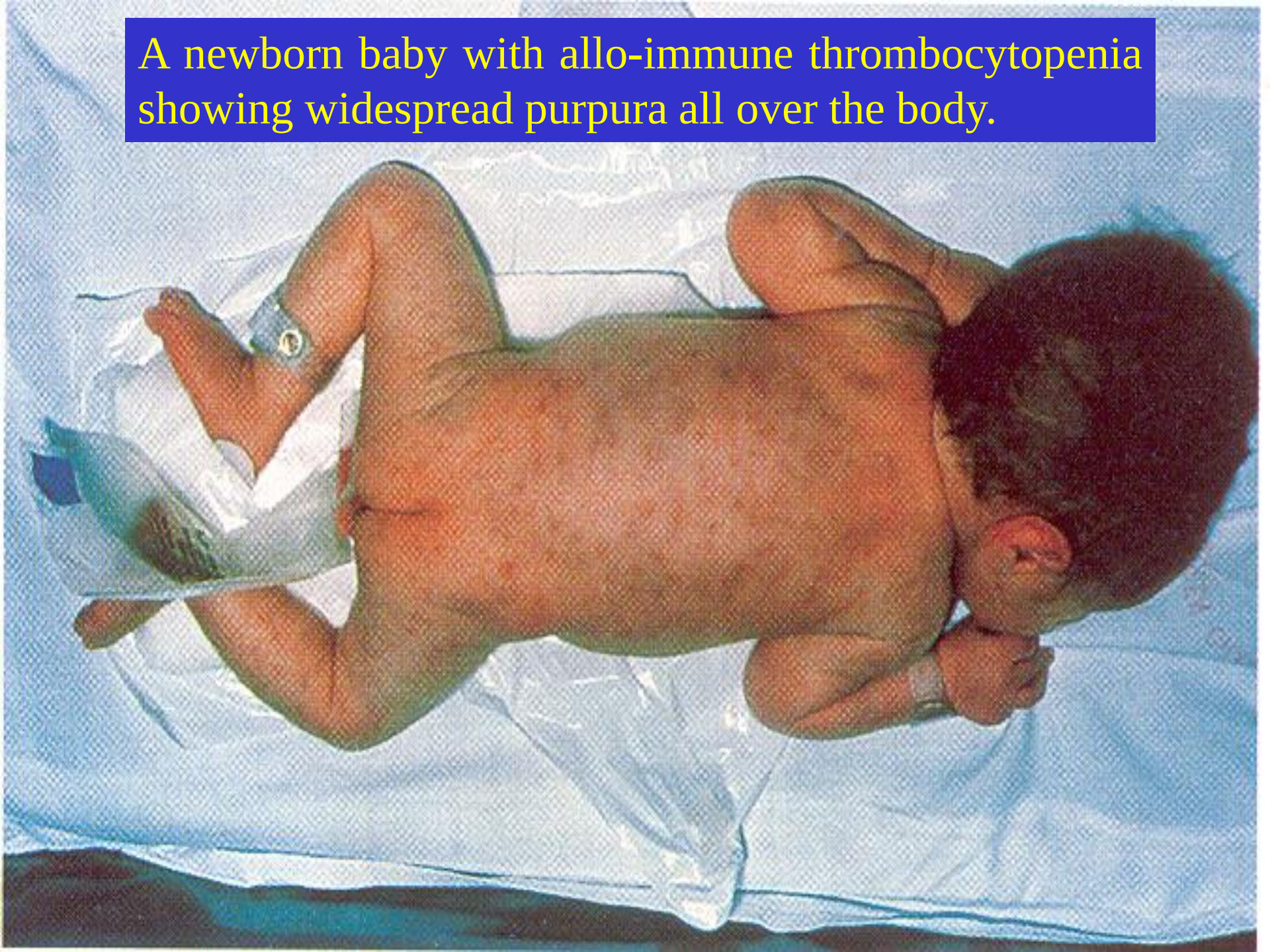
Causes of thrombocytopenia (continued)

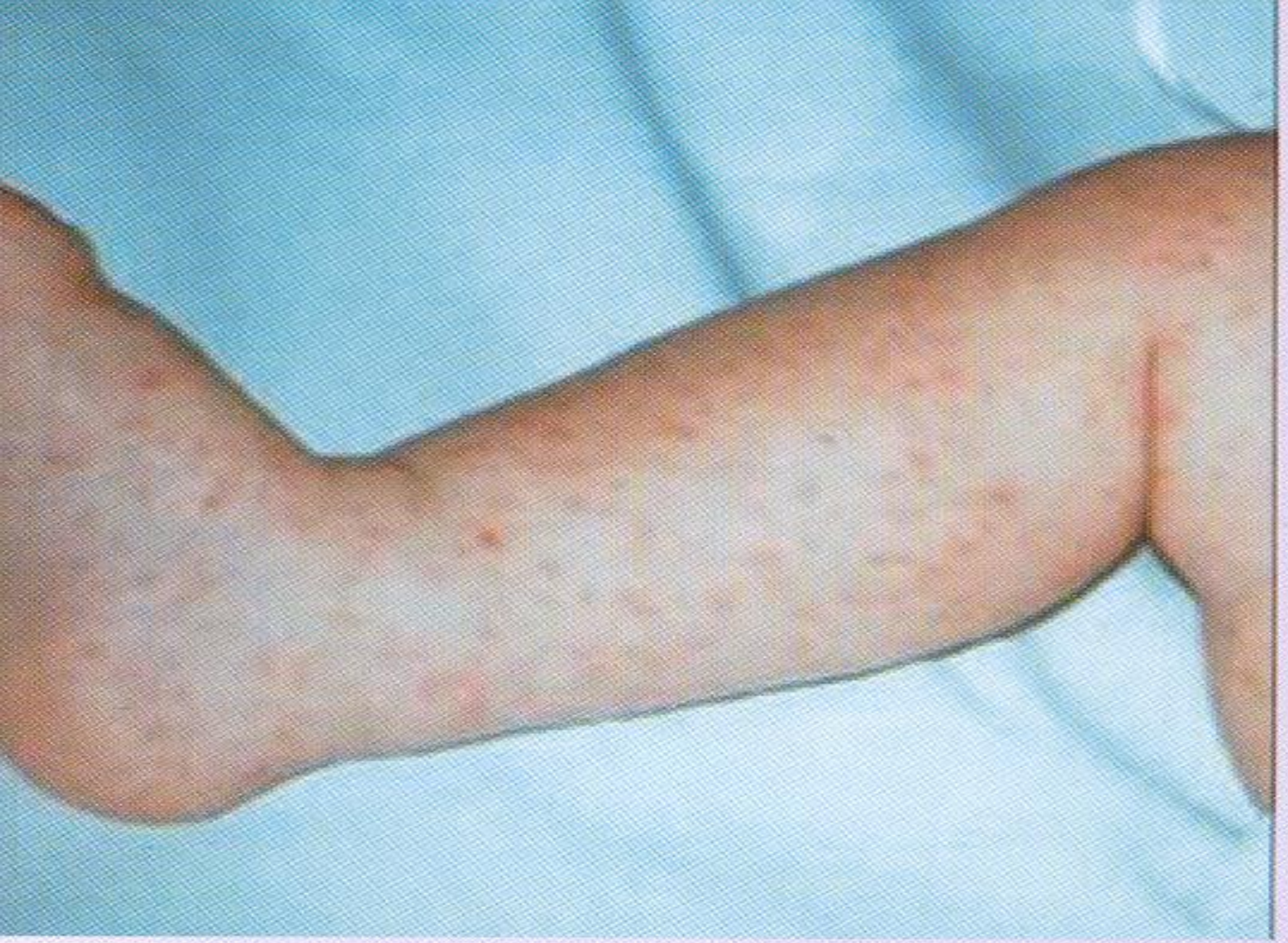
Increased consumption of platelets in the peripheral blood

- **Immune**
  - **autoimmune (idiopathic)**
  - **associated with systemic luups erythematosus, chroniclymphocytic leukaemia or lymphoma**
  - **feto-maternal alloimmune thrombocytopenia**
  - **post-transfusional purpura**
- **infections: HIV, other viruses, malaria**
- **drug-induced (e.g. heparin induced thrombocytopenia)**
- **Disseminated intravascular coagulation**
- **Thrombotic thrombocytopenic purpura**
- **Abnormal distribution of platelets**
  - **Splenomegaly**
- **Dilutional loss**
  - **Massive transfusion of stored blood to bleeding**

