Diabetes & Heart Attack

The two headed monster of the 21st. Century

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Diabetes Mellitus

Diabetes Mellitus

A group of metabolic disorders sharing the common underlying feature of ***hyperglycemia***.

Diabetes Mellitus

Diabetes mellitus is a syndrome of impaired carbohydrate, fat, and protein metabolism caused by either lack of insulin secretion or decreased sensitivity of the tissues to insulin or both.

Epidemiology

Worldwide,

more than 140 million people suffer from diabetes, making this one of the most common non-communicable diseases.

THE CURRENT COST OF DIABETES IN THE UK

- 10-30% reduction in life expectancy
- Most common cause of blindness in age group 20-65 years
- 1000 patients per annum reach end-stage renal failure

THE CURRENT COST OF DIABETES IN THE UK

- Lower limb amputation rate increased 25-fold.
- Use of hospital beds increased six fold.
- 5-7% of total National Health Service budget.

Epidemiology

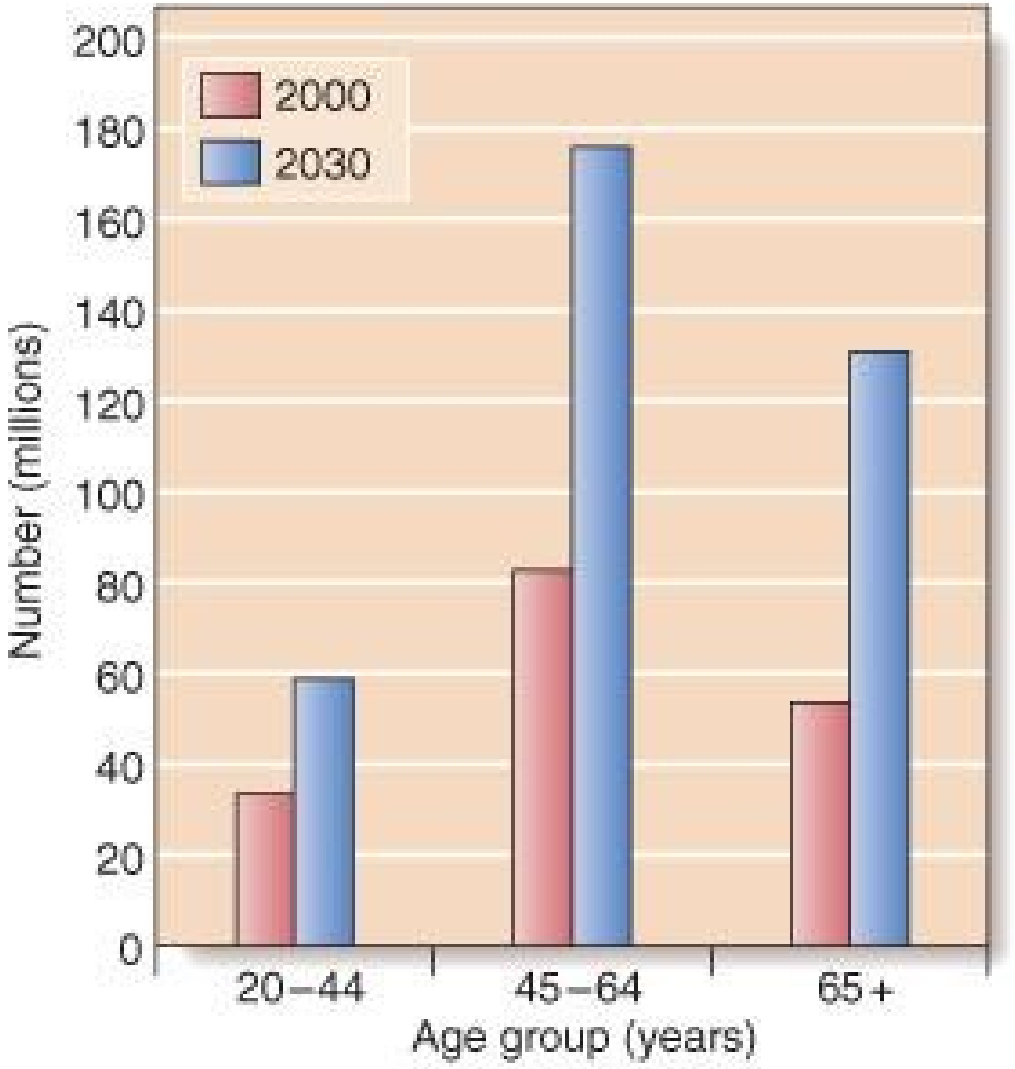
The number of affected individuals with diabetes is expected to double by 2025. The countries with the largest number of diabetics are,

India,

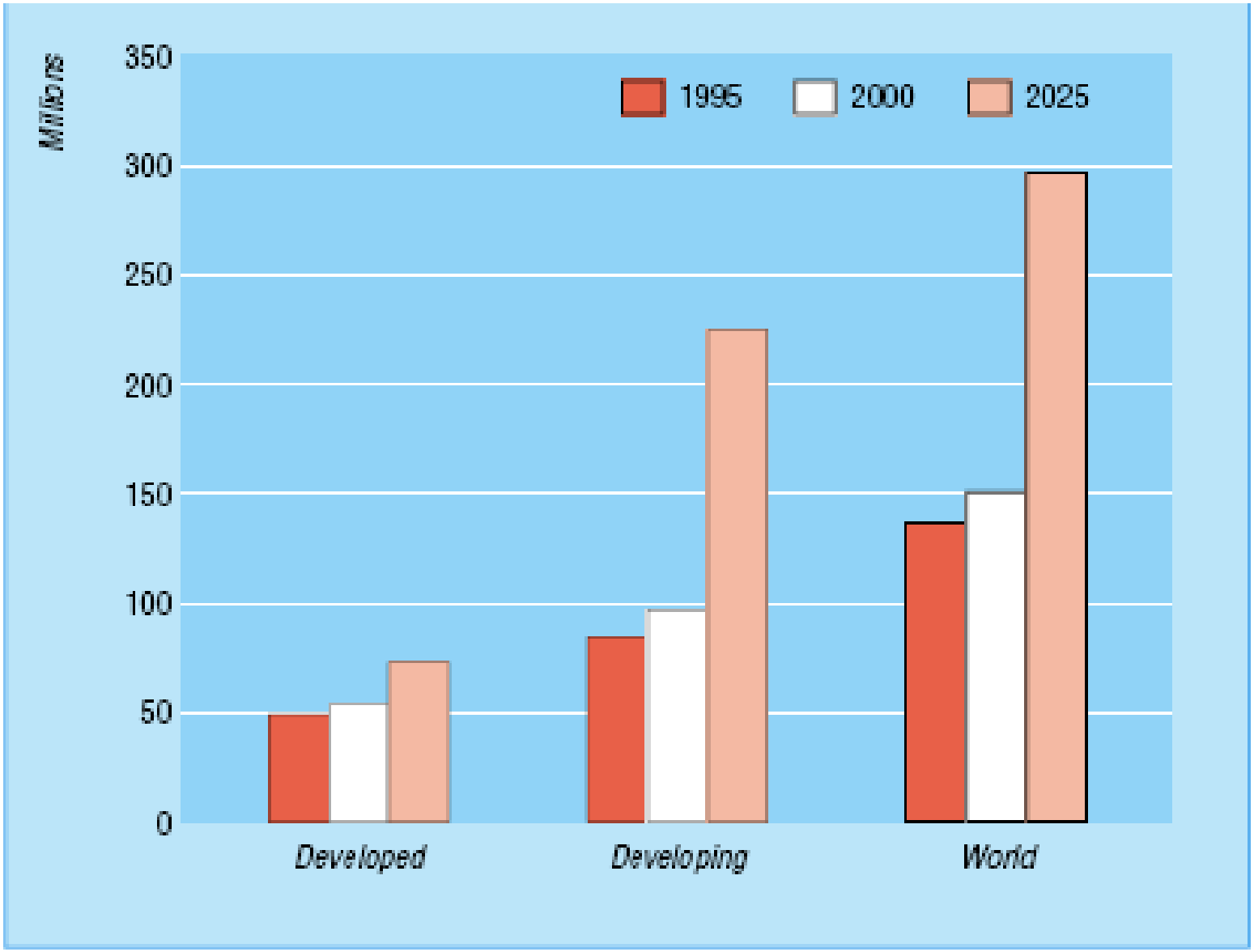
China,

United States.

Incidence of adult diabetes



Incidence of adult T2DM



Diabetes Mellitus

How & Why ?

Pancreas

Exocrine

Endocrine

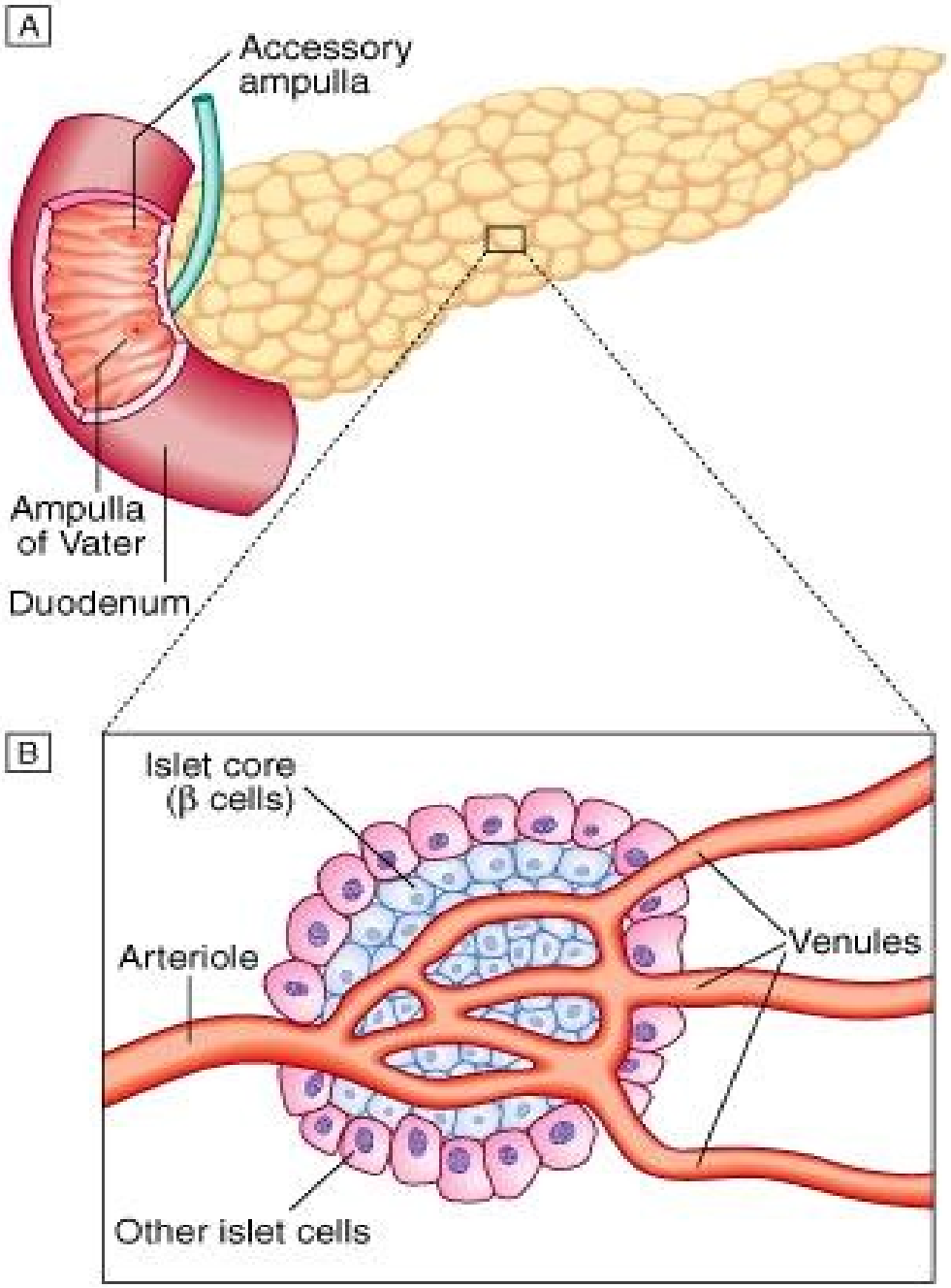
- ✓ **Islets of Langerhans**
  - Insulin
  - Glucagon
  - etc. etc.