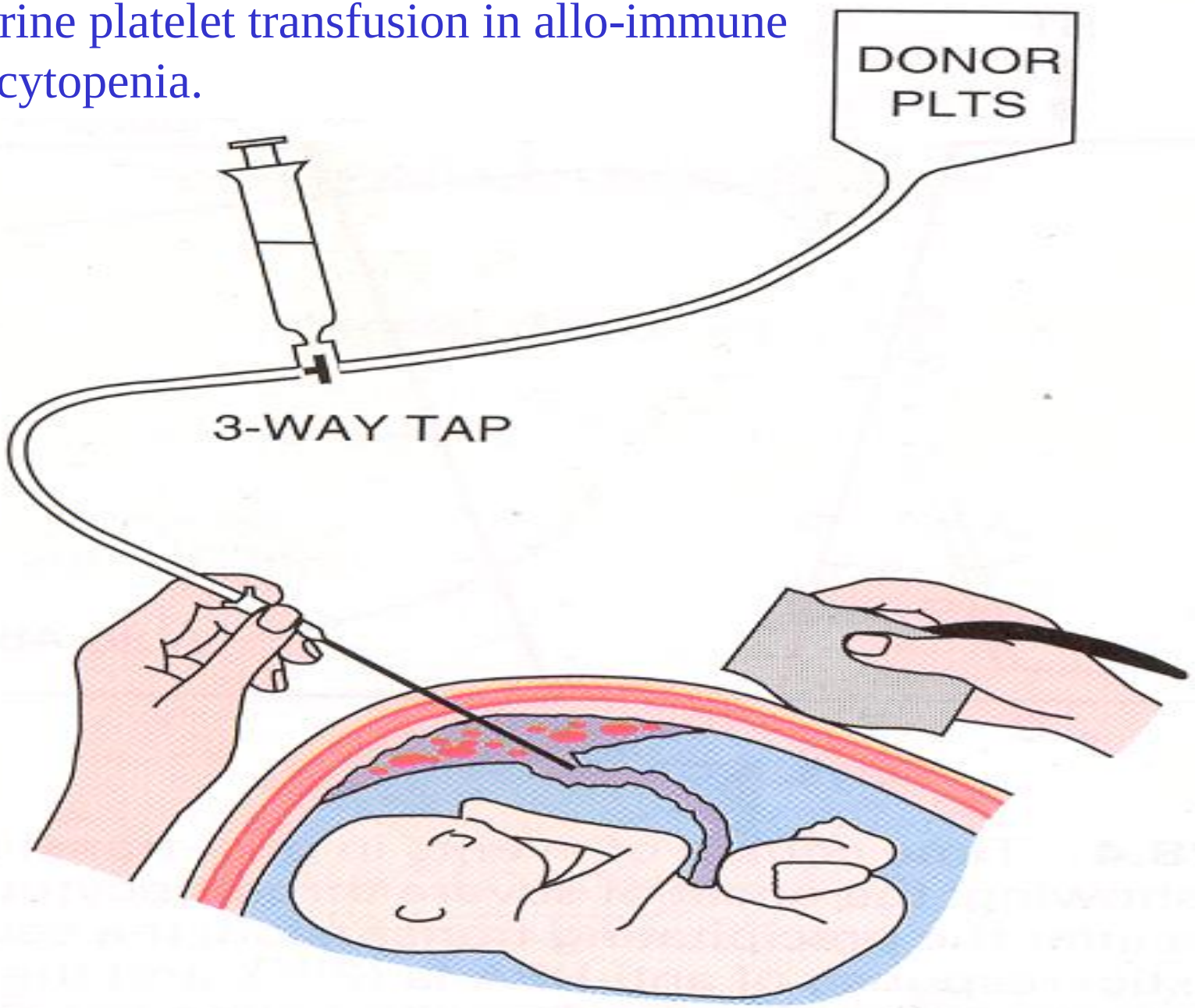
Increased splenic pooling

- A normal spleen contains within its microcirculation about 30% of all the blood platelets.
- The splenic platelet pool increases with increasing splenic size, so that in patients with moderate to massive splenomegaly it may account for 50-90% of all blood platelets, thus causing thrombocytopenia.


A newborn baby with allo-immune thrombocytopenia showing widespread purpura all over the body.



Intra-uterine platelet transfusion in allo-immune thrombocytopenia.



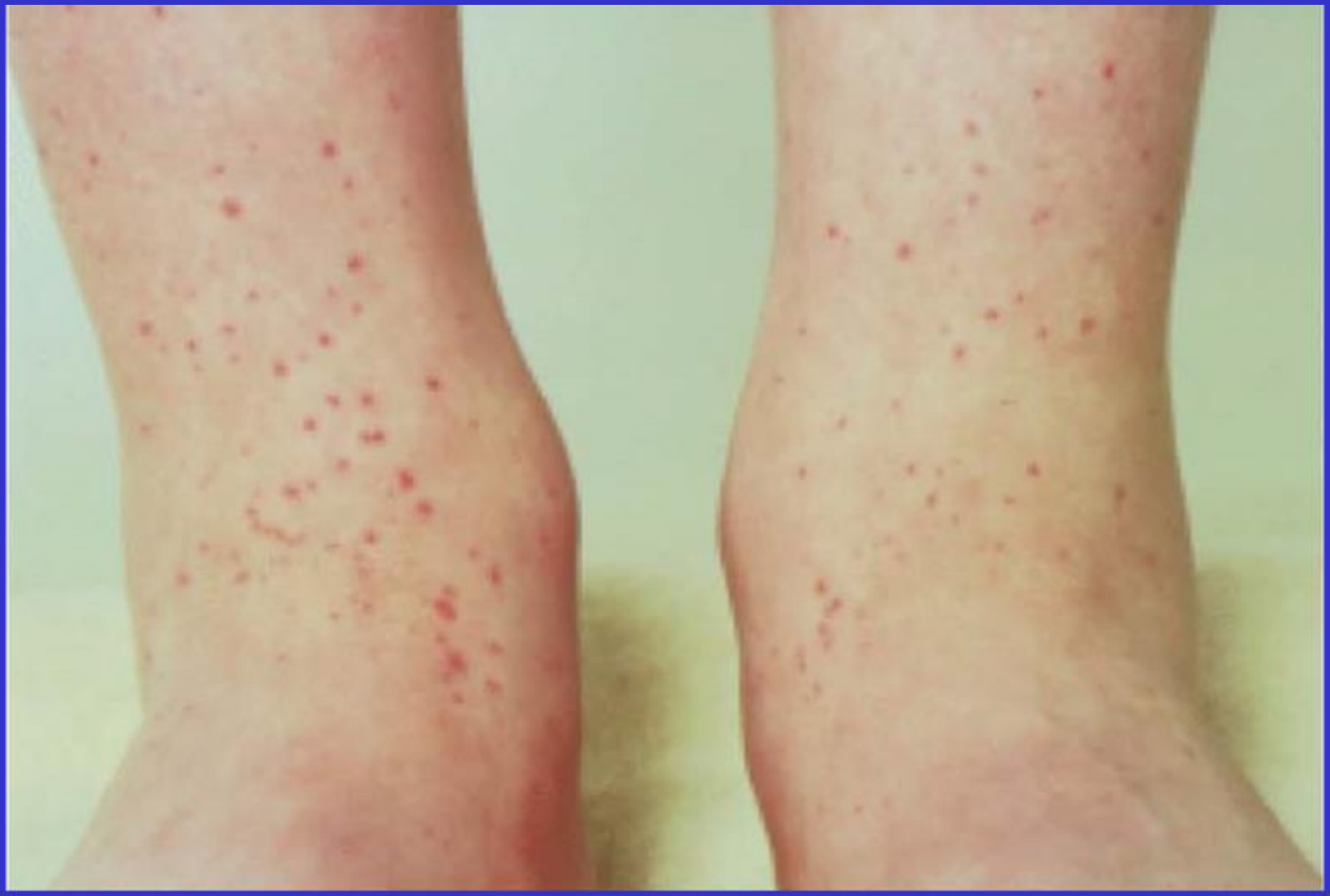
Immune thrombocytopenic purpura (ITP)

ITP is characterized by petechiae, bruising, spontaneous bleeding from mucous membranes and a reduction in the platelet count. The disease presents in both an acute and a chronic form.

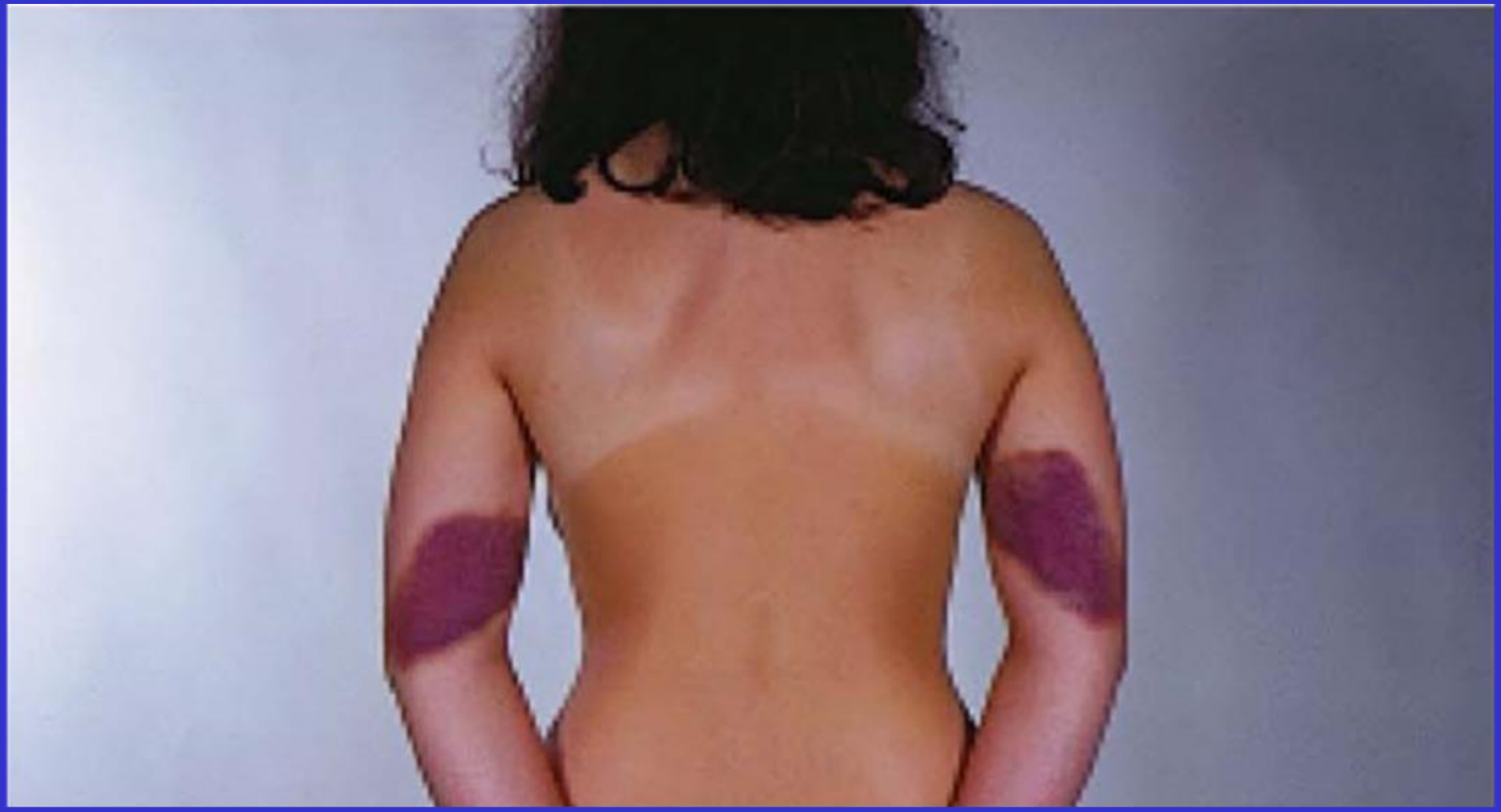
Clinical features

Acute ITP

This is seen at all ages but is most common before the age of 10 years. Two-thirds of patients give a history of a common childhood viral infection (e.g. upper respiratory tract infection, chicken pox, measles) 2-3 weeks preceding the purpura. Platelet counts are often less than 20×10^9/L. In most patients the disease runs a self-limiting course of 2-4 weeks, but in approximately 20% it becomes chronic; that is, it lasts more than 6 months. The mortality is low, the main danger being intracranial bleeding.