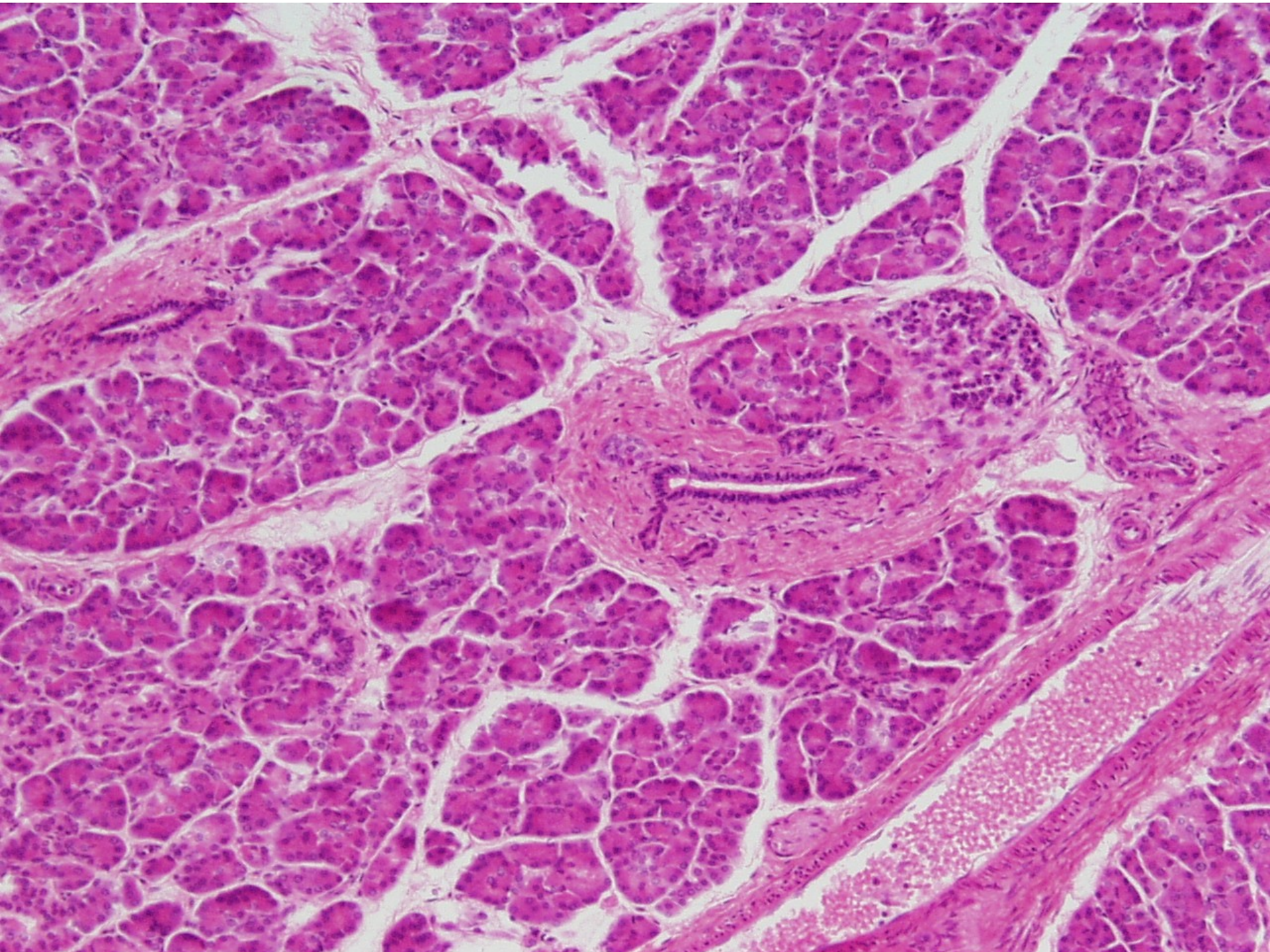
Pancreas

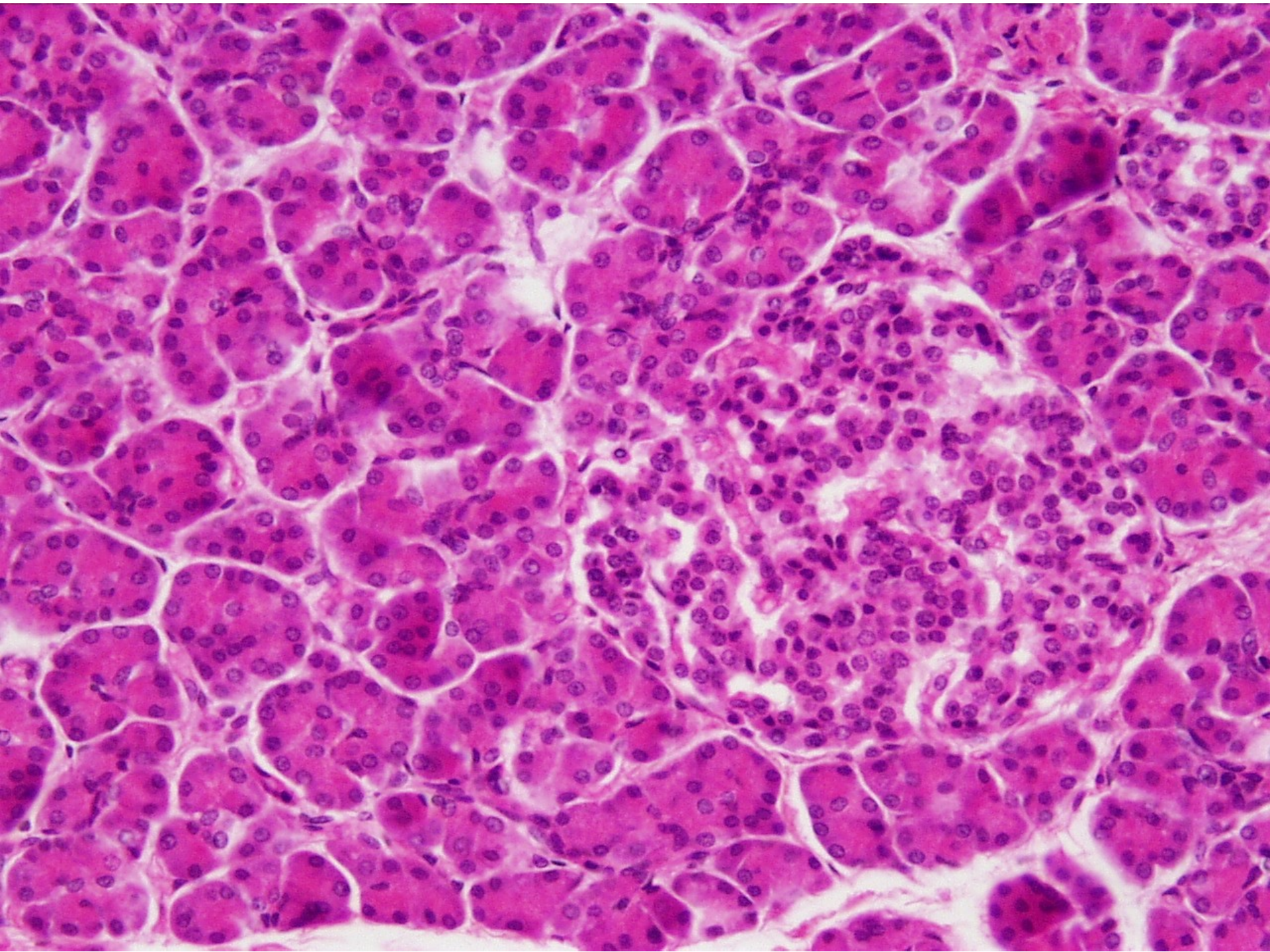
Exocrine

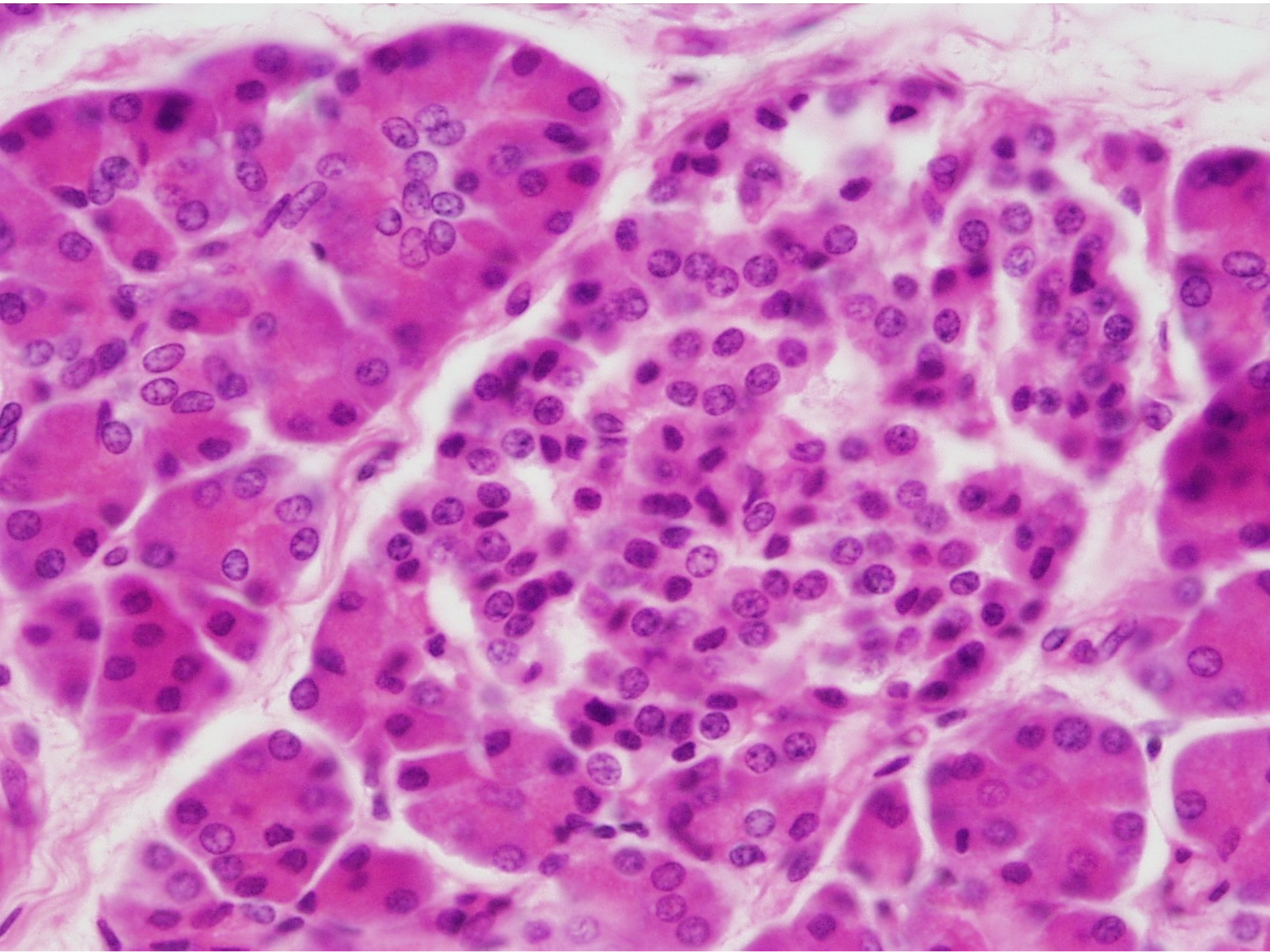
Endocrine

- ✓ **Islets of Langerhans**
  - **Insulin**
  - Glucagon
  - etc. etc.


A
Accessory ampulla
Ampulla of Vater
Duodenum
B
Islet core (β cells)
Arteriole
Venules
Other islet cells

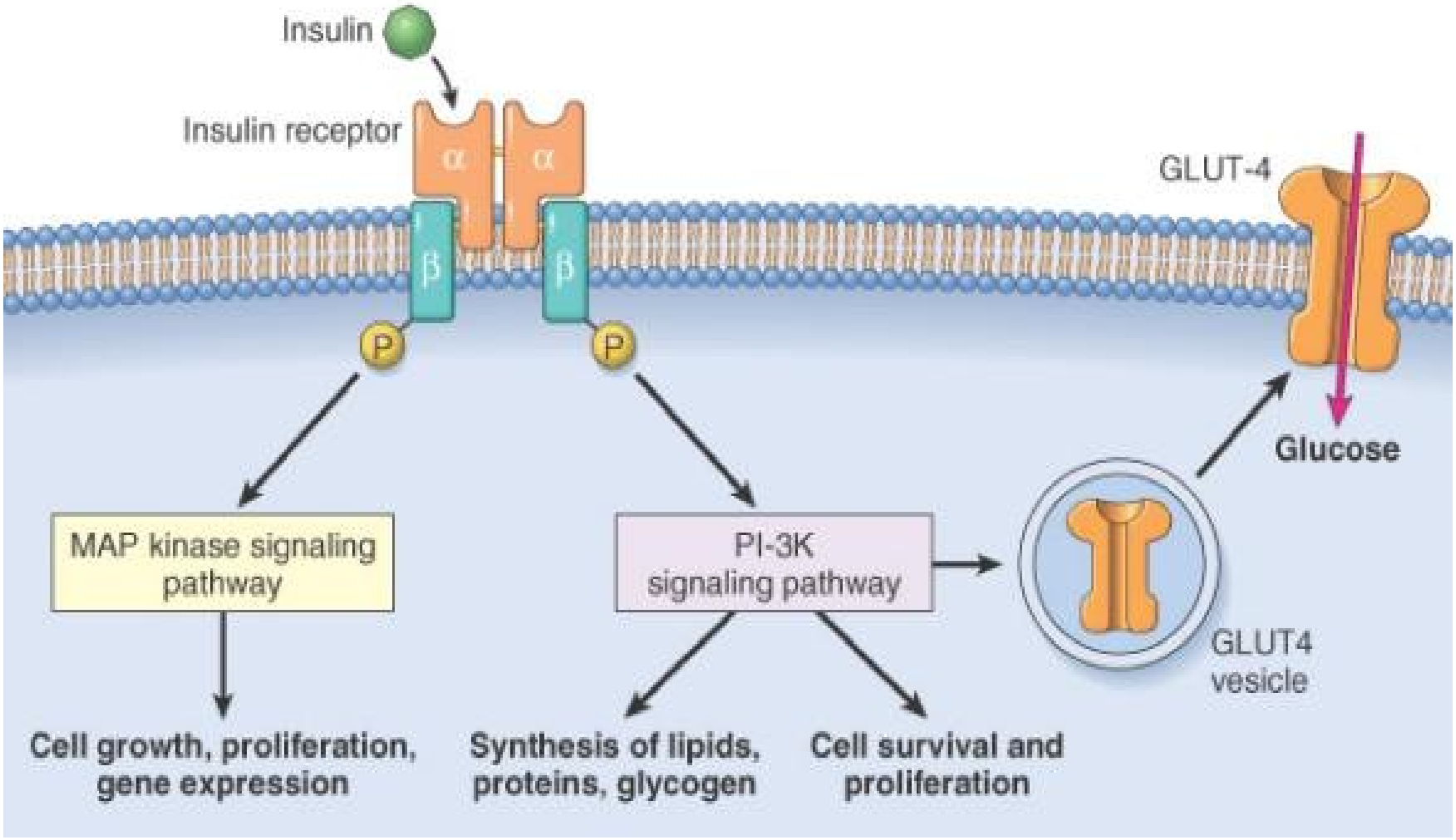






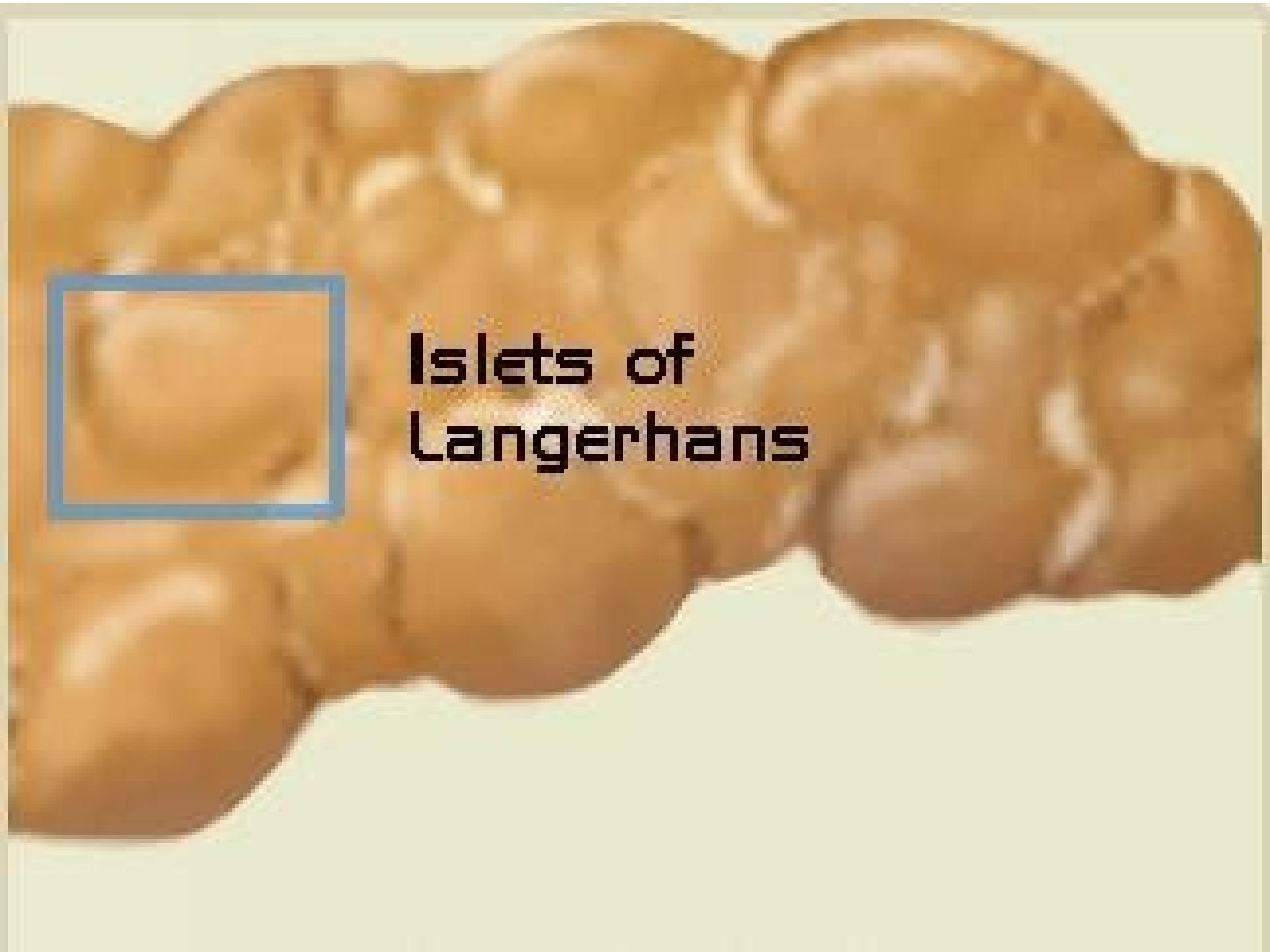
Insulin

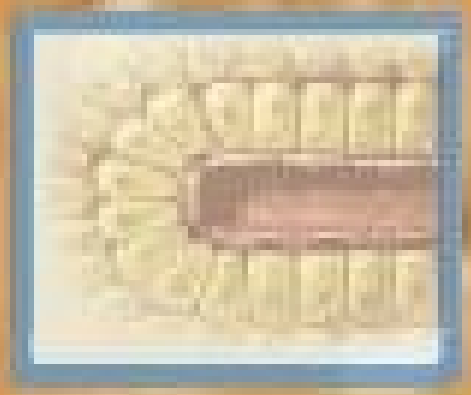
Insulin action on target cell



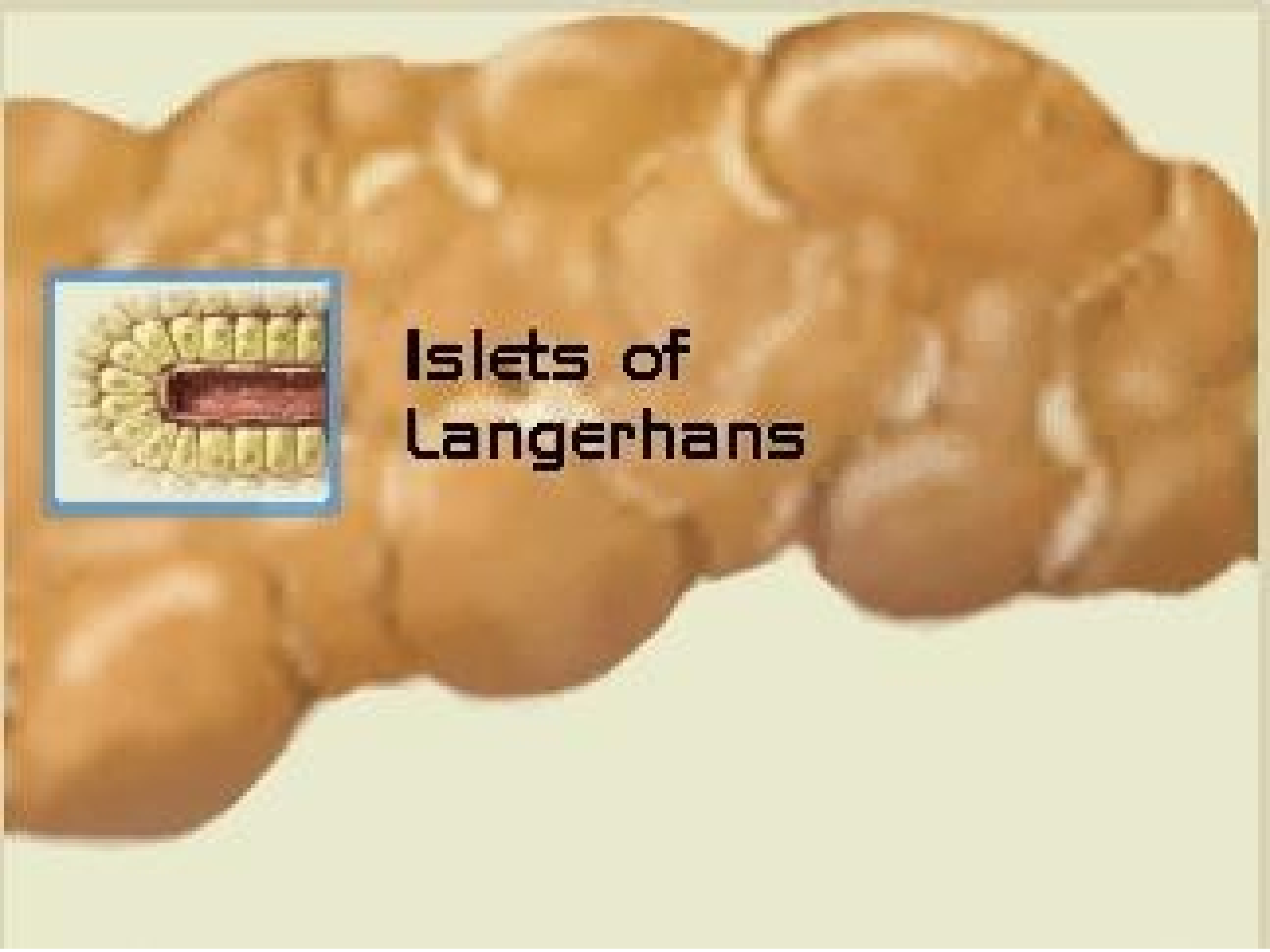

Pancreas


Pancreas


Islets of
Langerhans



Islets of Langerhans


Islets of
Langerhans

Islets of Langerhans


Islets of
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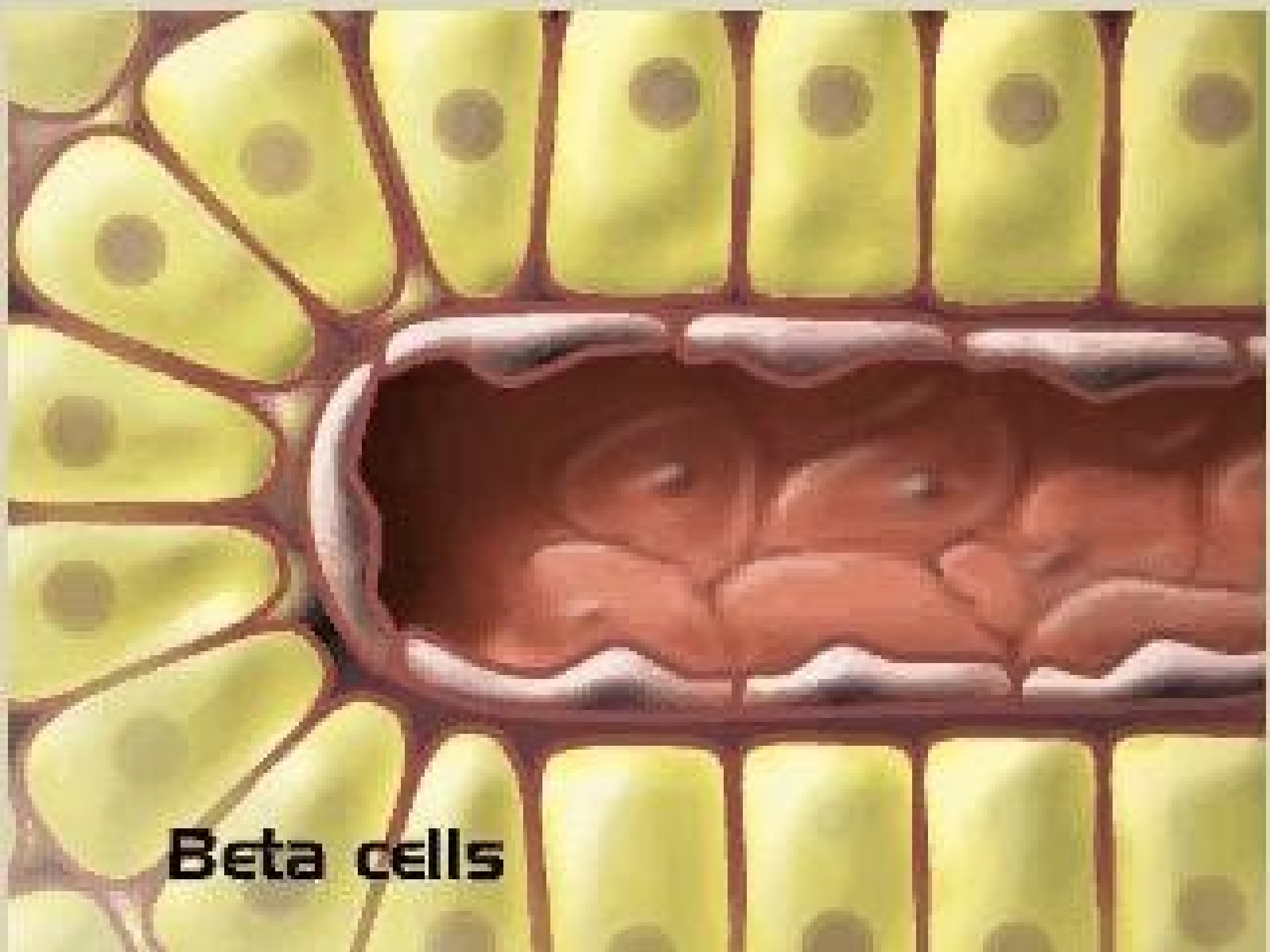
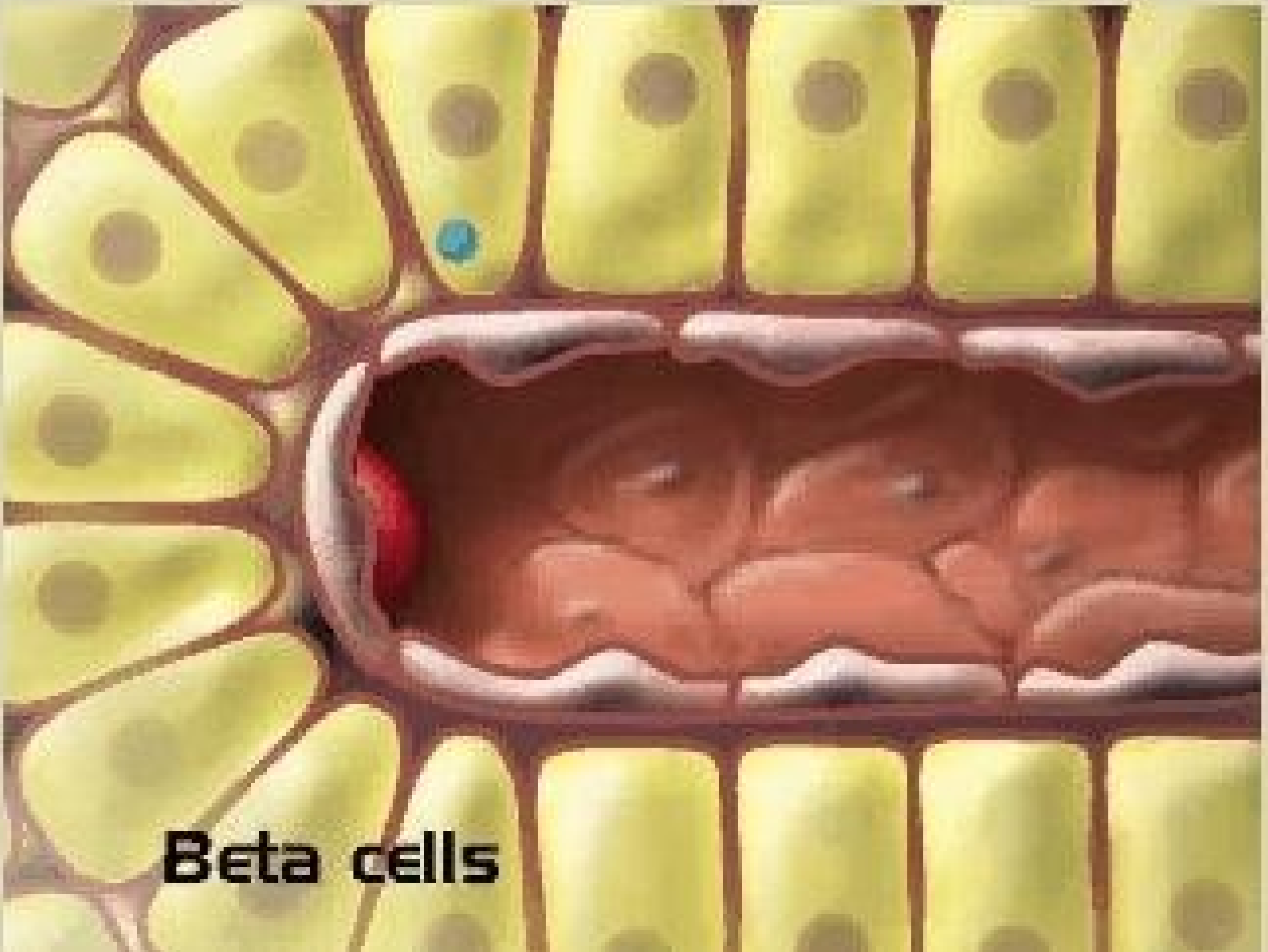