Multiple pin-point haemorrhages (petechiae) on the legs of a patient with idiopathic thrombocytopenic purpura (ITP).



Large ecchymoses on both the upper arms of a woman with ITP.

Clinical features of immune thrombocytopenia

Degree of Thrombocytopenia	Symptoms	Physical findings
Mild (>50 000/mm^3)	None	None
Moderate (30-50 000/mm^3)	Bruising with minor trauma	Scattered ecchymoses at trauma site
Severe (10-30 000/mm^3)	Spontaneous bruising. menorrhagia	Petechiae and purpura, more prominent on extremities
Marked (<10 000mm^3)	spontaneous brusing, mucosal bleeding, risk for CNS bleeding	Generalized purpura, epistaxis, GU bleeding CNS symptoms

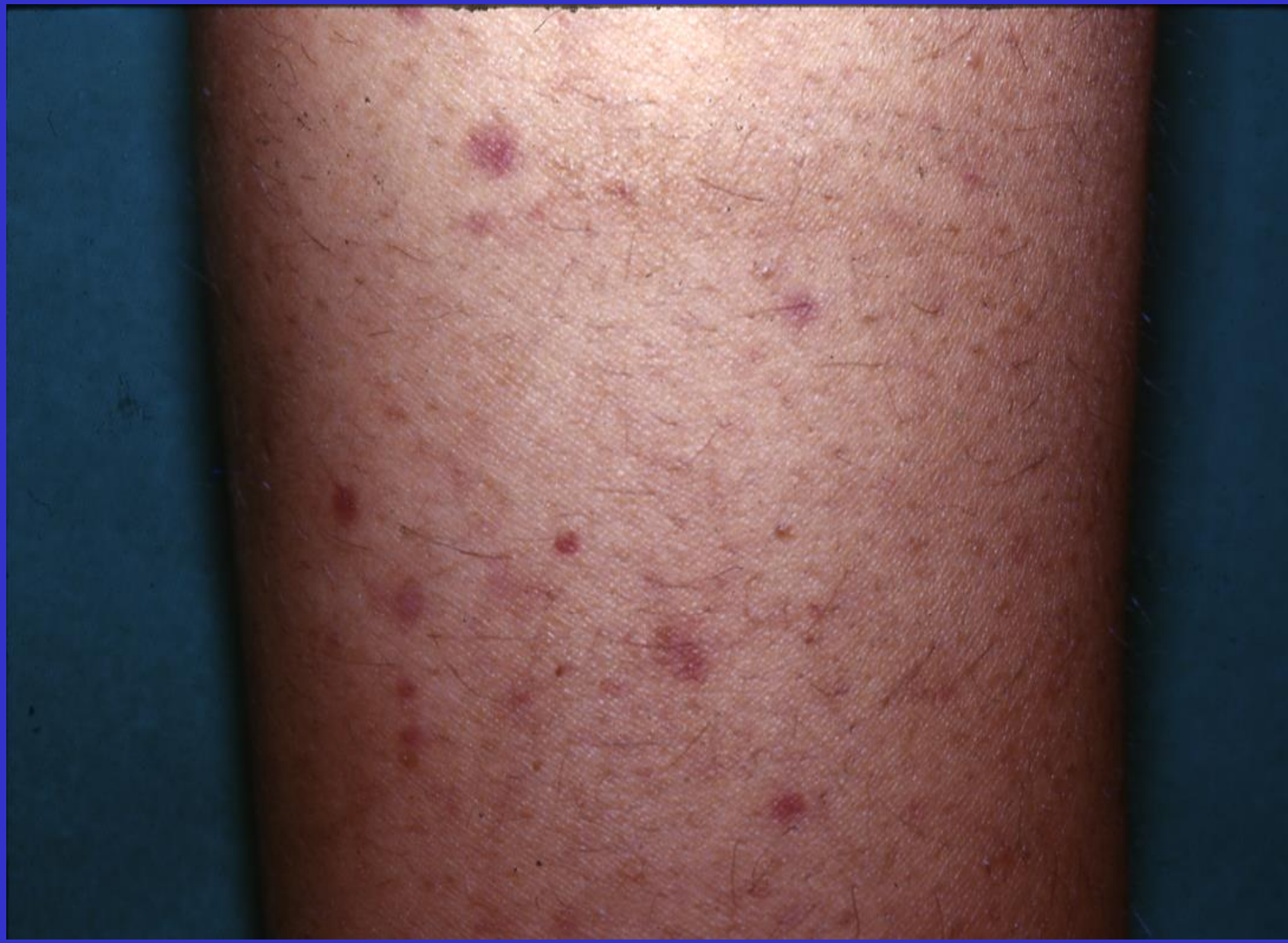
cont'd…

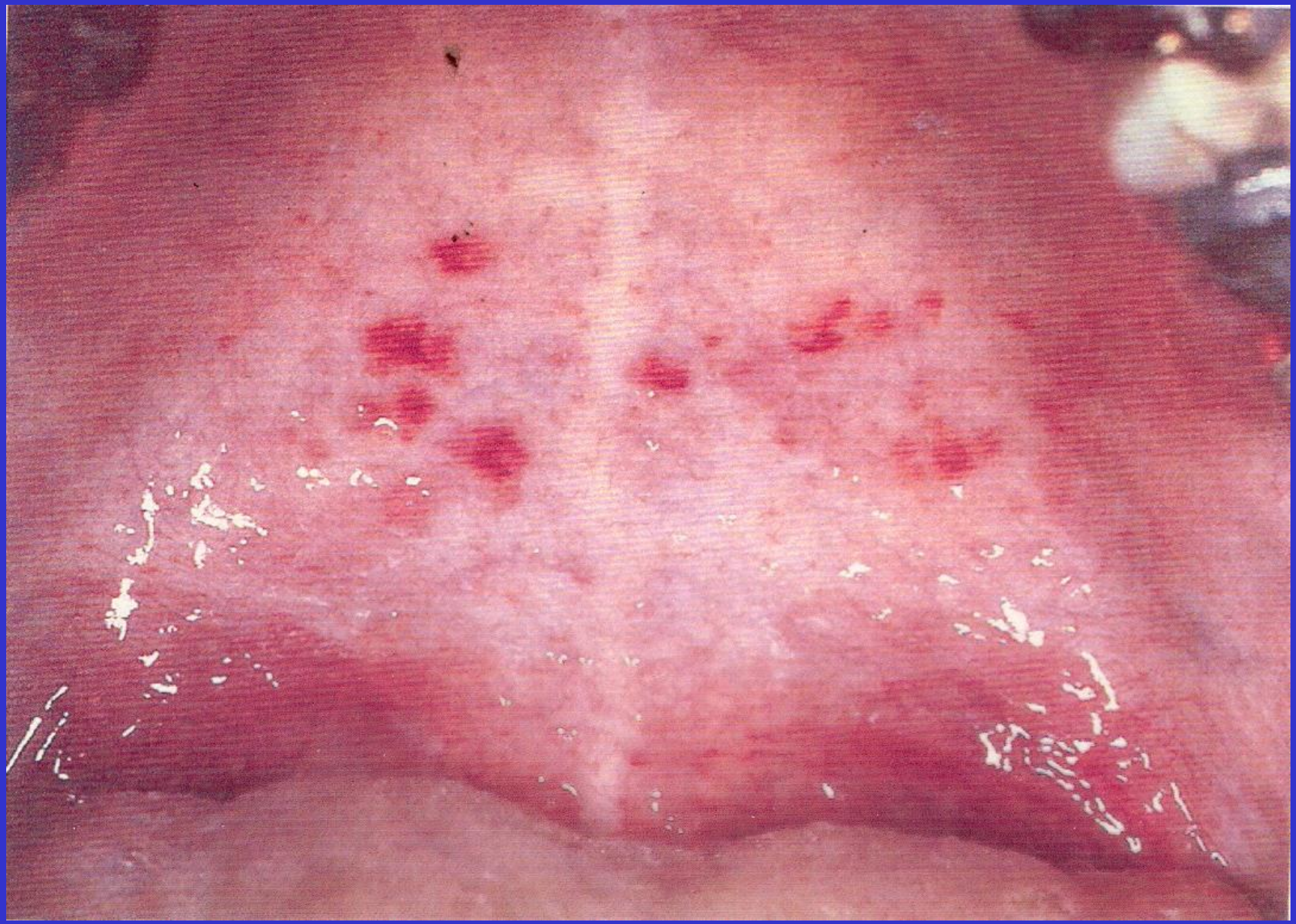
Chronic ITP

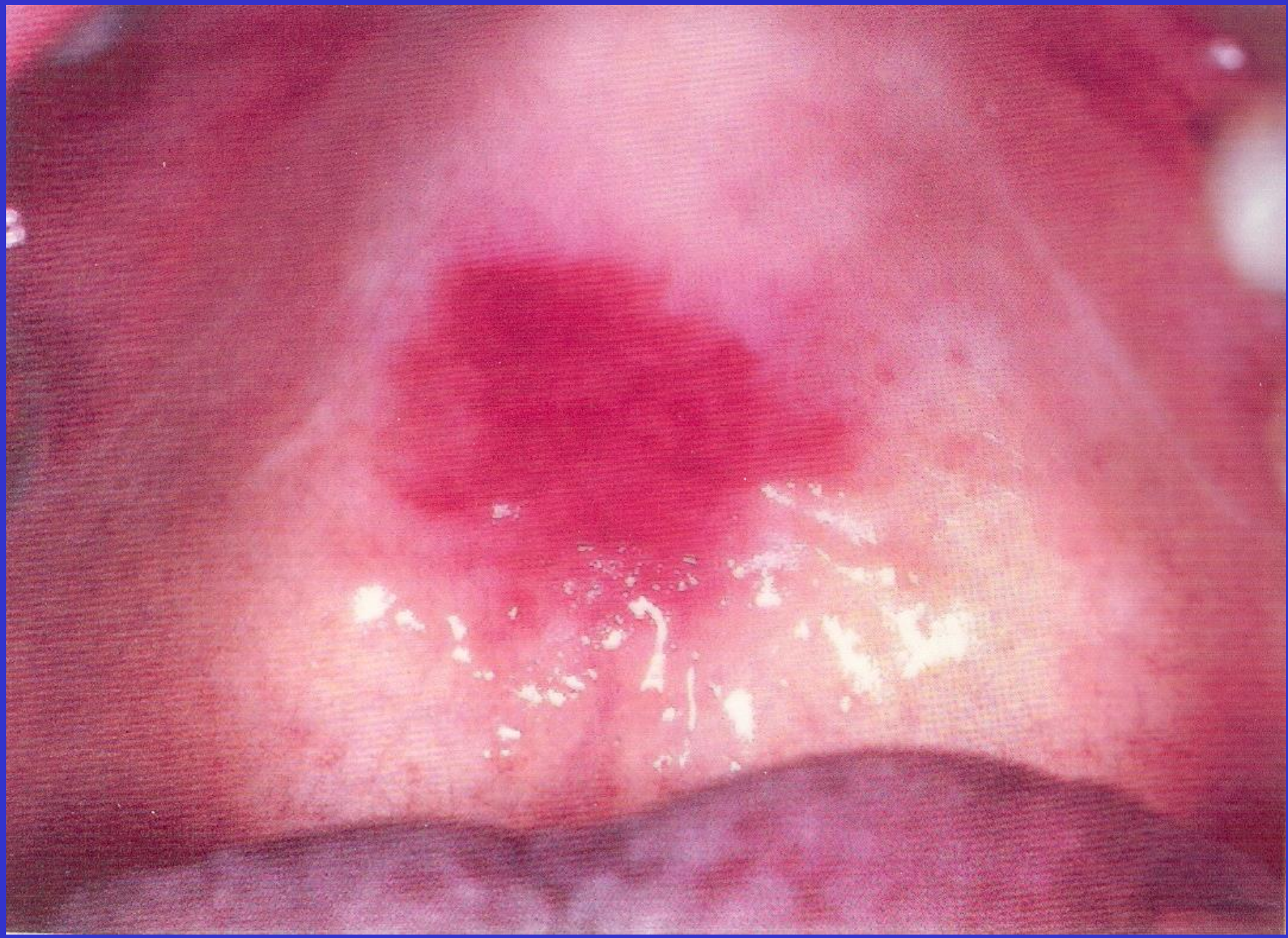
This occurs mainly in the age period 15-50 years; higher incidence in women than in men. Platelet counts are usually between 20 and 80 X 10^9/L. Spontaneous cures are rare and the disease is characterized by relapses and remissions.

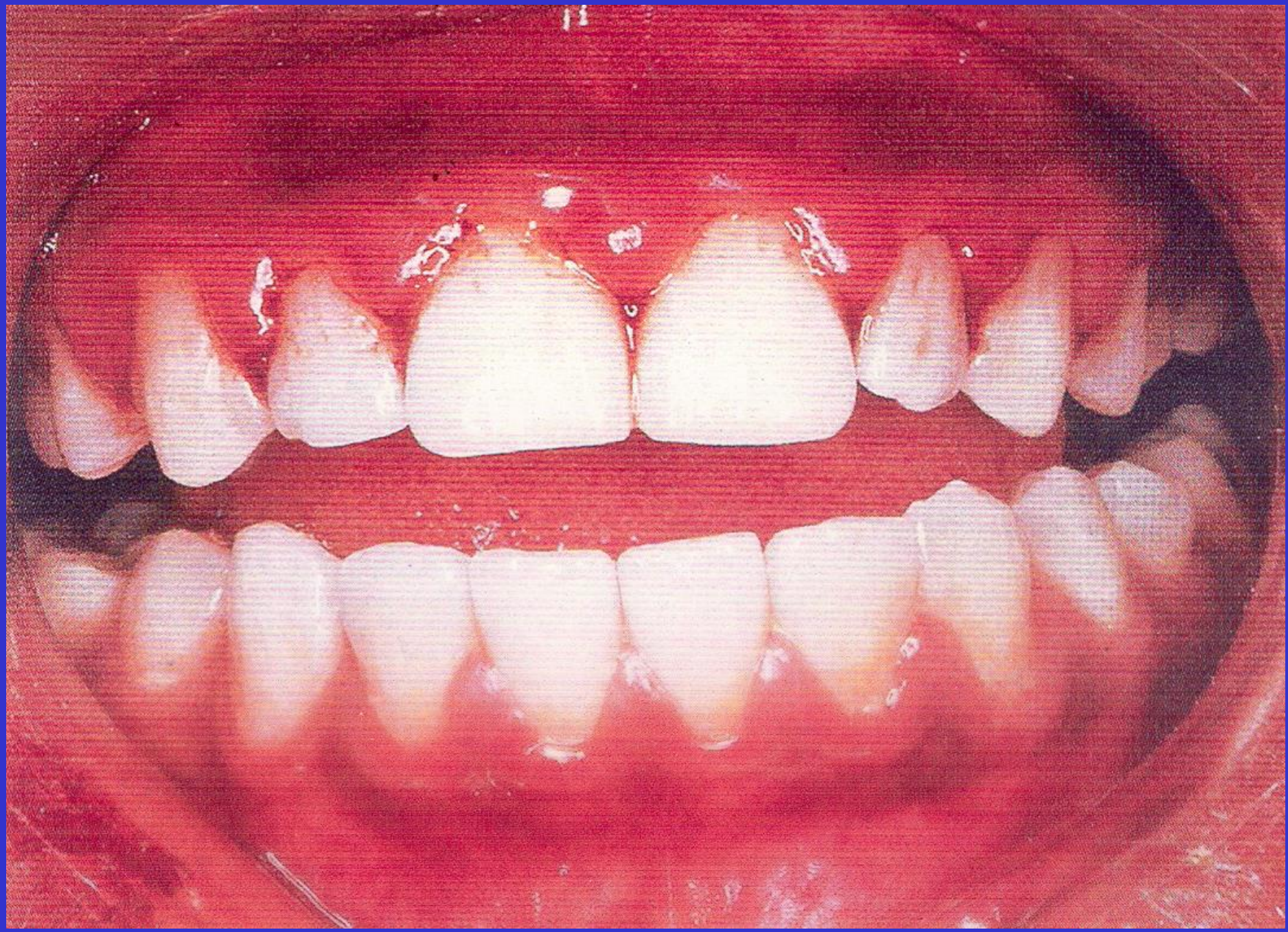
Diagnosis

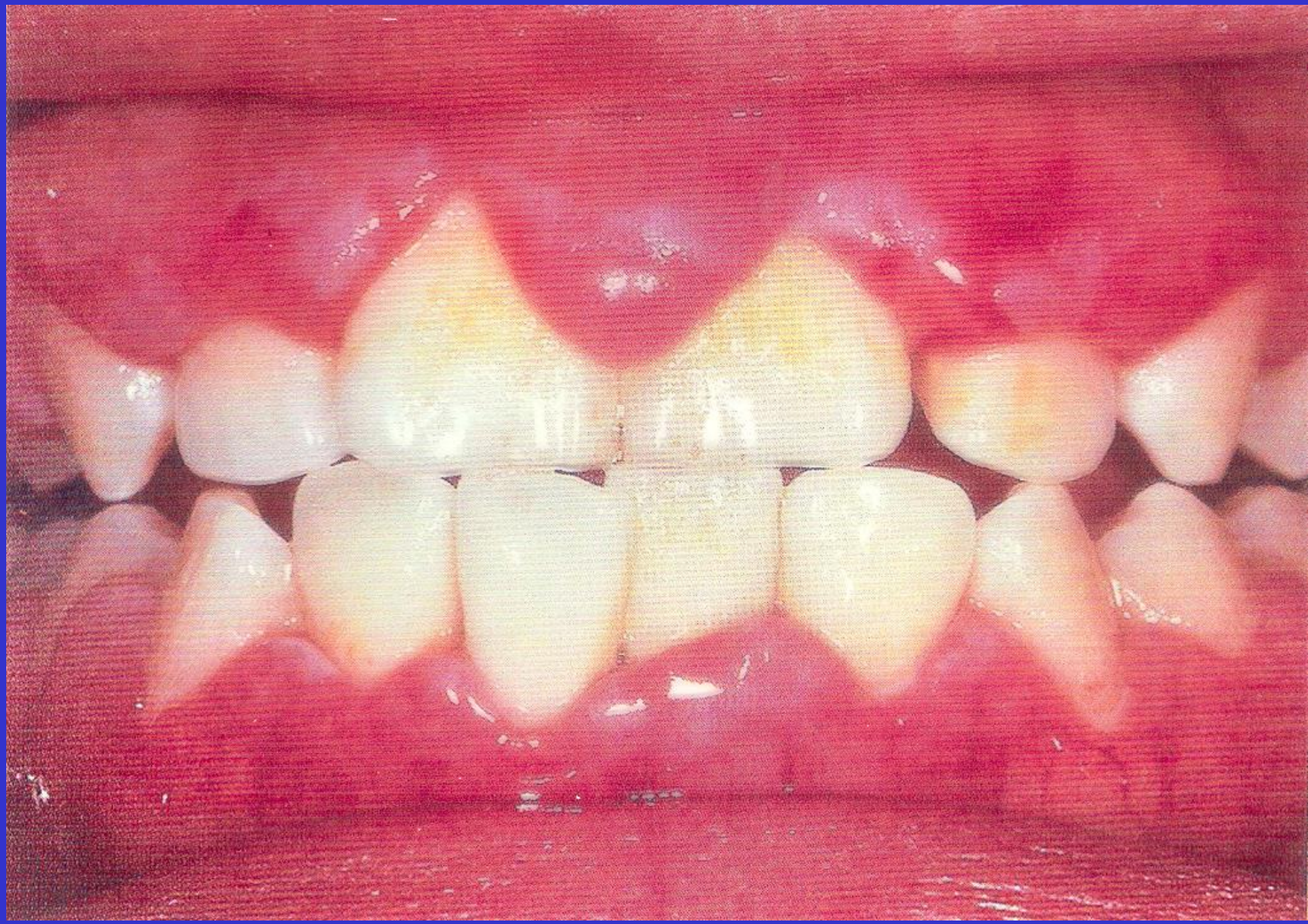
- Children with the appropriate clinical features, acute thrombocytopenia and an otherwise normal blood count (i.e. no evidence of acute leukaemia).
- In ITP, bone marrow megakaryocytes are normal or increased in number (up to four-or eightfold) and increased in size.