Beta cells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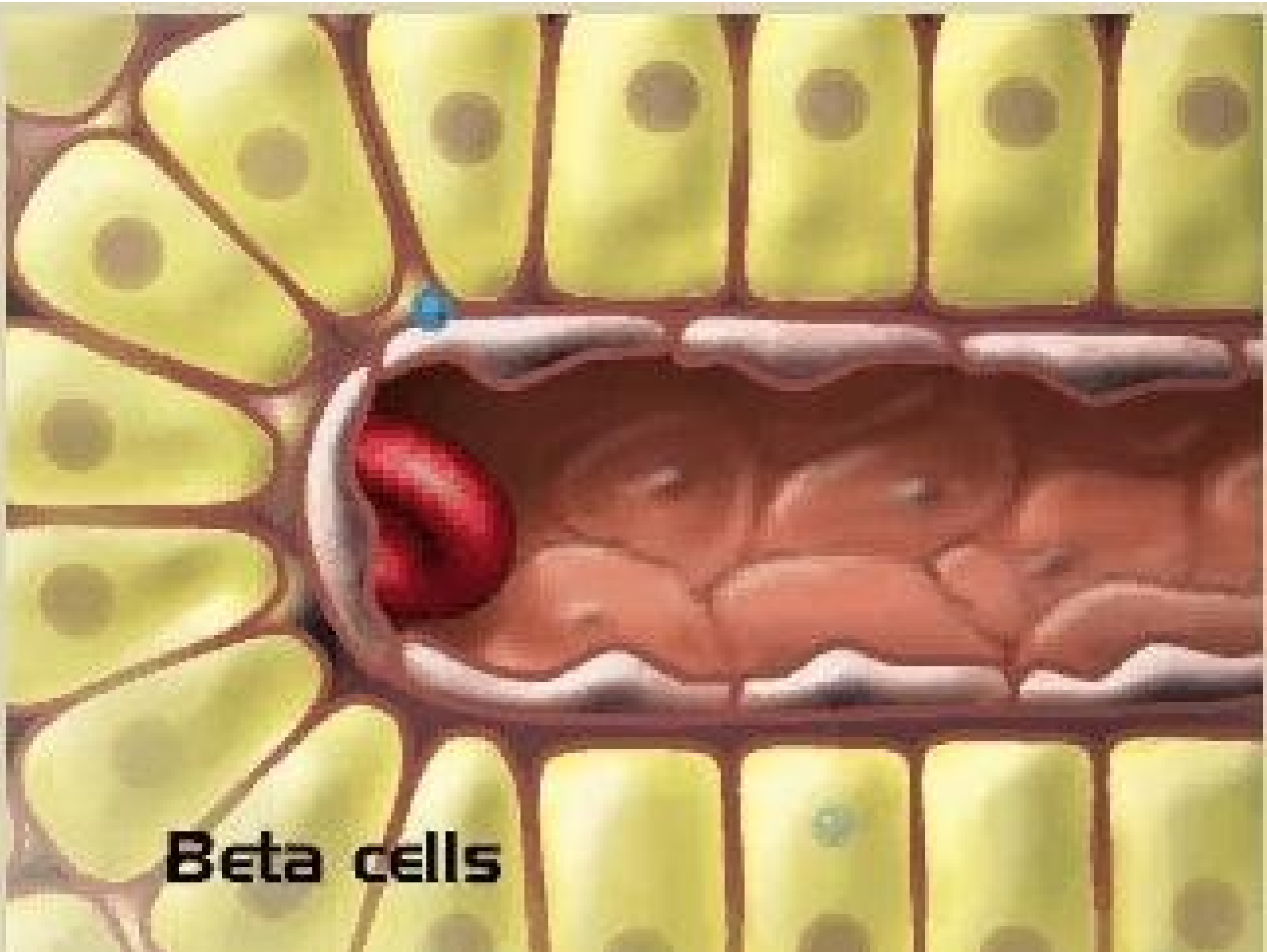
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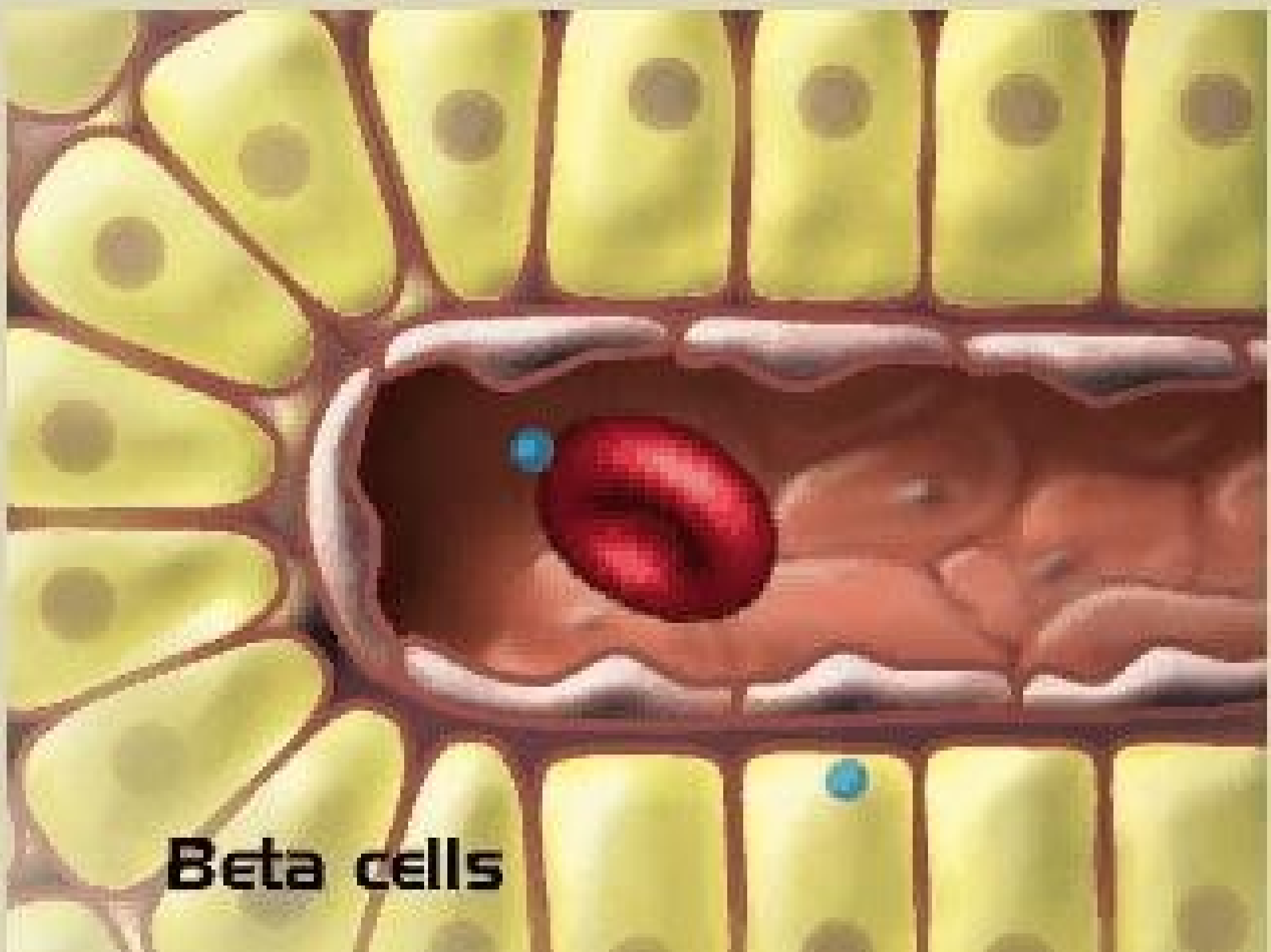
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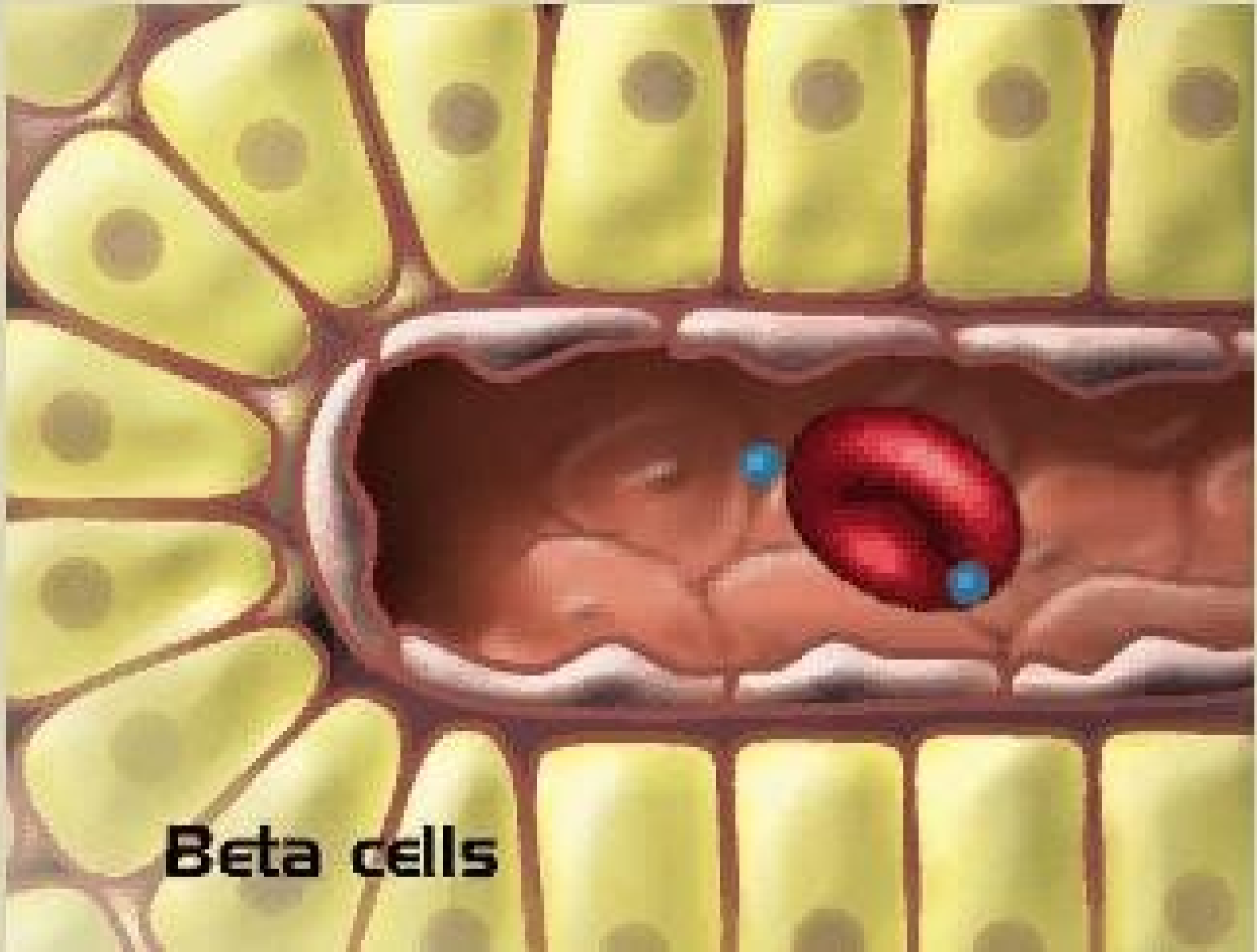