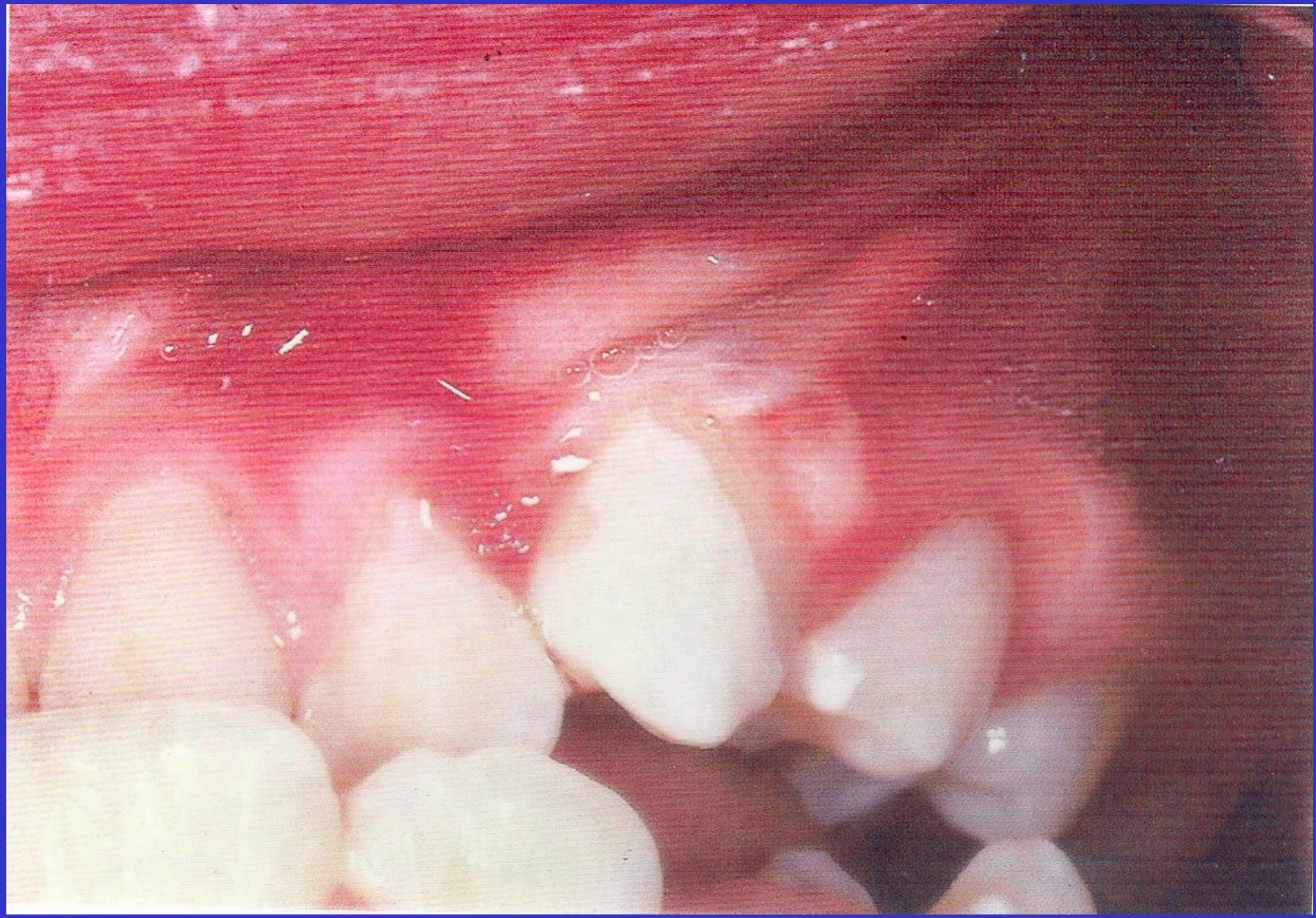


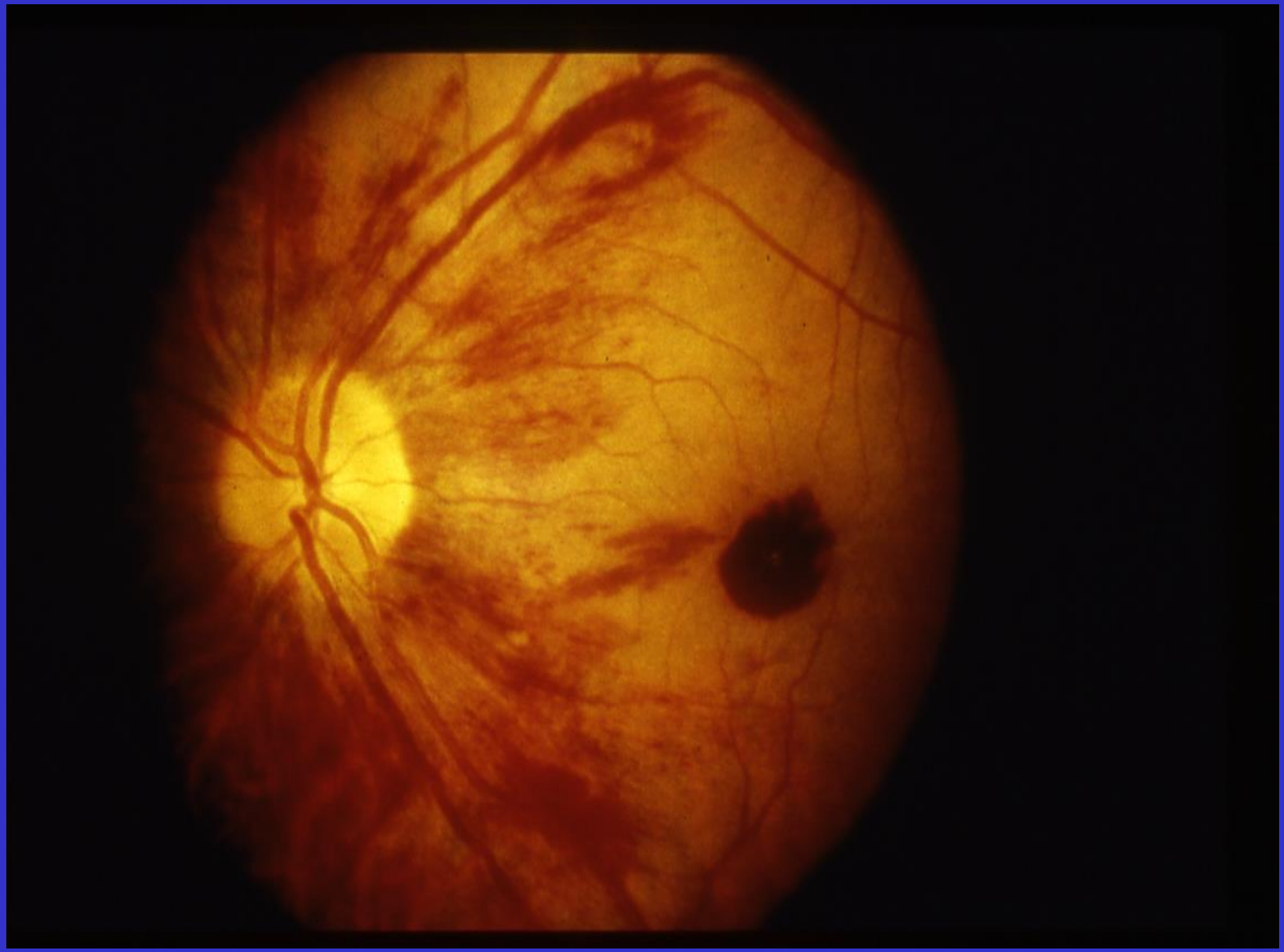


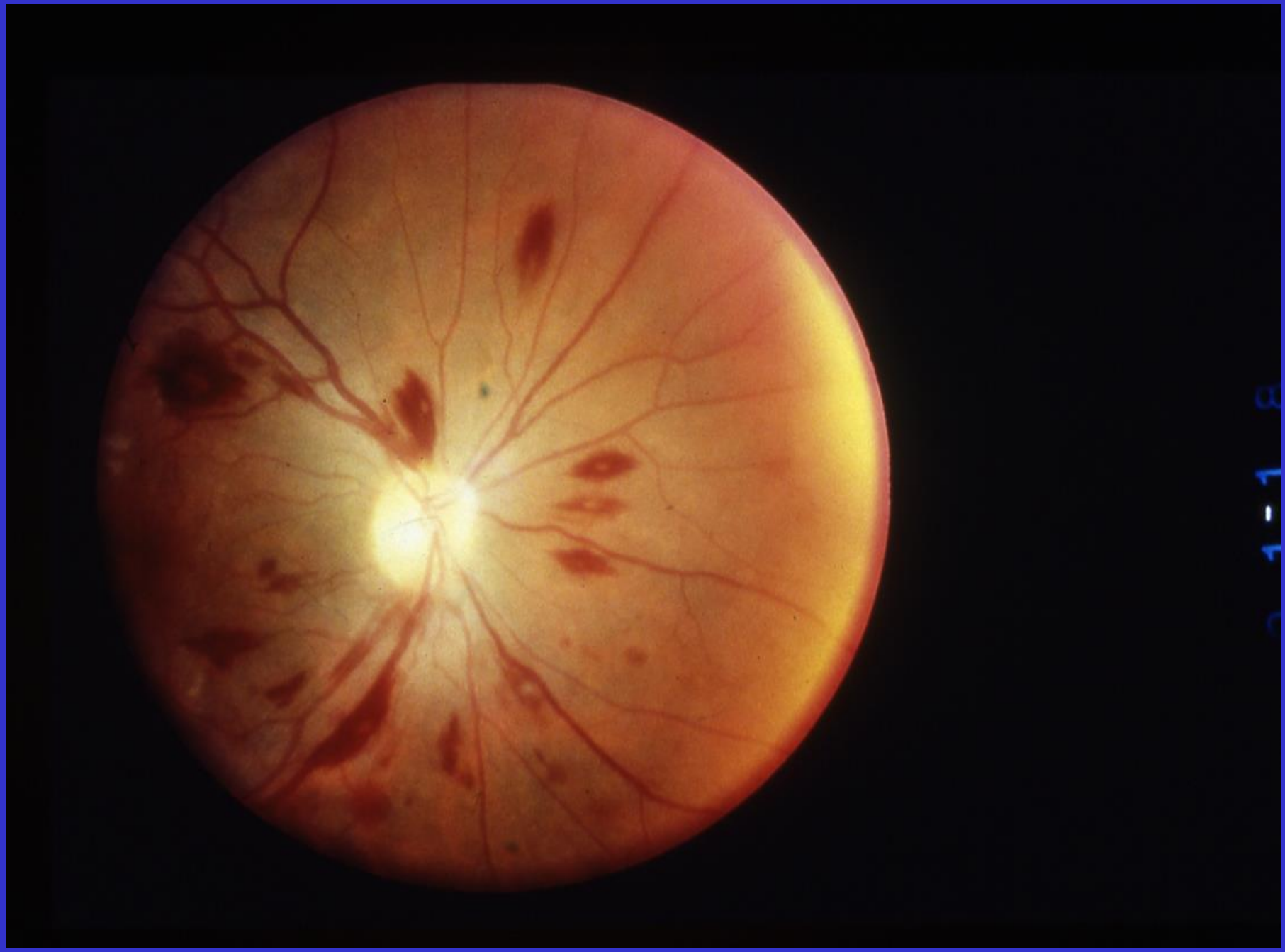


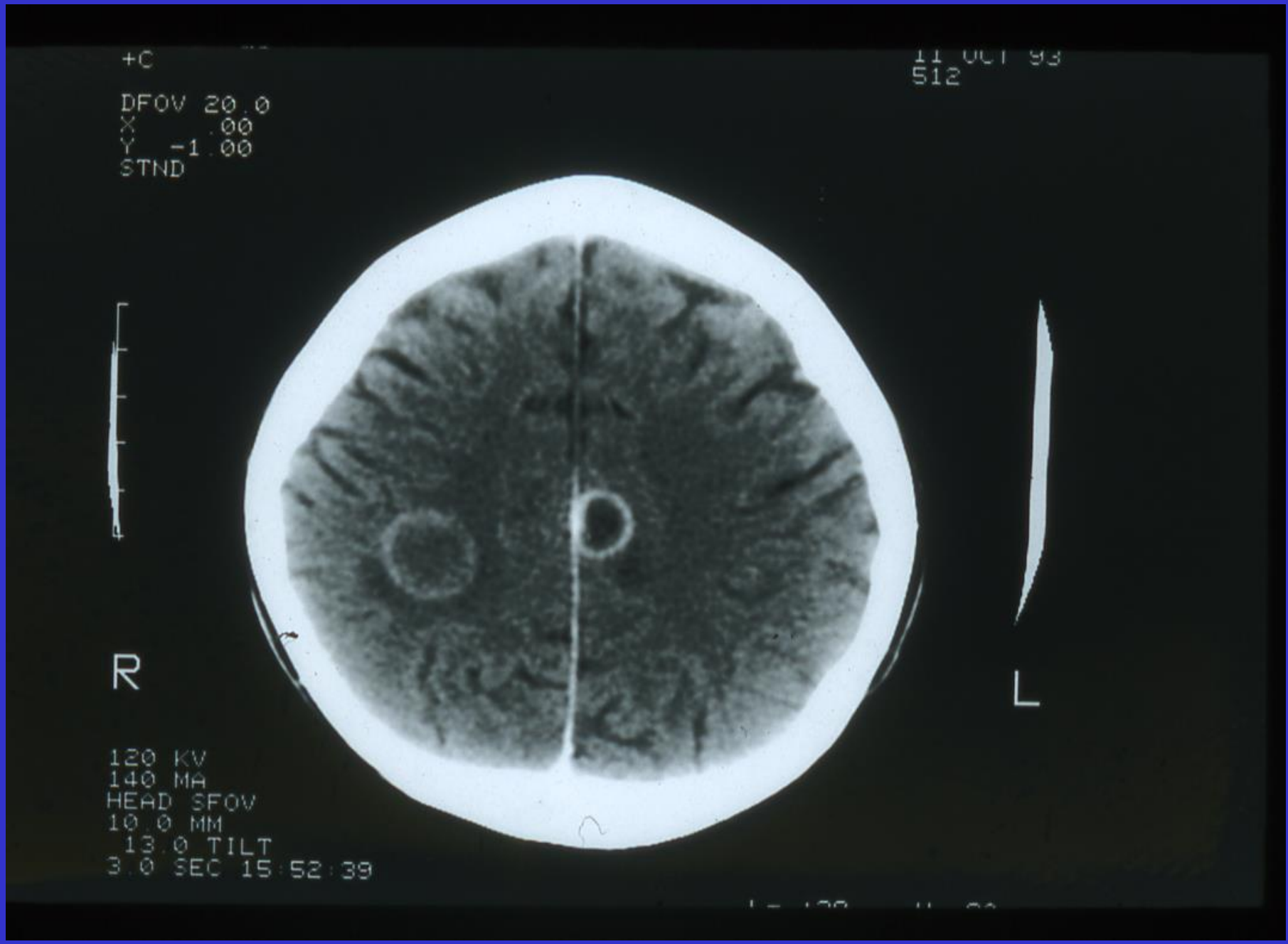






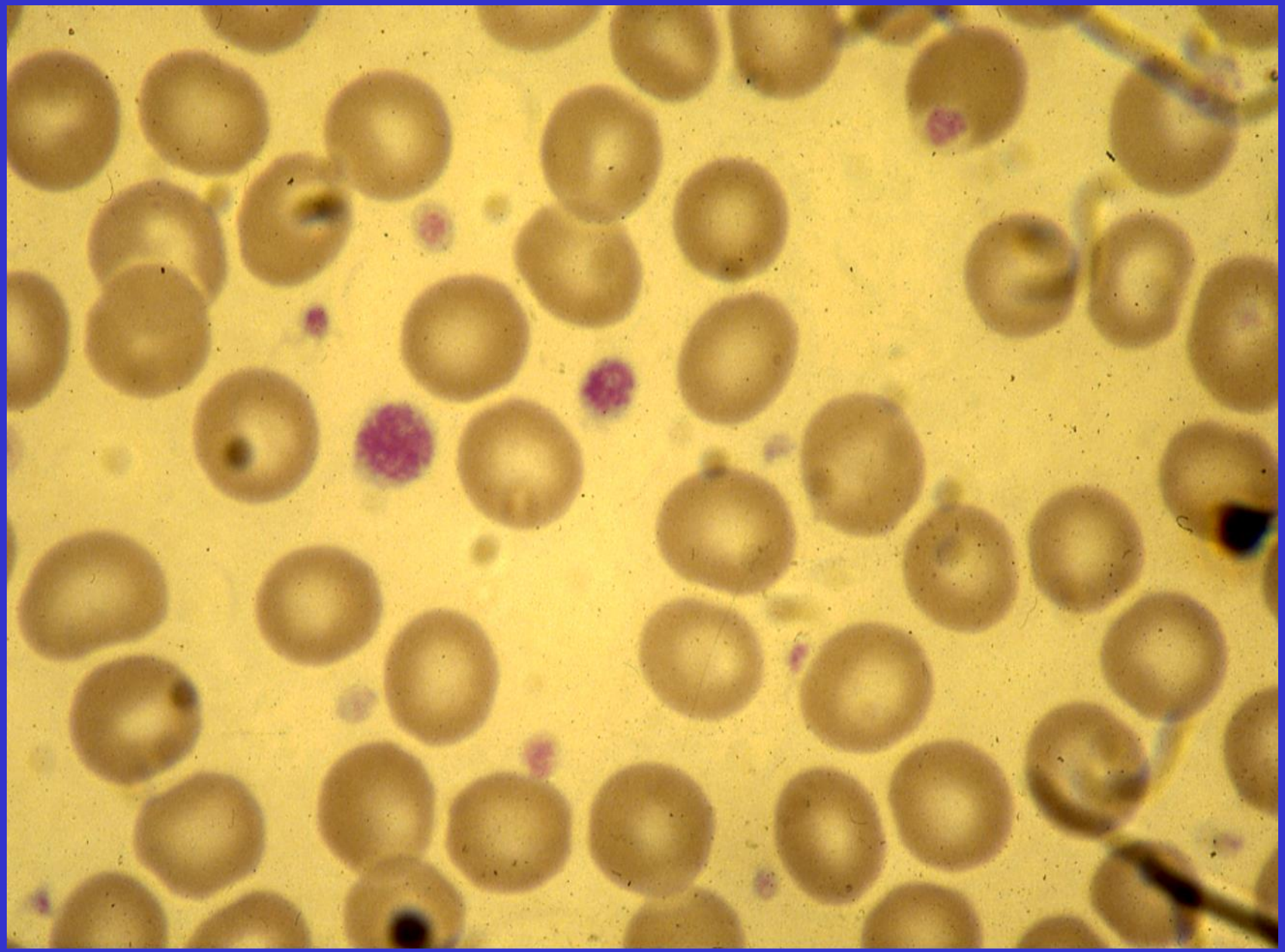




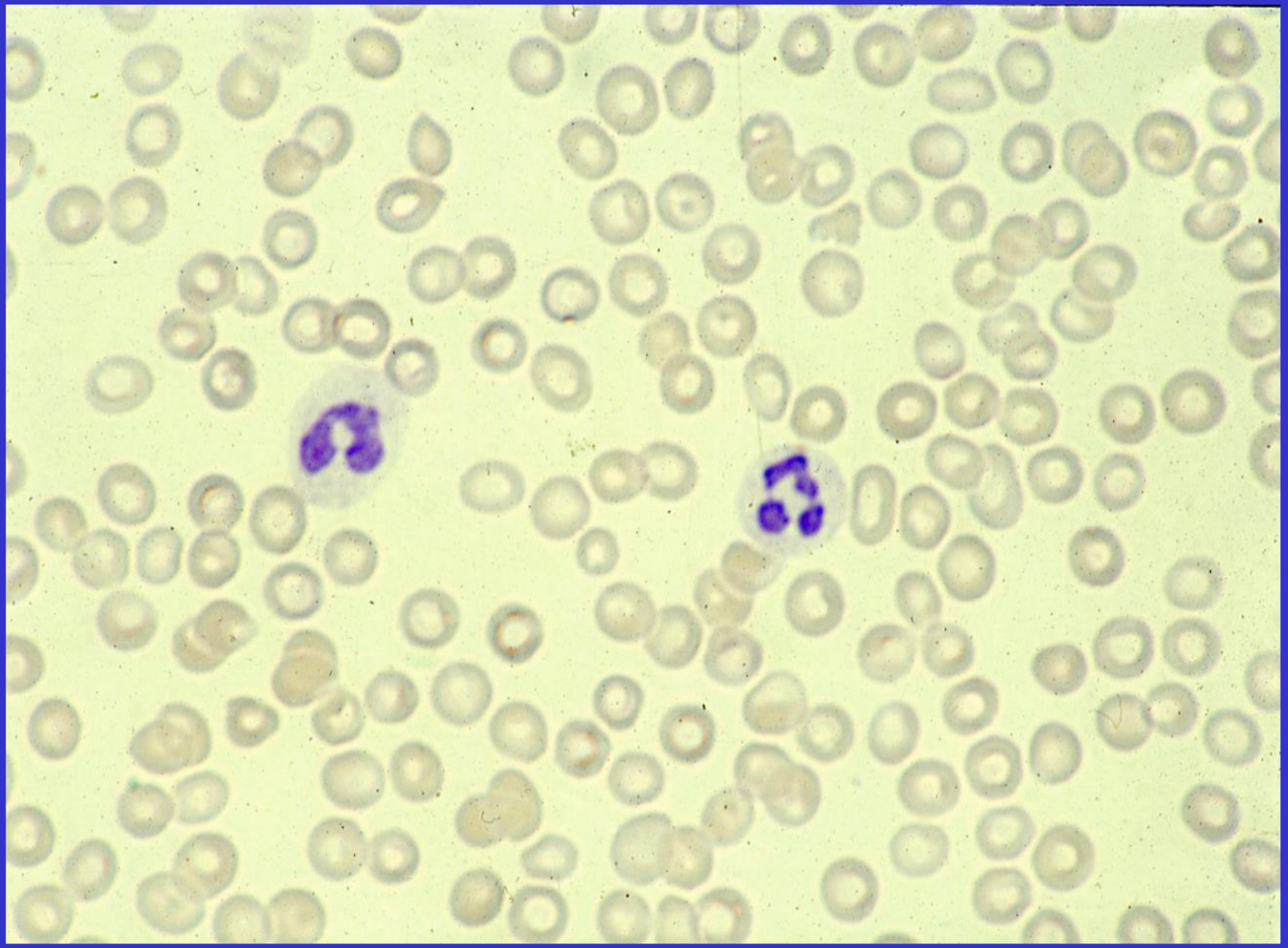

+C
DFOV 20.0
X .00
Y -1.00
STND
512
R
L
120 KV
140 MA
HEAD SFOV
10.0 MM
13.0 TILT
3.0 SEC 15:52:39

Laboratory features of immune thrombocytopenia

- Thrombocytpenia with increased numbers of large platelets (>3μ)
- Increased numbers and size of megakaryocytes.
- Reduced intravascular platelet survival.
- Elevated levels of platelet-associated IgG or IgM.



Normal blood film.



Blood film from ITP patient (severe thrombocytopenia).

Treatment

Acute ITP

Over 80% of patients recover without any treatment.

- Corticosteroids are widely used
- High doses of intravenous immunoglobulin (Ig) cause a rapid increase in the platelet count

Chronic ITP

Treatment is usually not needed in patients with platelet counts above 30-50 X 10^9/L who have no significant spontaneous bleeding.