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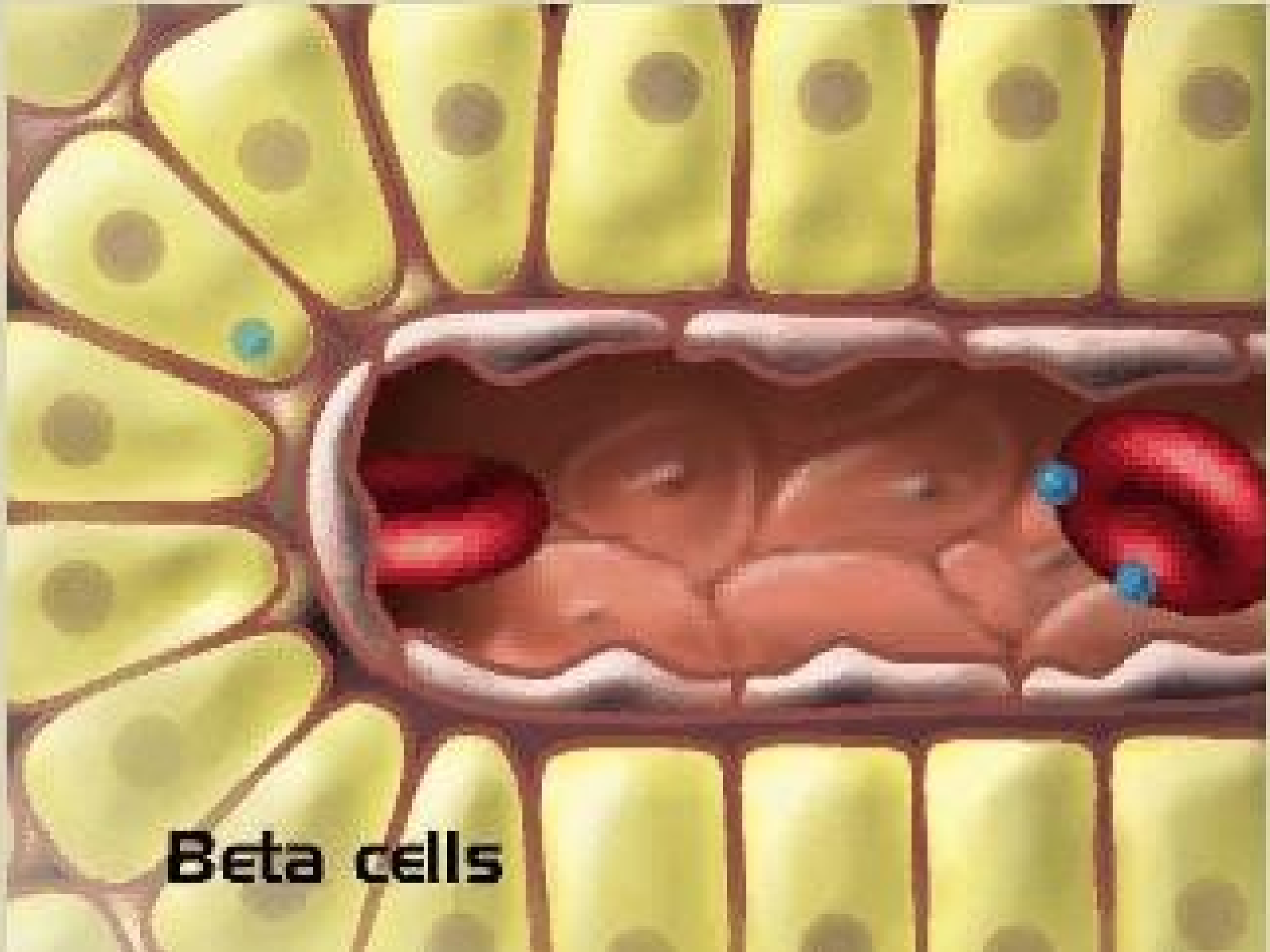
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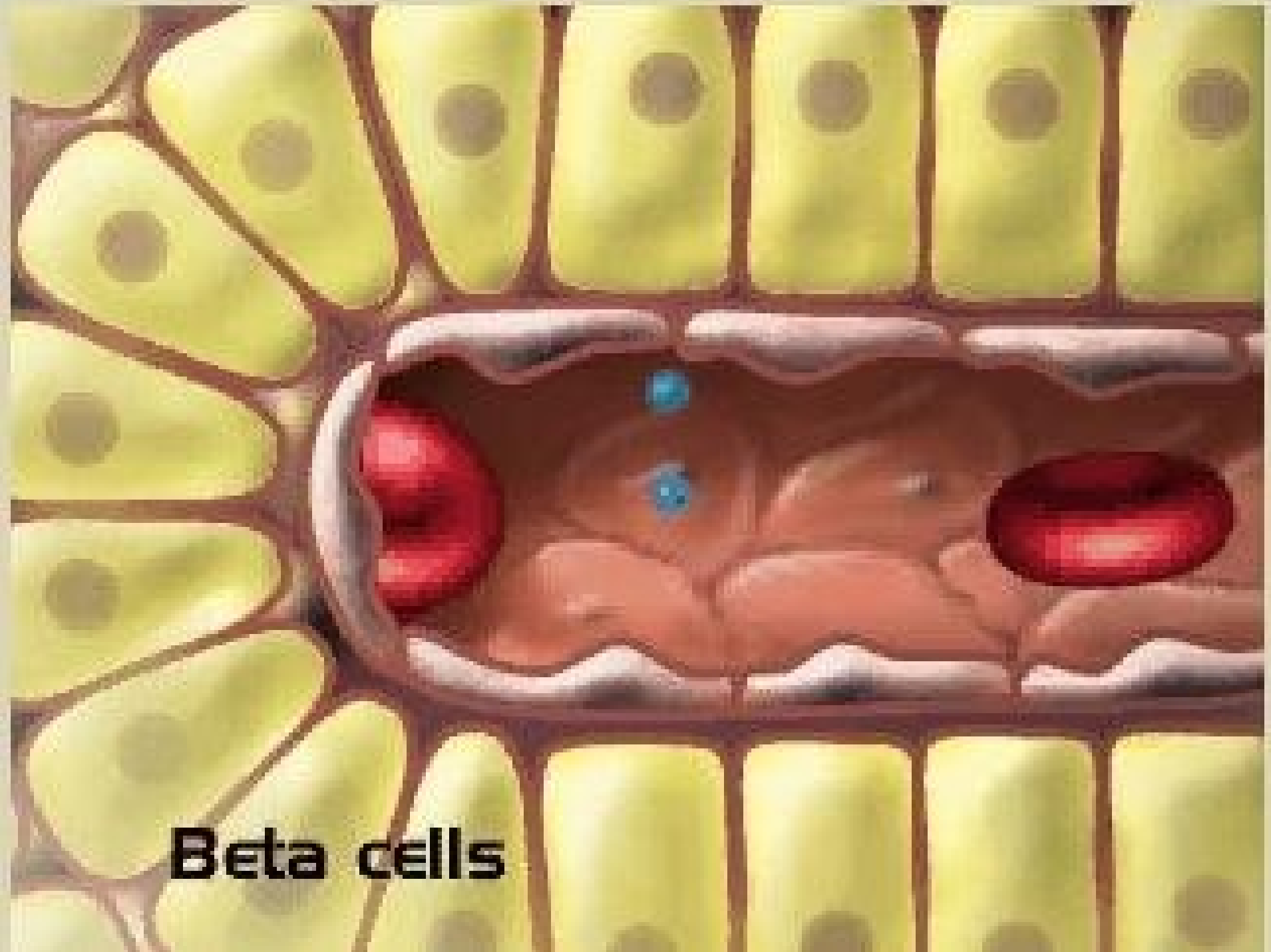
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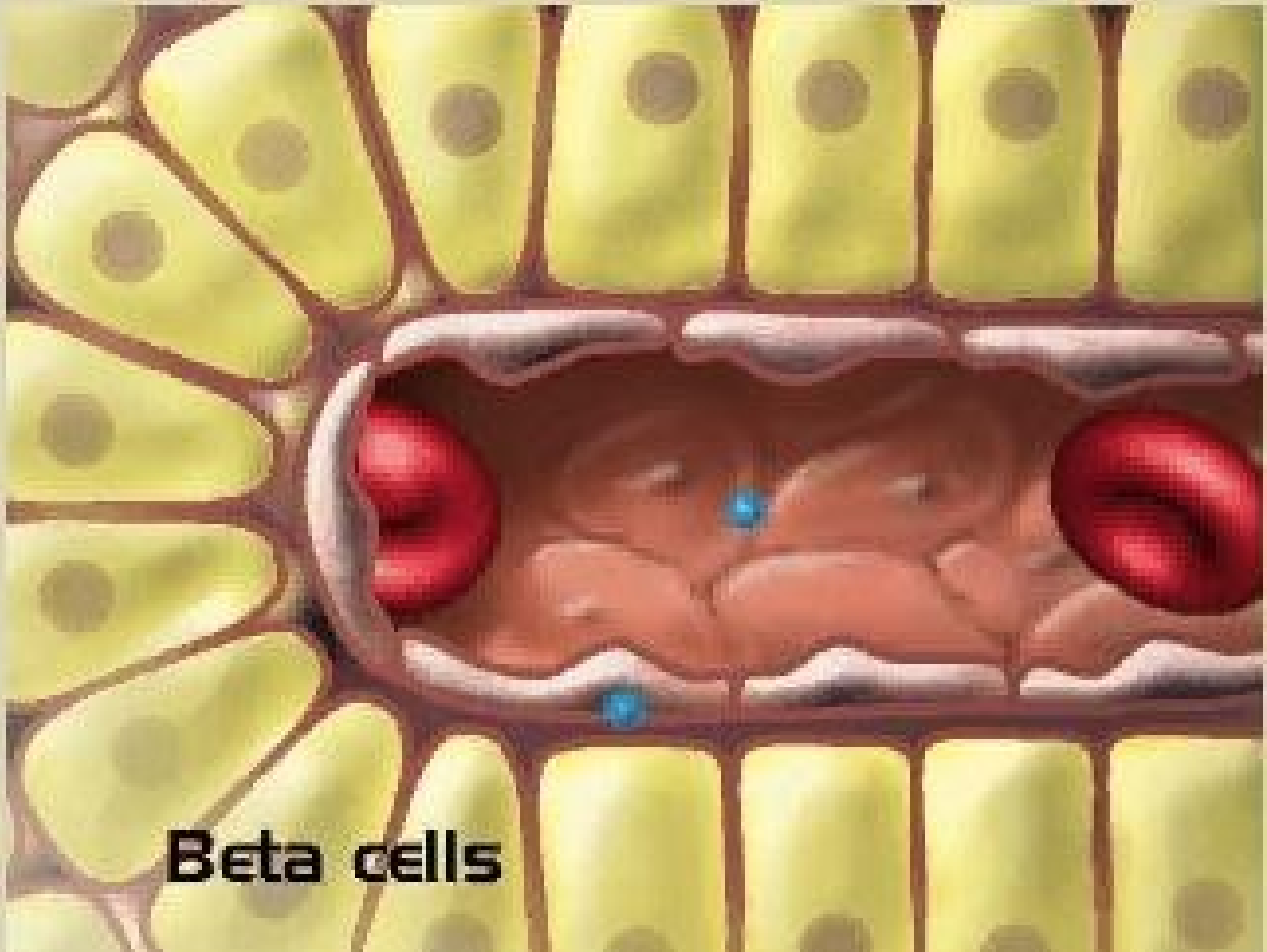
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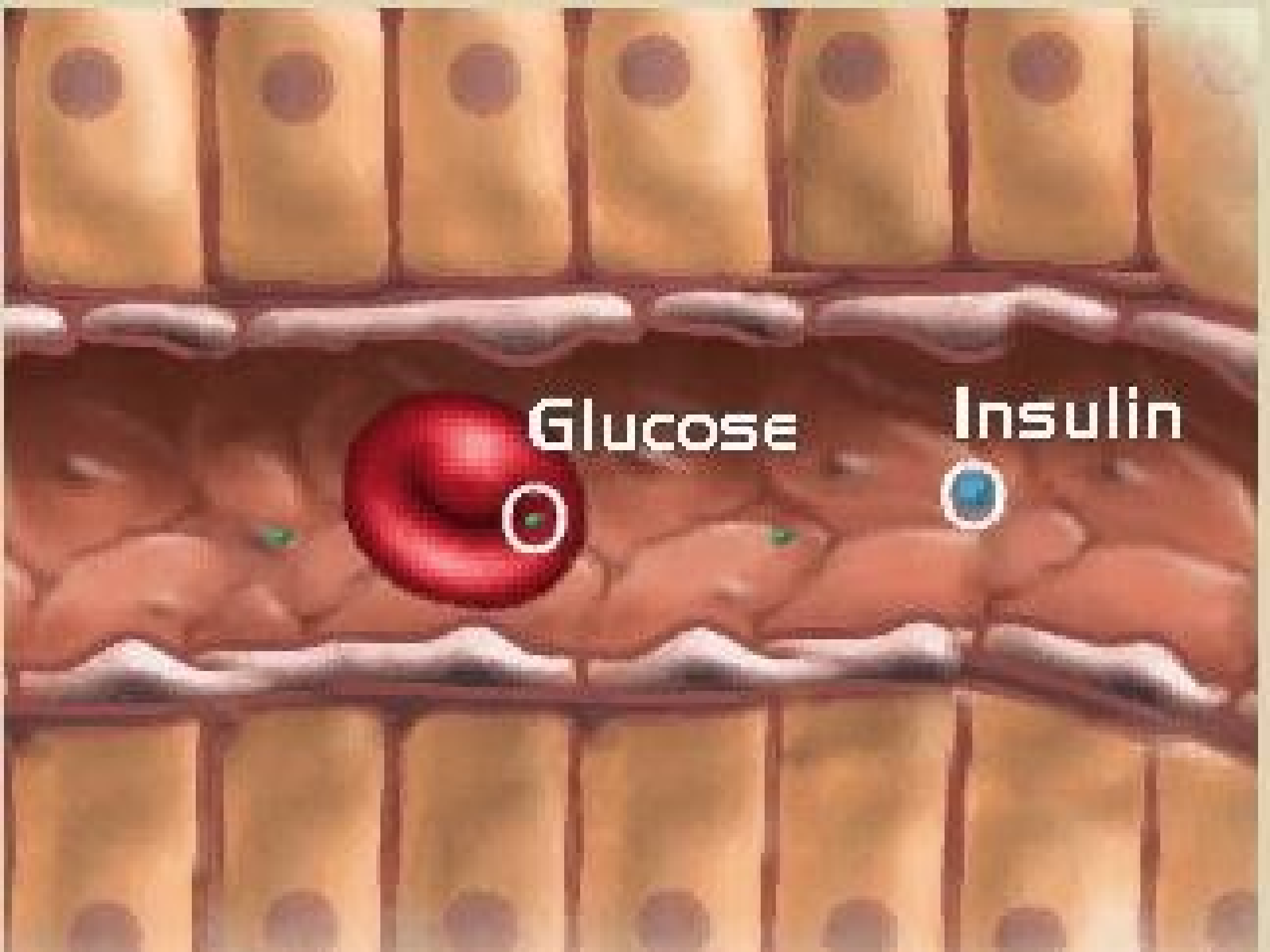
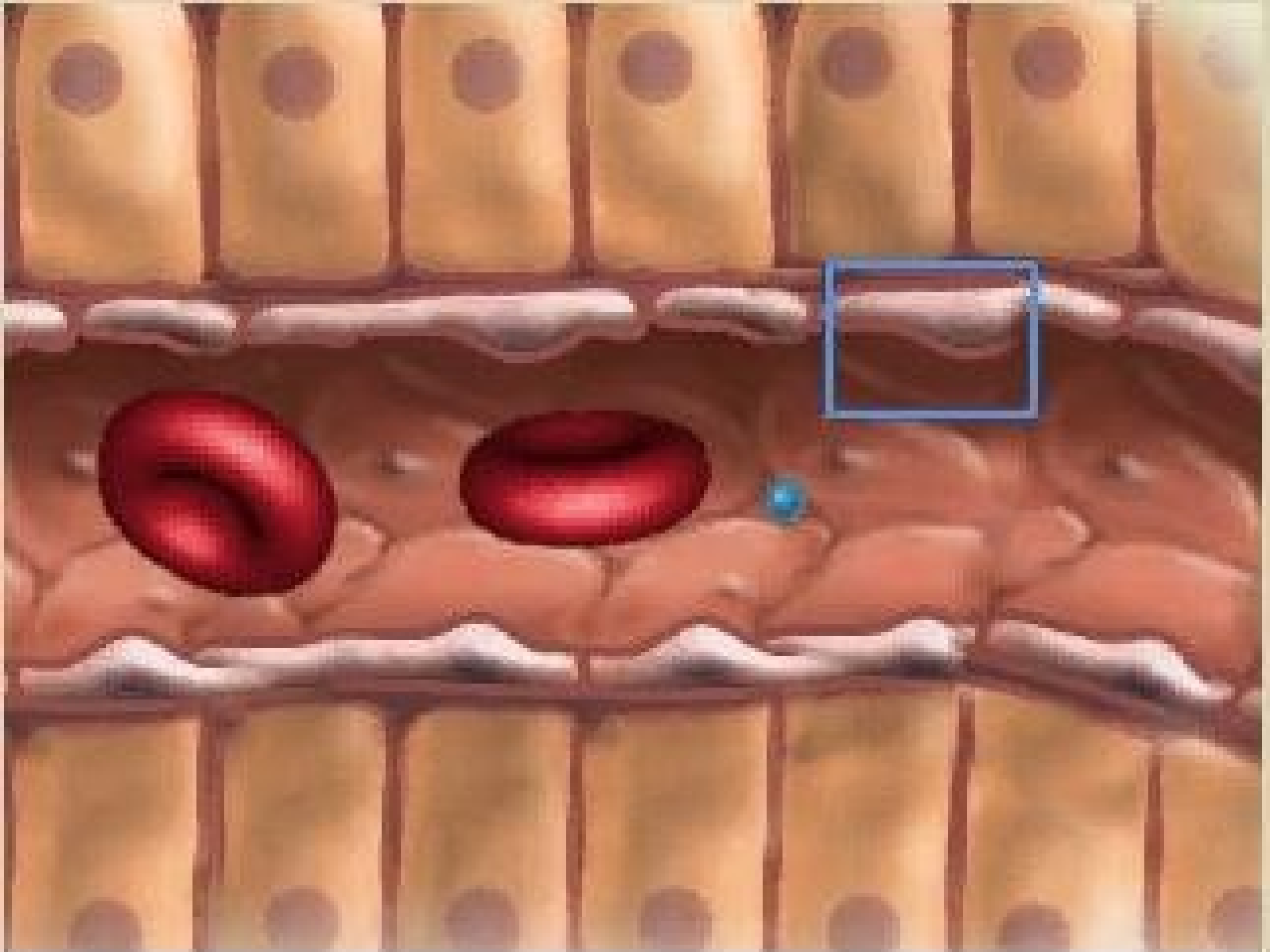
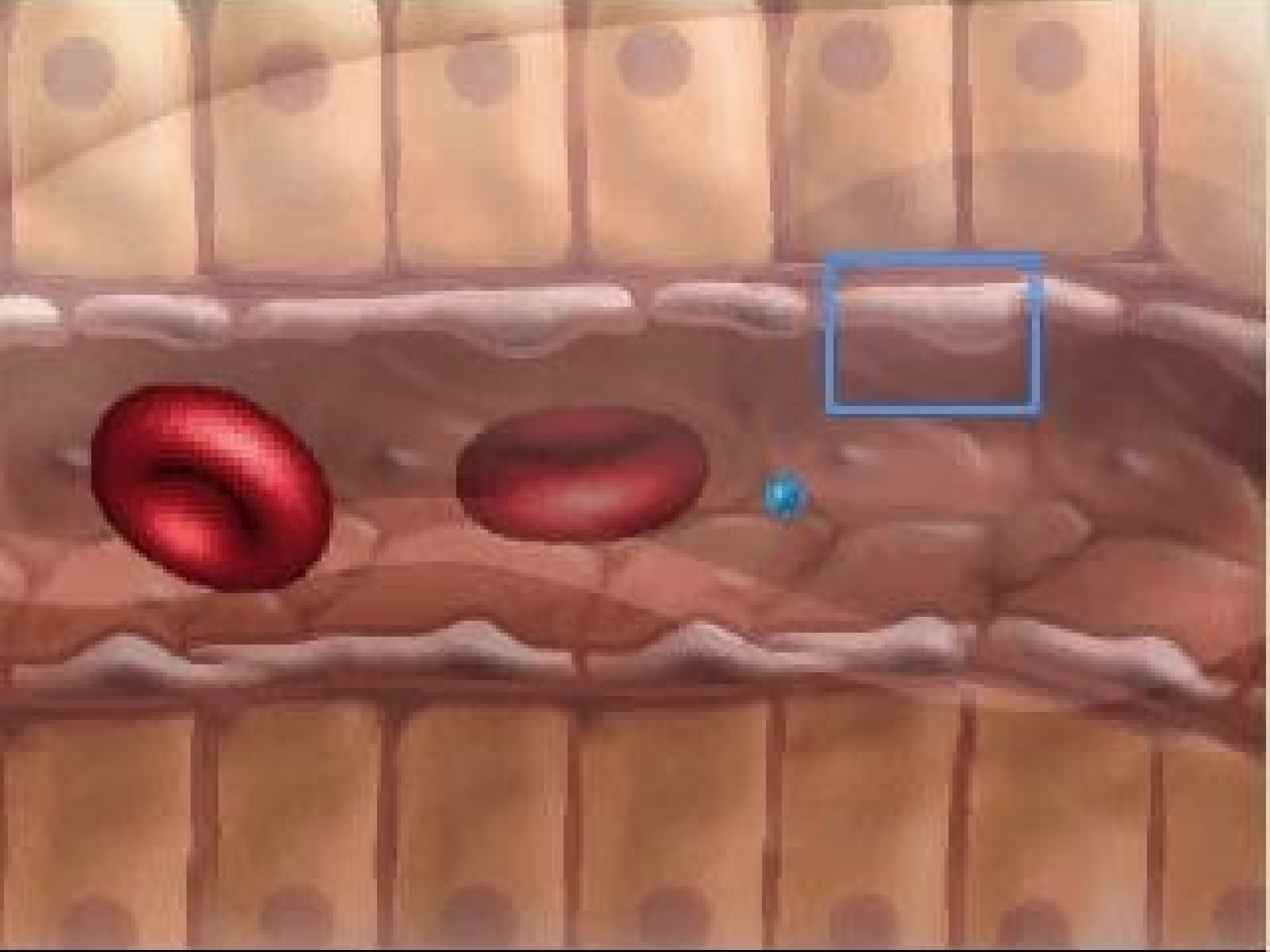
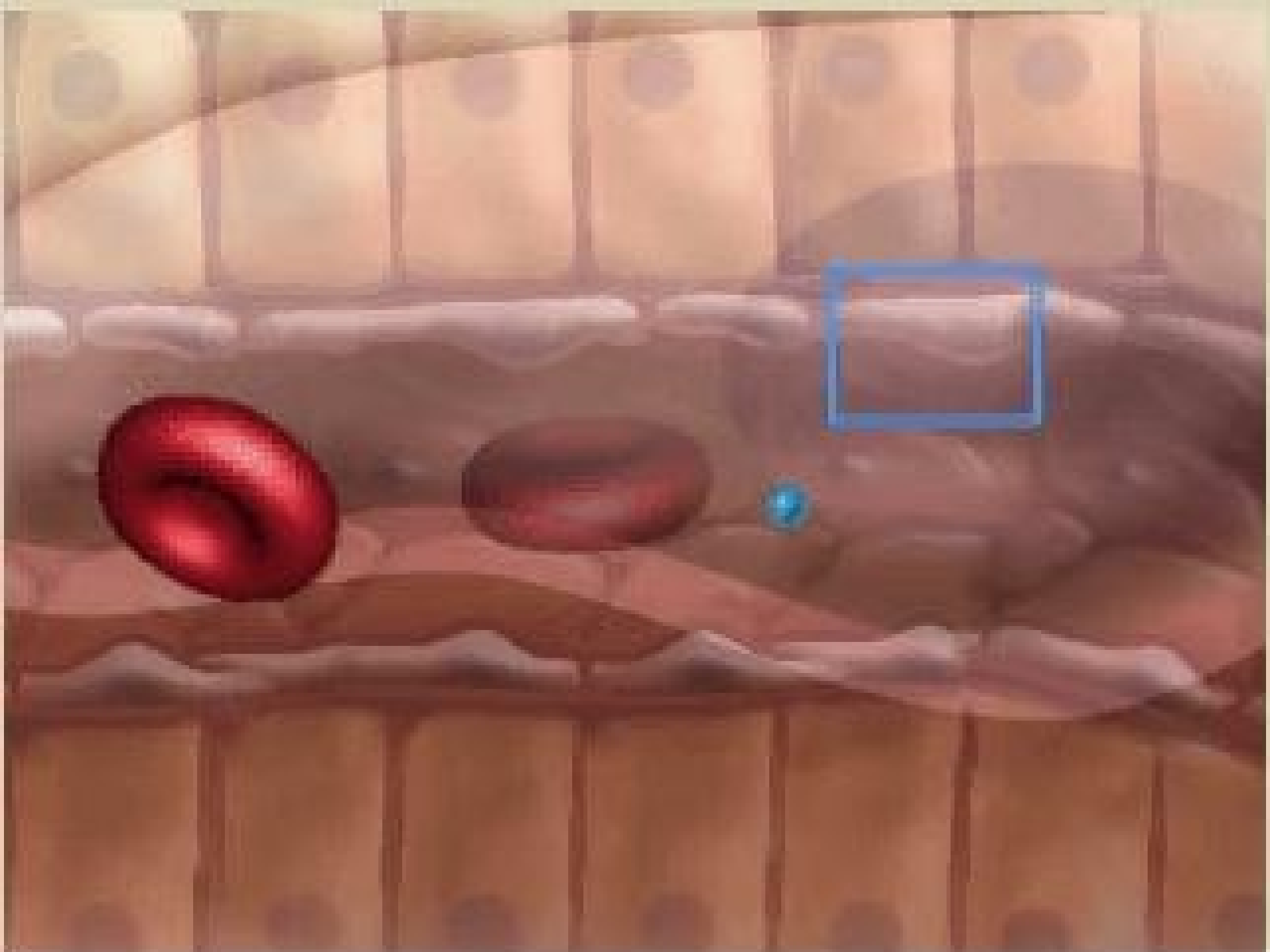
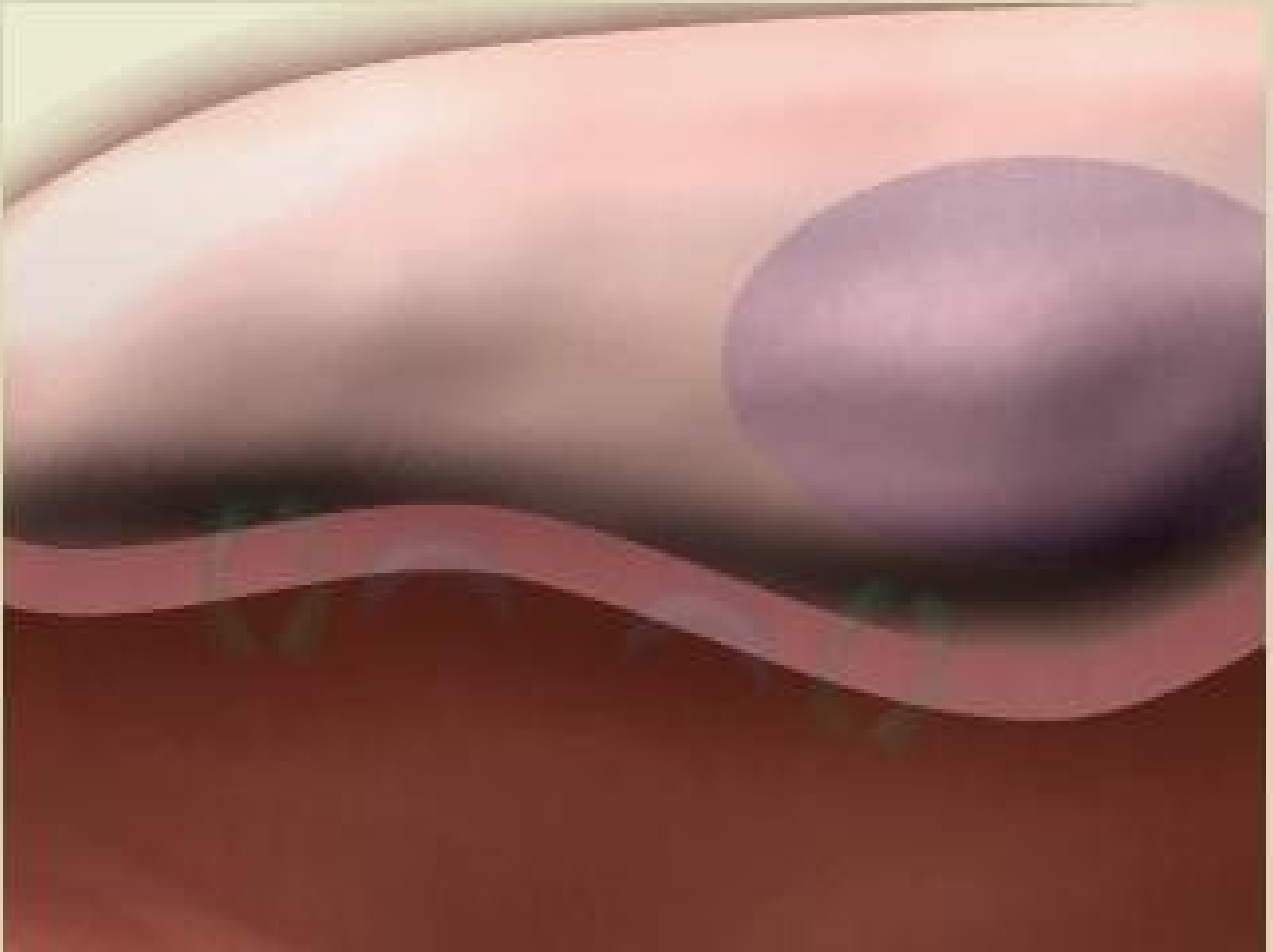
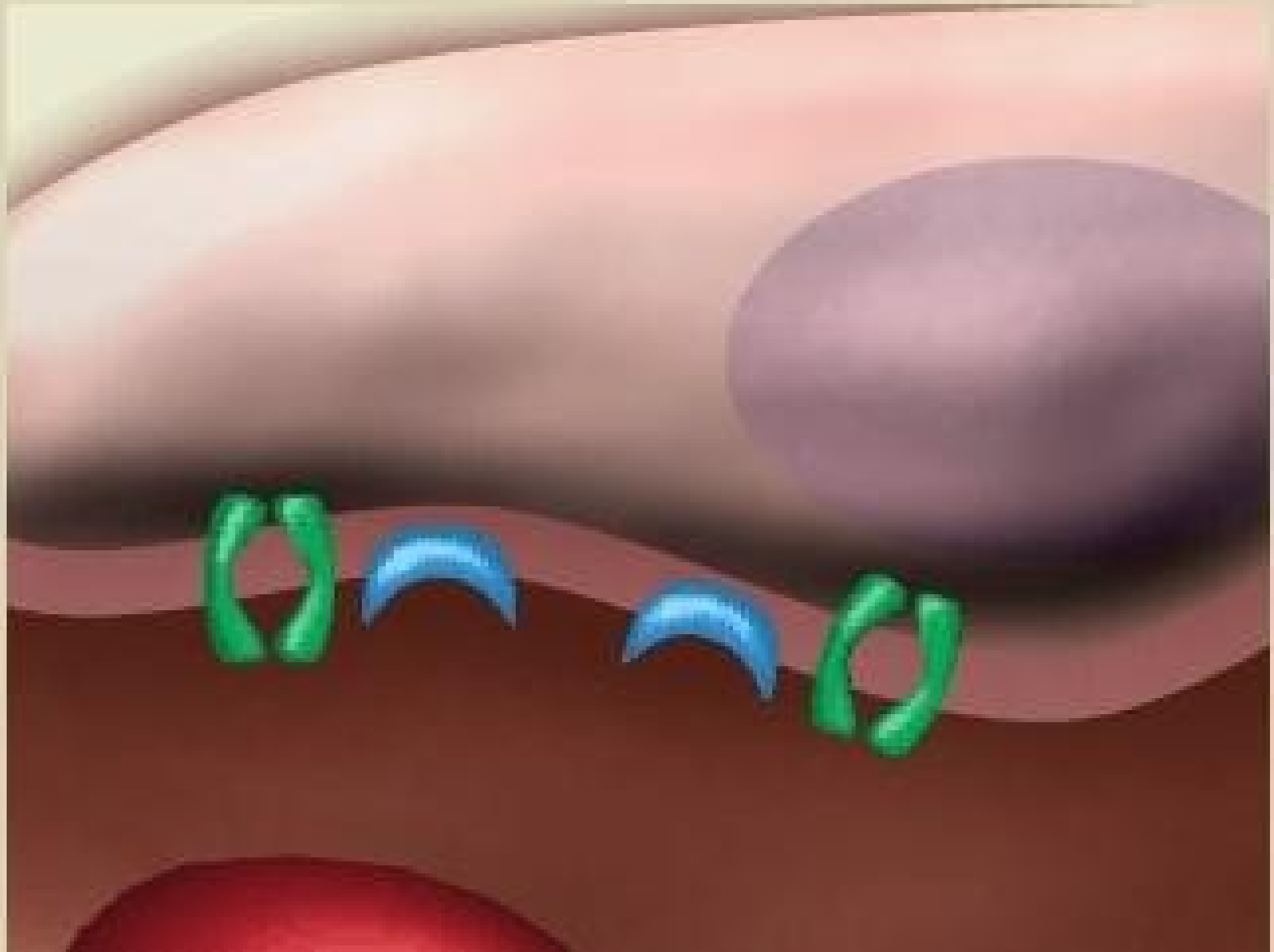