- High-dose corticosteroid therapy increases the platelet count to more than 50 X 10^9/L
- Prednisolone 60 mg/day

cont'd…

- Splenectomy
- Second-line treatment
- Azathioprine, cyclophosphamide, danazol, dapsone, cyclosporine A, mycophenolate mofetil and rituximab have all been used, particularly in patients who fail to respond to splenectomy.
- High dose of intravenous Ig (e.g. 1 g/kg/day for 2 days) has also been found to increase the platelet count to greater than 50 X 10^9/L in 80% of patients with chronic ITP.

Thrombocytopenia as a result of drugs or toxins

- Bone marrow supression
- Predictable (dose-related)

  ionizing radiation, cytotoxic drugs, ethanol
- Occasional
- chloramphenicol, co-trimoxazole, idoxuridine, penicillamine, organic arsenicals, benzene, etc.
- Immune mechanisms (proven or probable)
- Analgesics, anti-inflammatory drugs,

  gold salts
- Antimicrobials

  penicillins, sulphonamides, trimethoprim, rifampicin

Thrombocytopenia as a result of drugs or toxins
(Continued…)

- sedatives, anticonvulsants
  dizepam, sodium valproate, carbamazepine
- Diuretics
  acetazolamide, chlorathiazides, frusemide
- Antidiabetics
  chlorpropamide, tolbutamide
- Others
  digitoxin, heparin, methyldopa, oxyprenolol, quinine, quinidine
- Platelet aggregation
  Ristocetin, heparin

Thrombotic thrombocytopenic purpura (TTP)

- In healthy individuals a VWF-cleaving protease (ADAMTS 13) cleaves the Tyr 842-Met 843 peptide bond in VWF to produce the characteristic multimer profile. In the absence of the protease, ultra-large VWF multimers are released that lead to platelet aggregation and the disease known as 'thrombotic thrombocytopenic purpura' (TTP).
- This is a serious illness characterized by widespread arteriolar platelet thrombi leading to fragmentation of red cells, thrombocytopenia, neurological symptoms and renal impairment.

TTP & HUS

- Clinical Features

Fever, Thrombocytopenic purpura, Haemolytic Anaemia, Neurological symptoms & renal Dysfunction.

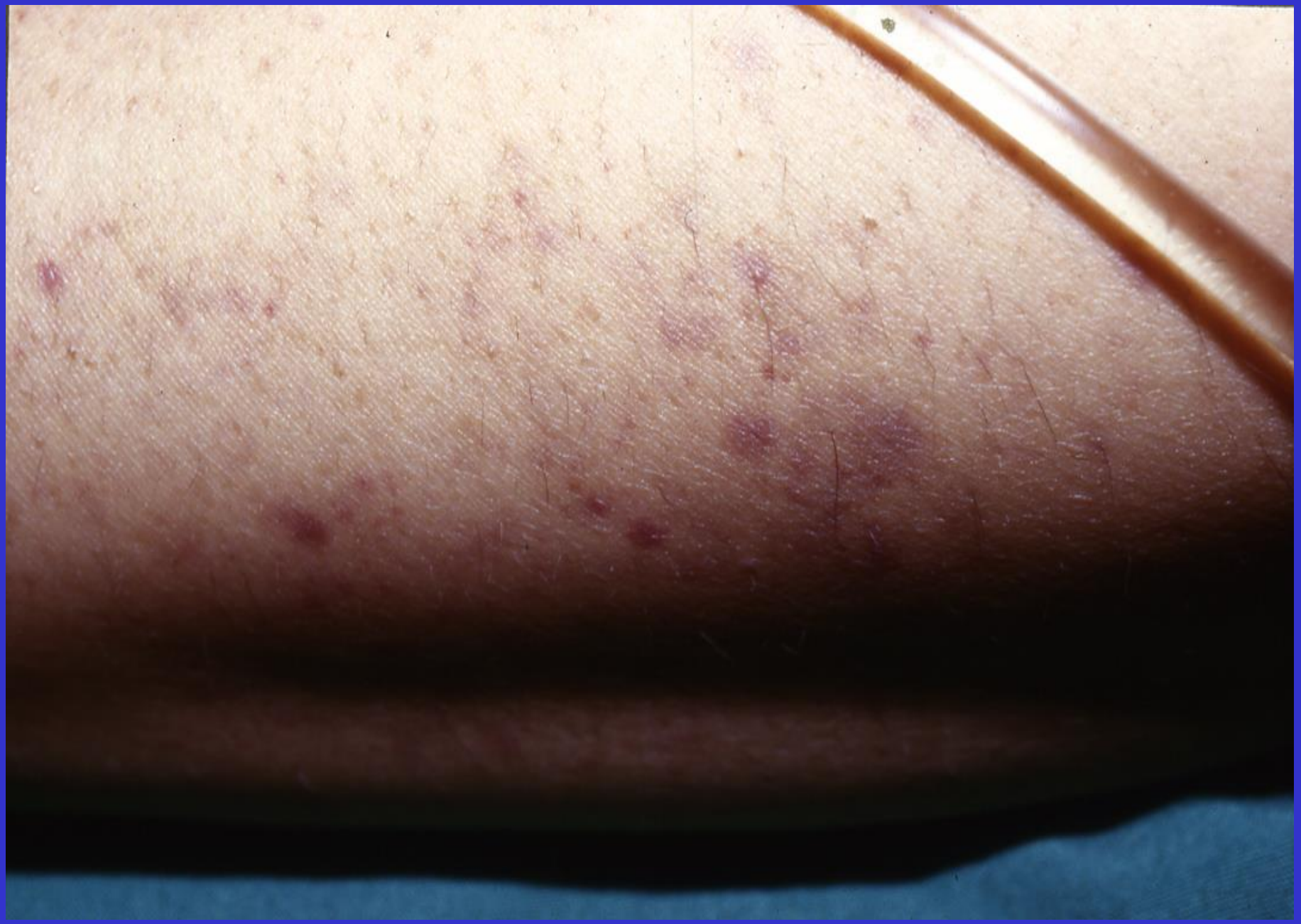
- Association with other conditions
- Genetic predisposition
- Infections - Bacterial, E-coll type 0157, shigella dysenteriae serotype I, and viral infection.
- Hypersensitivity

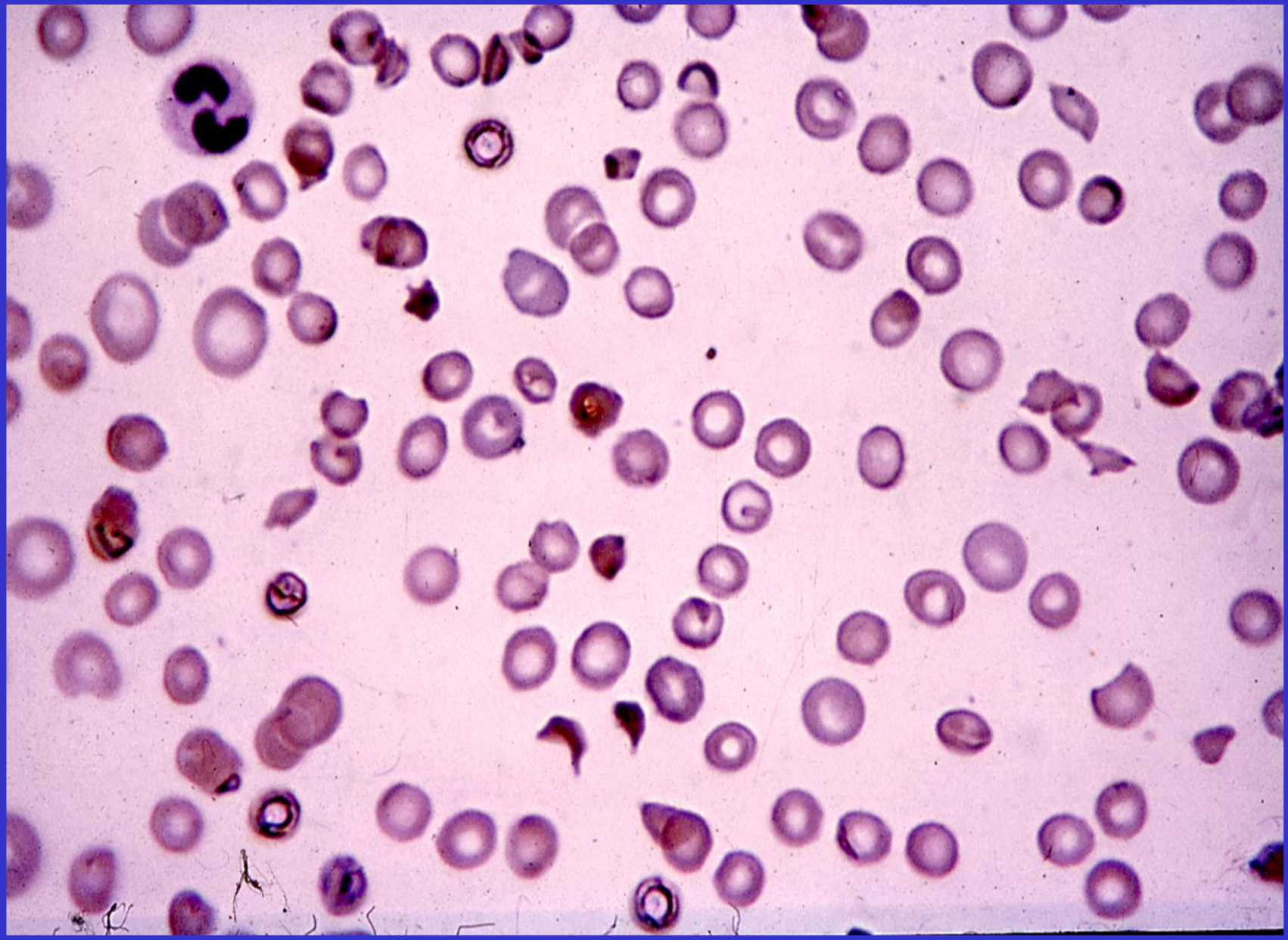
Pregnancy:

- Oral contraceptives
- Auto Immune Disease
  - SLE
  - Rheumaticd, Arthritis
  - Rheumaticd, Spondylitis
  - Polyarthritis Nodosa
  - Sjorgen's Syndrome

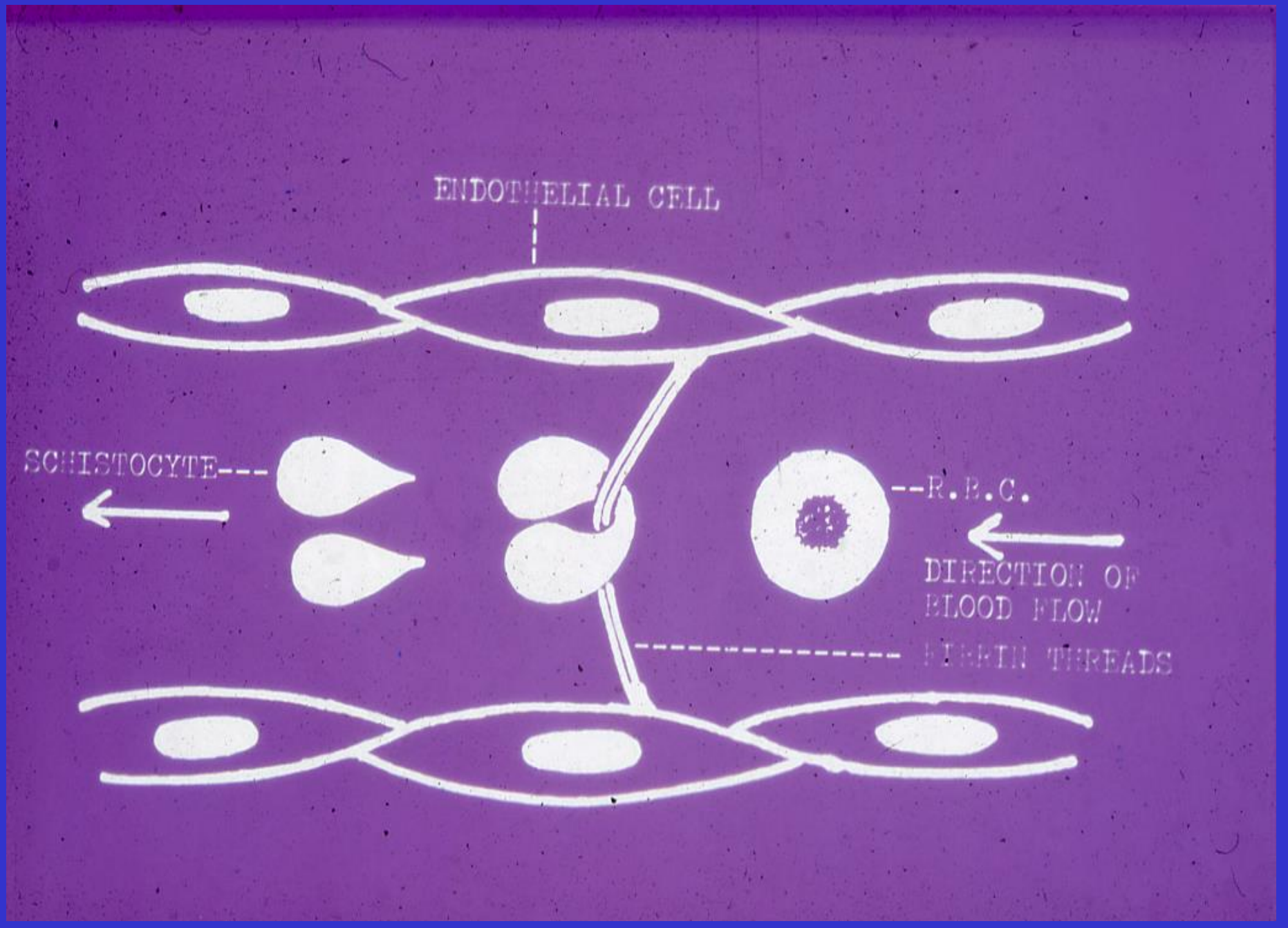
TTP - HUS Associated with Chemotheraphy

- Mitomycin
- Cisplatinum
- Bleomycin
- Vindestine
- Vinblasine
- Doxorubicin
- Vincristine + Asparaginase + Prednisone
- Cyclosporin





Blood film from TT patient (showing many schistocytes).


ENDOTHELIAL CELL
SCHISTOCYTE---
--R.B.C.
DIRECTION OF
BLOOD FLOW
FIBRIN THREADS

BLOOD COUNT FILM

LOW PLATELET COUNT

1-BONE MARROW EXAMINATION
2-PLATELET ANTIBODIES

3-SCREEN TESTS FOR DIC

NORMAL PLATELET COUNT

1-BLEEDING TIME
2-PLATELET AGGREGATION
STUDIES WITH ADP,ADRENALIN,
COLLAGEN AND RISTOCETIN
3 -OTHER SPECIAL PLATELET TESTS
eg. ADHENSIONSTUDIES,NUCLEOTIDE,
POOL MEASUREMENT

4- FACTOR VIII CLOTTING ASSAY
vWF ASSAY
vWF ANTIGEN ASSAY

Platelet transfusions

- It is often possible to raise the platelet count temporarily by platelet transfusions.
- The main indication for platelet transfusion is severe haemorrhage caused by:

  (i) Thrombocytopenia due to diminished platelet production or DIC; or

  (ii) Abnormal platelet function.

cont'd…

- Transfusion may also be indicated in a patient with thrombocytopenia or defective platelet function prior to surgery.
- Another indication for platelet transfusion is thrombocytopenia (platelets <50 *X* 10^9/L) in patients receiving massive blood transfusions.
- Platelet counts need only be maintained above 10-20 *X* 10^9/L, since severe bleeding is rare above this level.


Thank you !!!