Glucose
Insulin

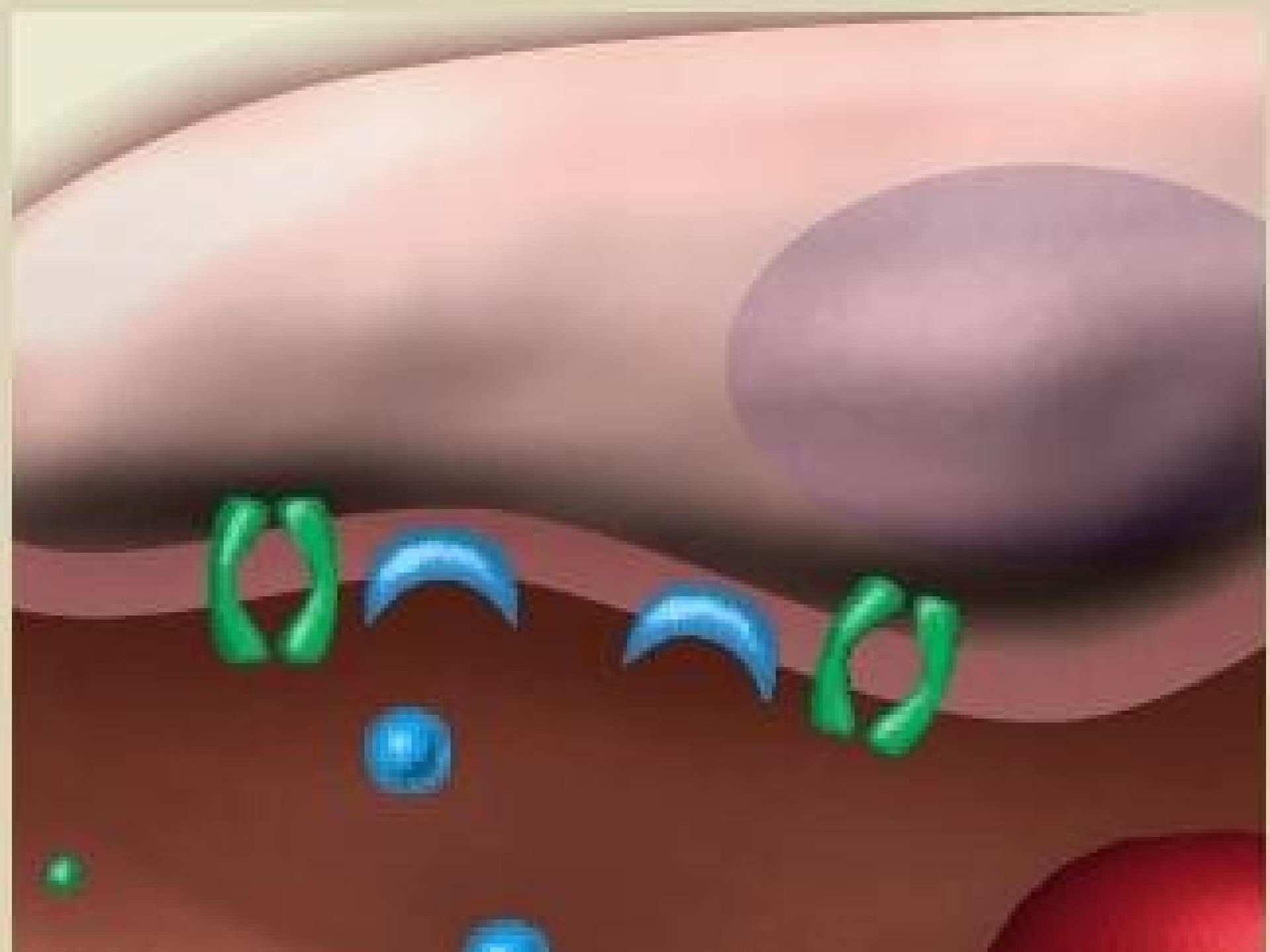


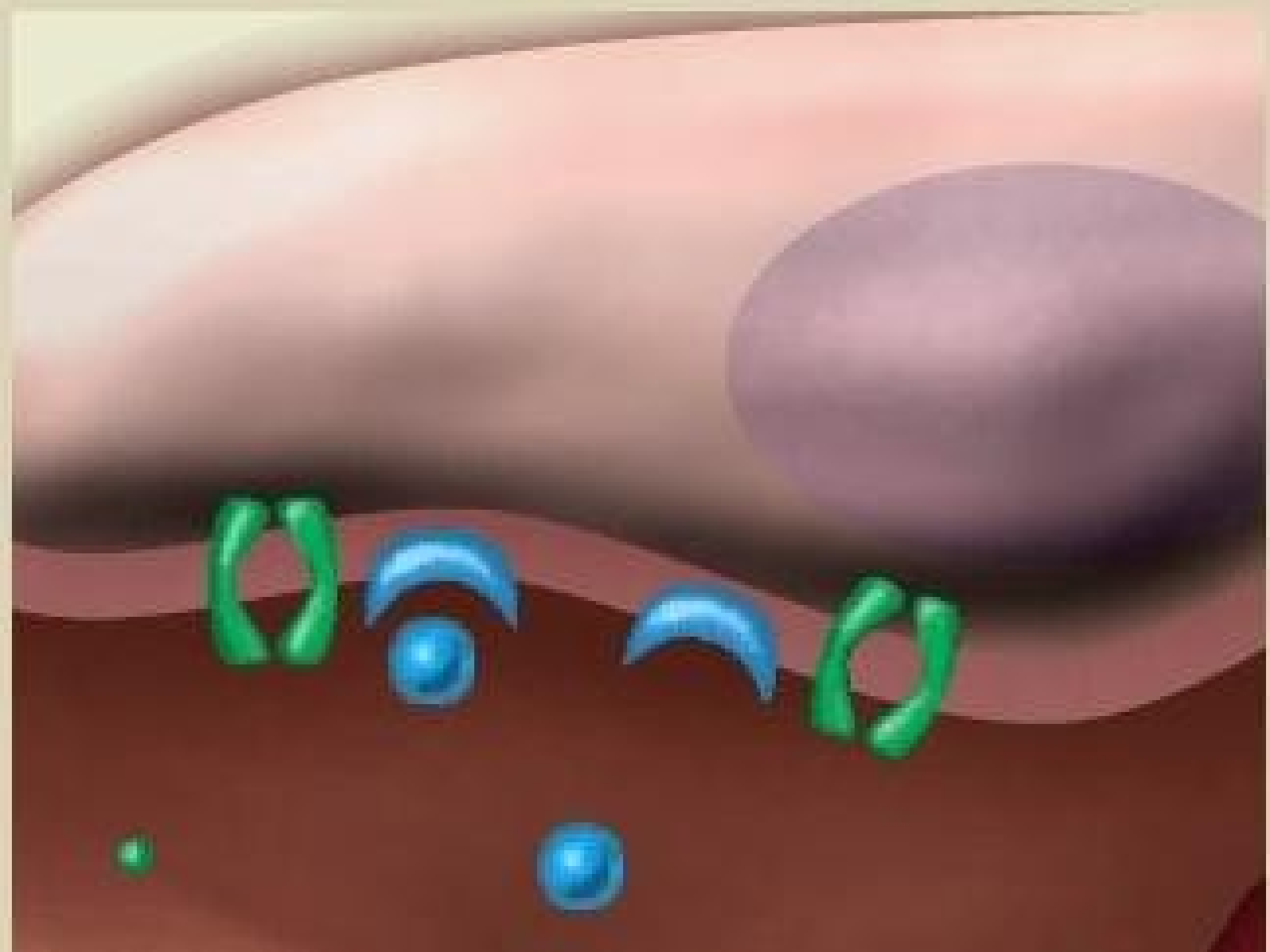




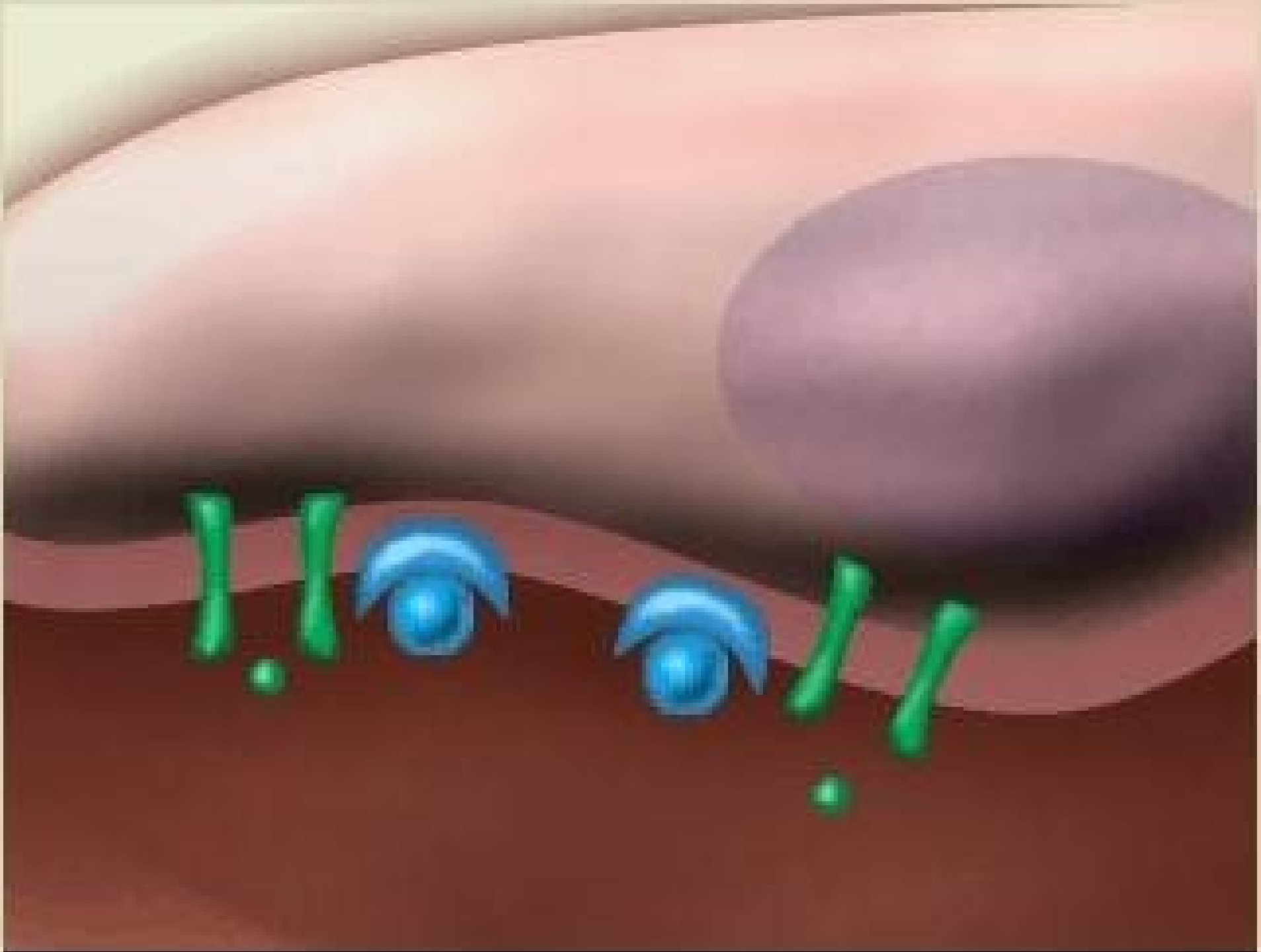


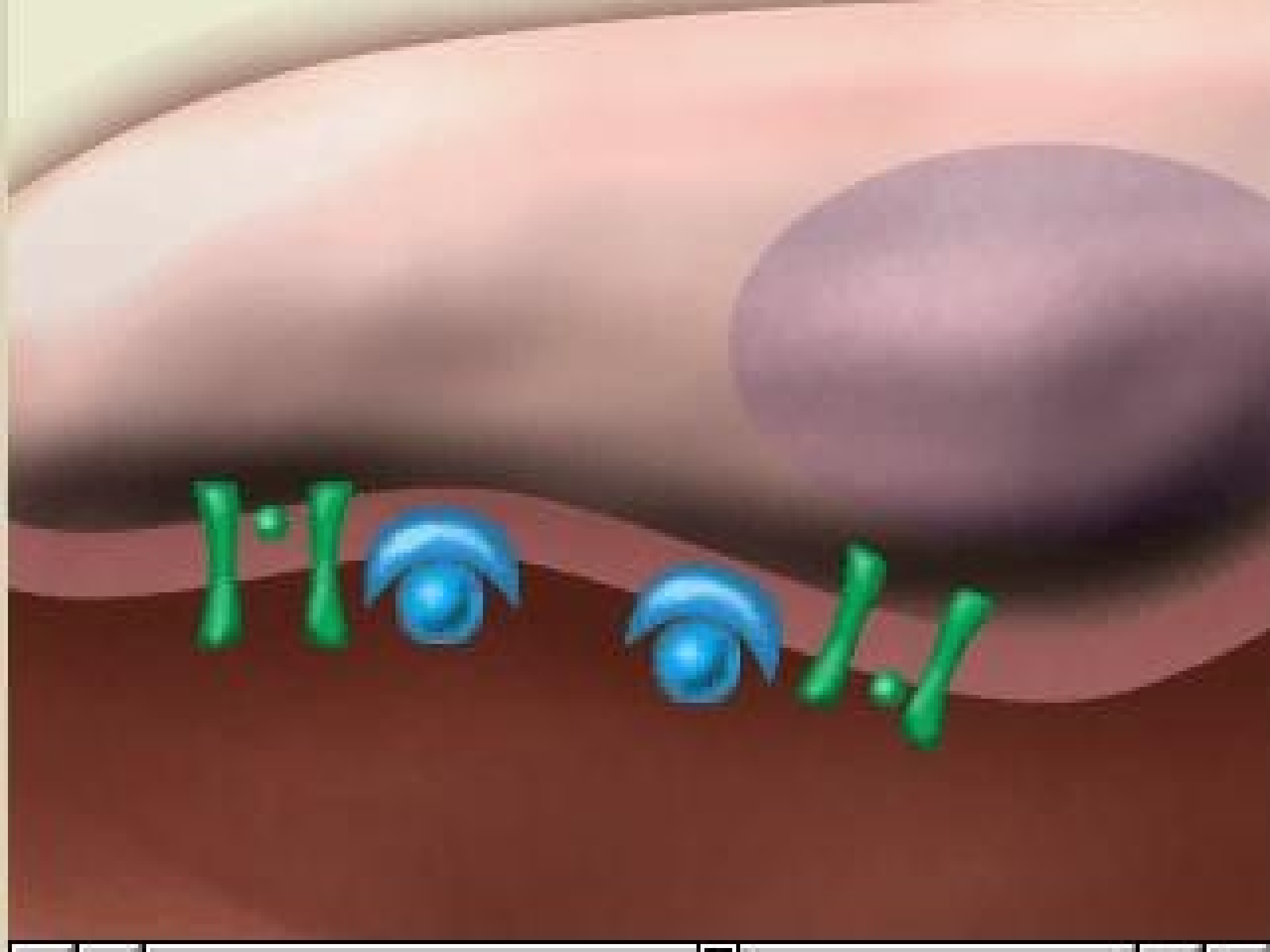


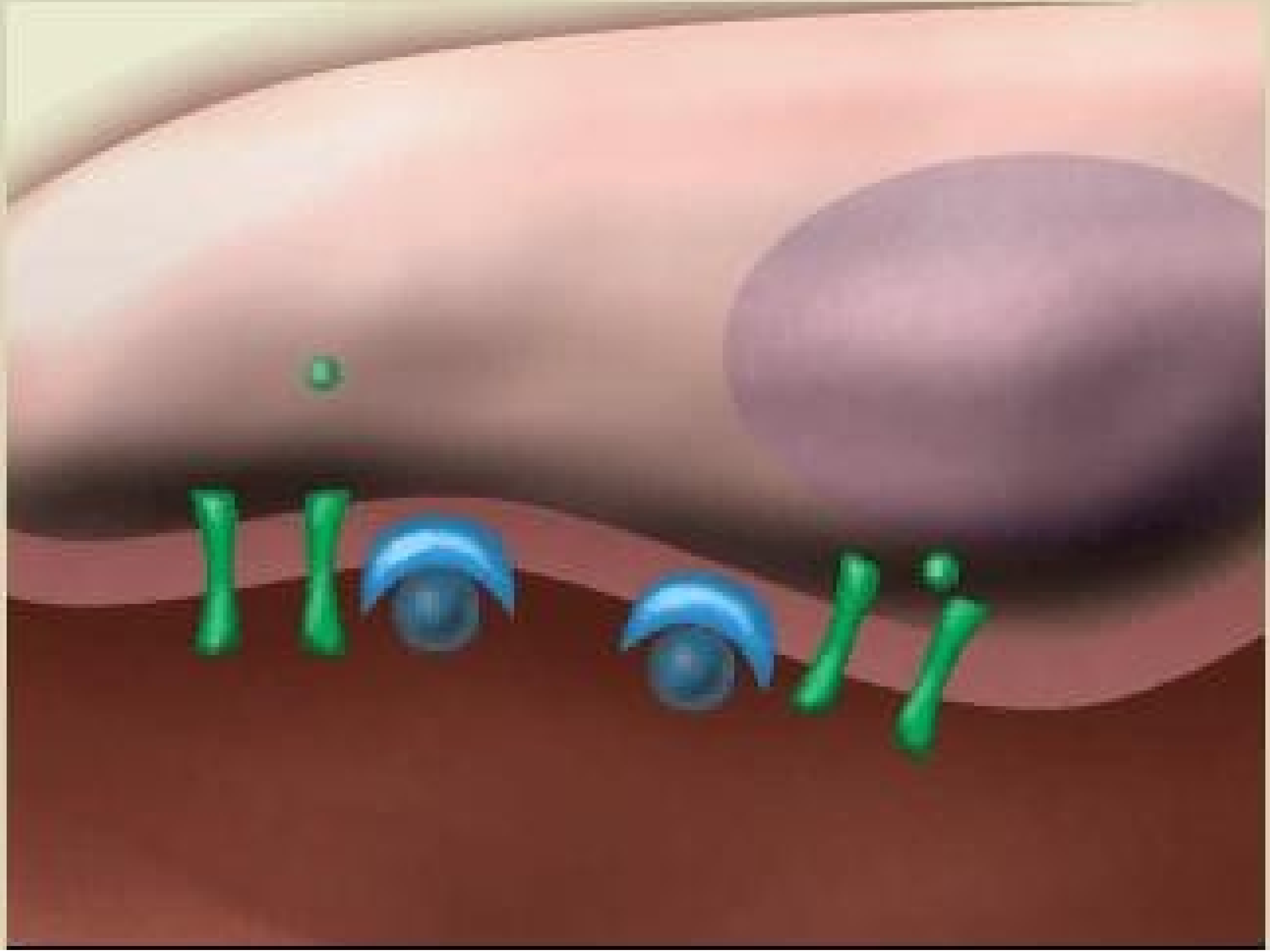


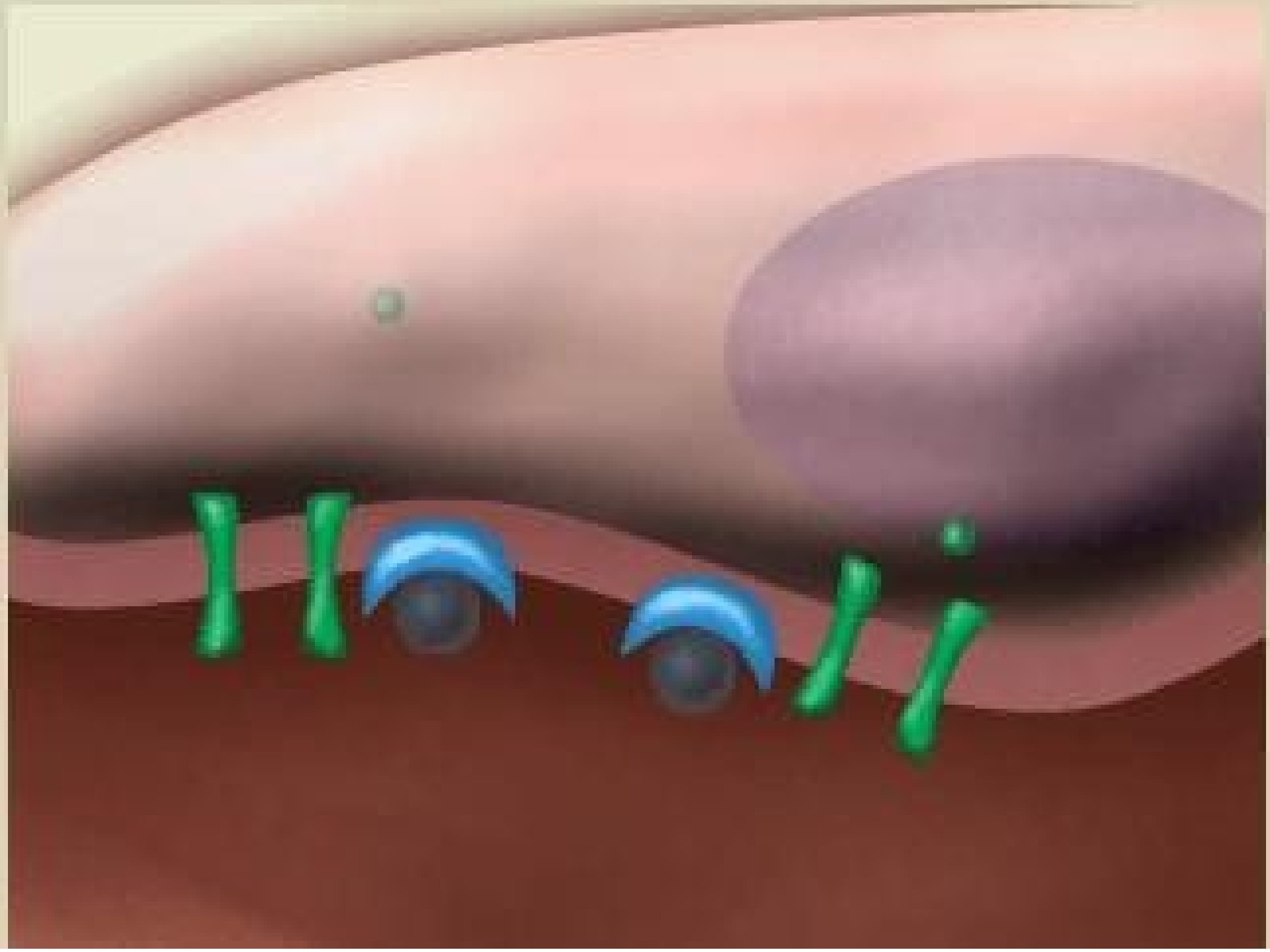


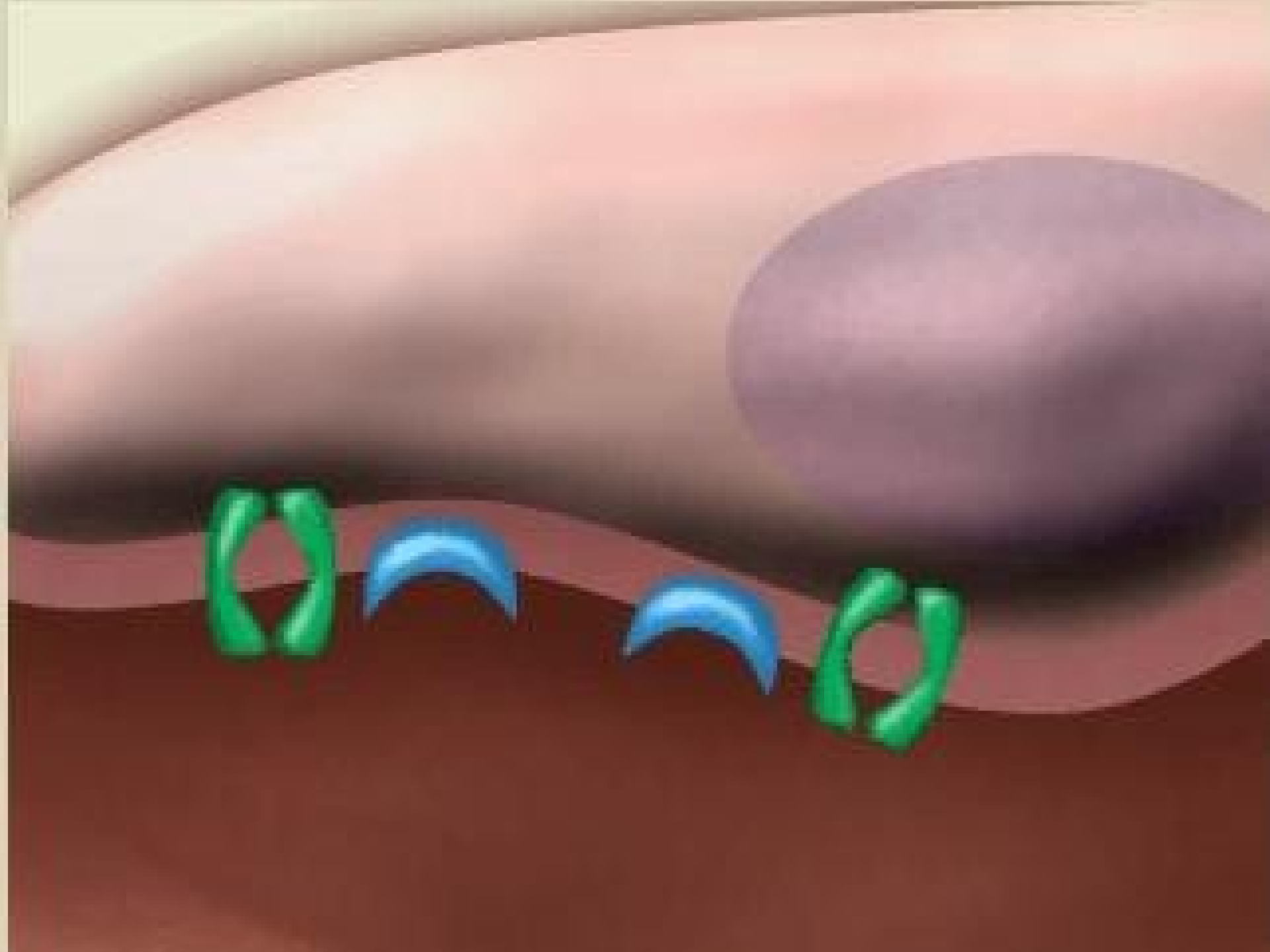

Hong



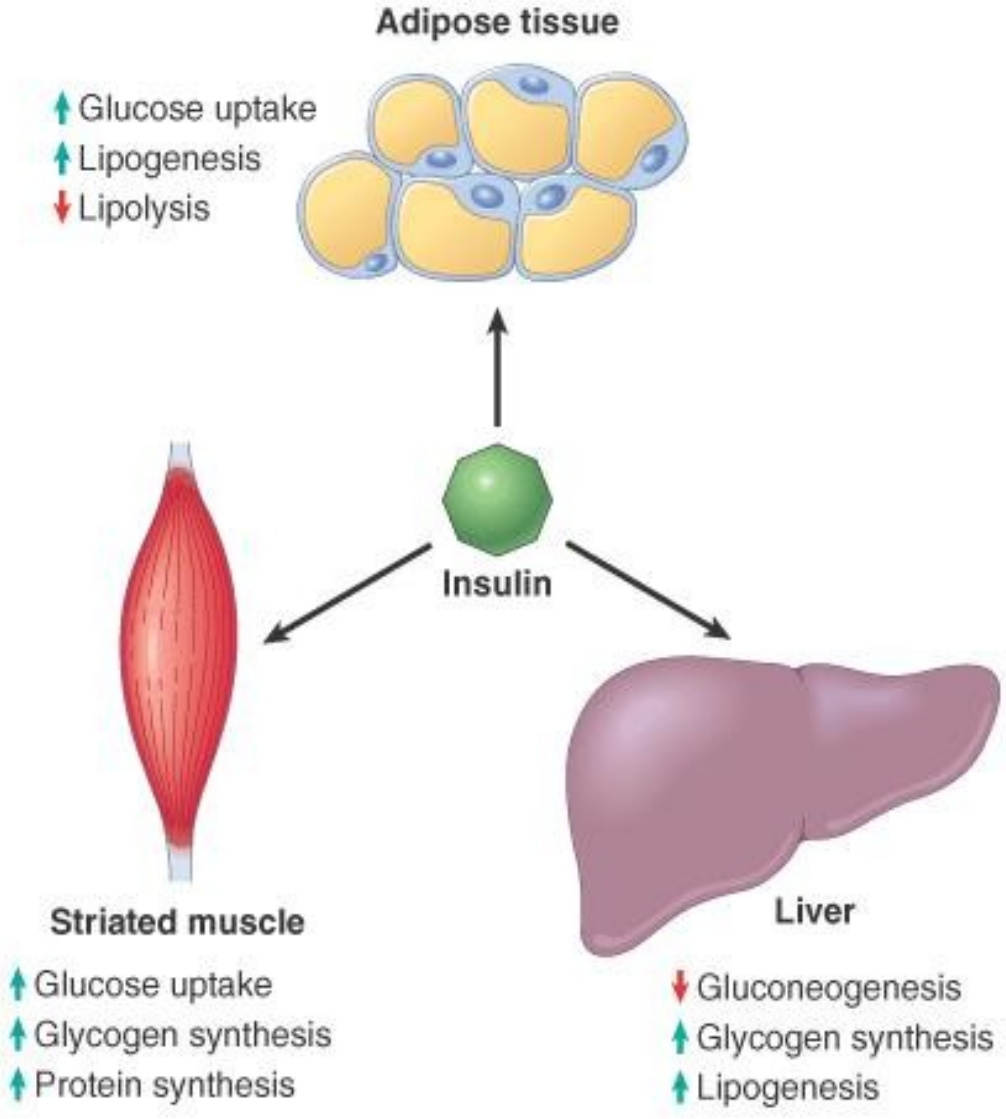

Ho ho







Metabolic action of Insulin

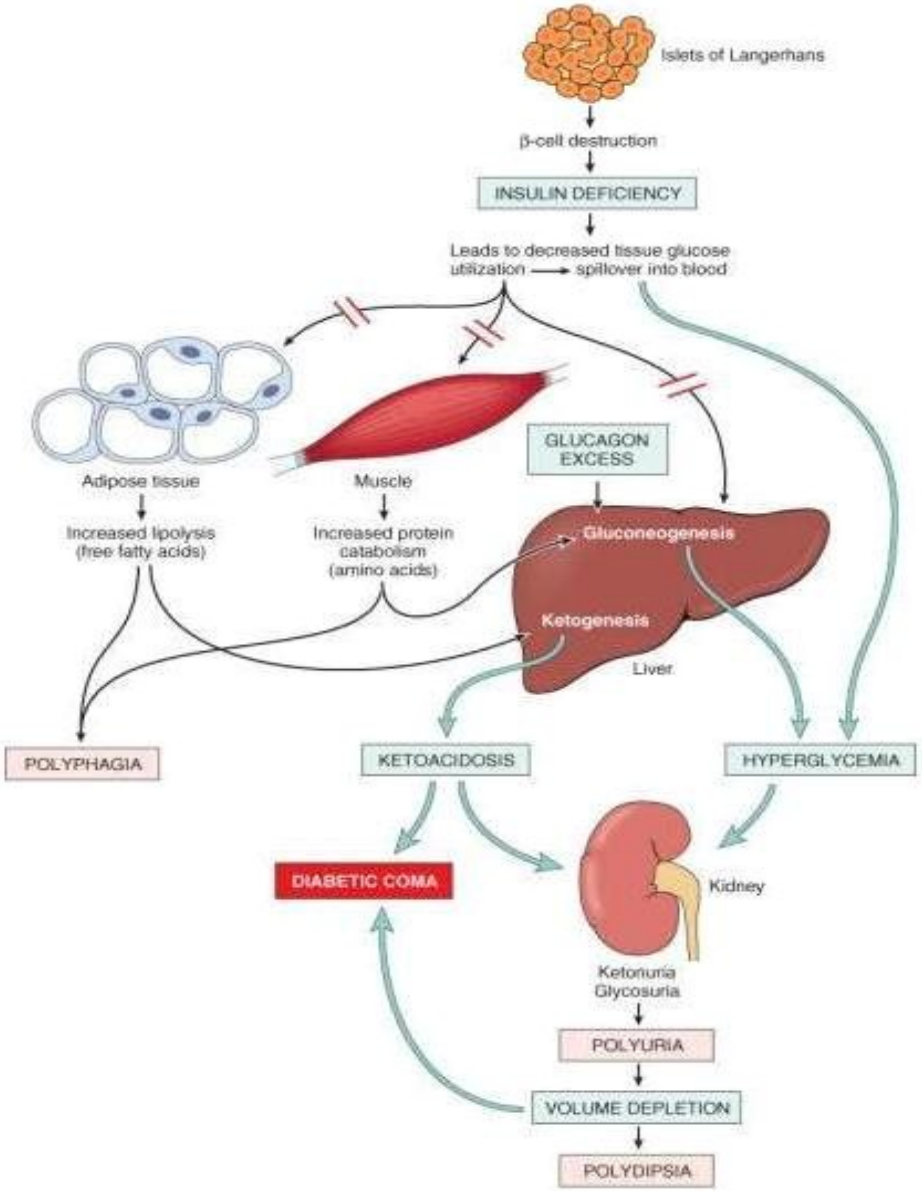


Diabetes Mellitus

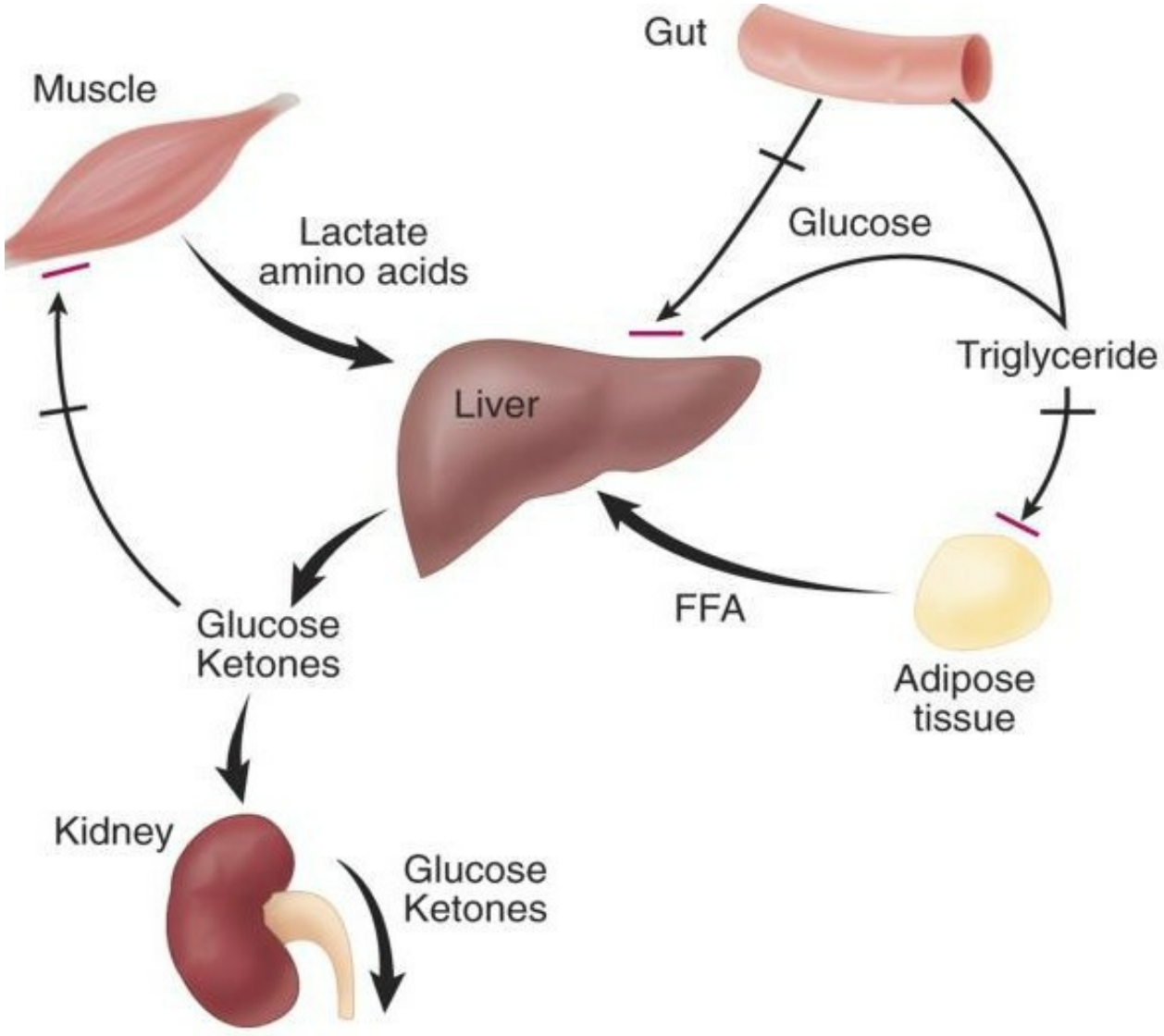
Deficiency of Insulin

- Absolute
- Relative

Metabolic derangements in Diabetes



Effect of Insulin deficiency



Features

Classical symptoms

- ✓ **Polyurea** – increased urination
- ✓ **Polyphagia** – increased appetite
- ✓ **Polydipsia** – increased thirst

Features

- Weight loss
- Weight gain
- Increased incidence of infections
- Neuropathy
- Nephropathy
- Coma

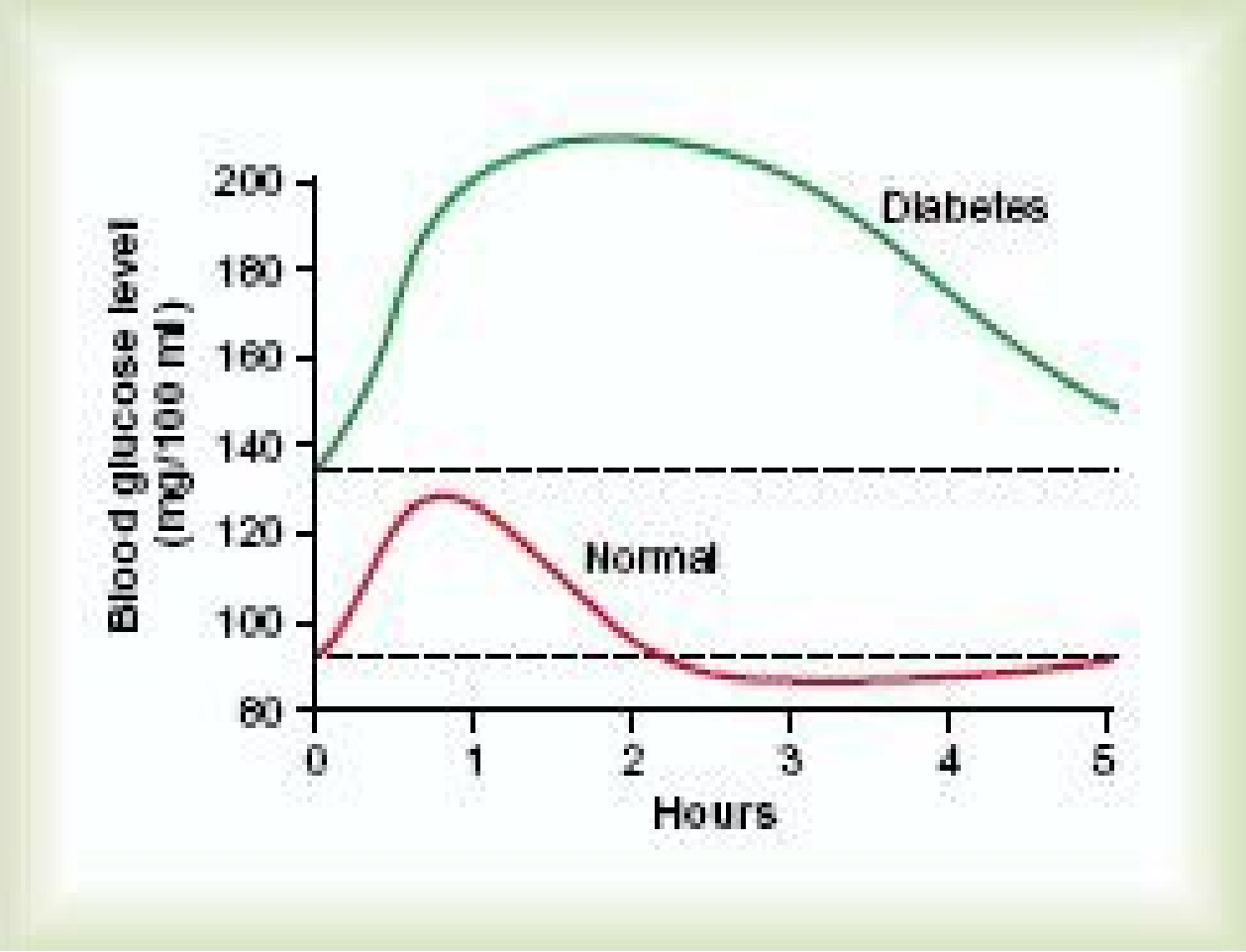
Diabetes: diagnostic criteria

any one of three criteria

- ✓ A random glucose > 200 mg/dL, with classical signs and symptoms.
- ✓ A fasting glucose > 126 mg/dL on more than one occasion.
- ✓ An abnormal oral glucose tolerance test (OGTT), in which the glucose is > 200 mg/dL 2 hours after a standard

Blood Sugar estimation

Diabetes: diagnostic blood test



Pre-Diabetes: diagnostic criteria

Intermediate states between normal glucose tolerance and DM type 2.

- Impaired fasting glucose (IFG)
- Impaired glucose tolerance (IGT)

Pre-Diabetes: diagnostic criteria

IFG is defined by fasting plasma glucose of 100 mg/dL to 125 mg/dL.

IGT is defined by a 2-hour oral glucose tolerance test plasma glucose from 140 mg/dL to 199 mg/dL.

Pre-Diabetes State

Crucial risk factor

Lifestyle modification

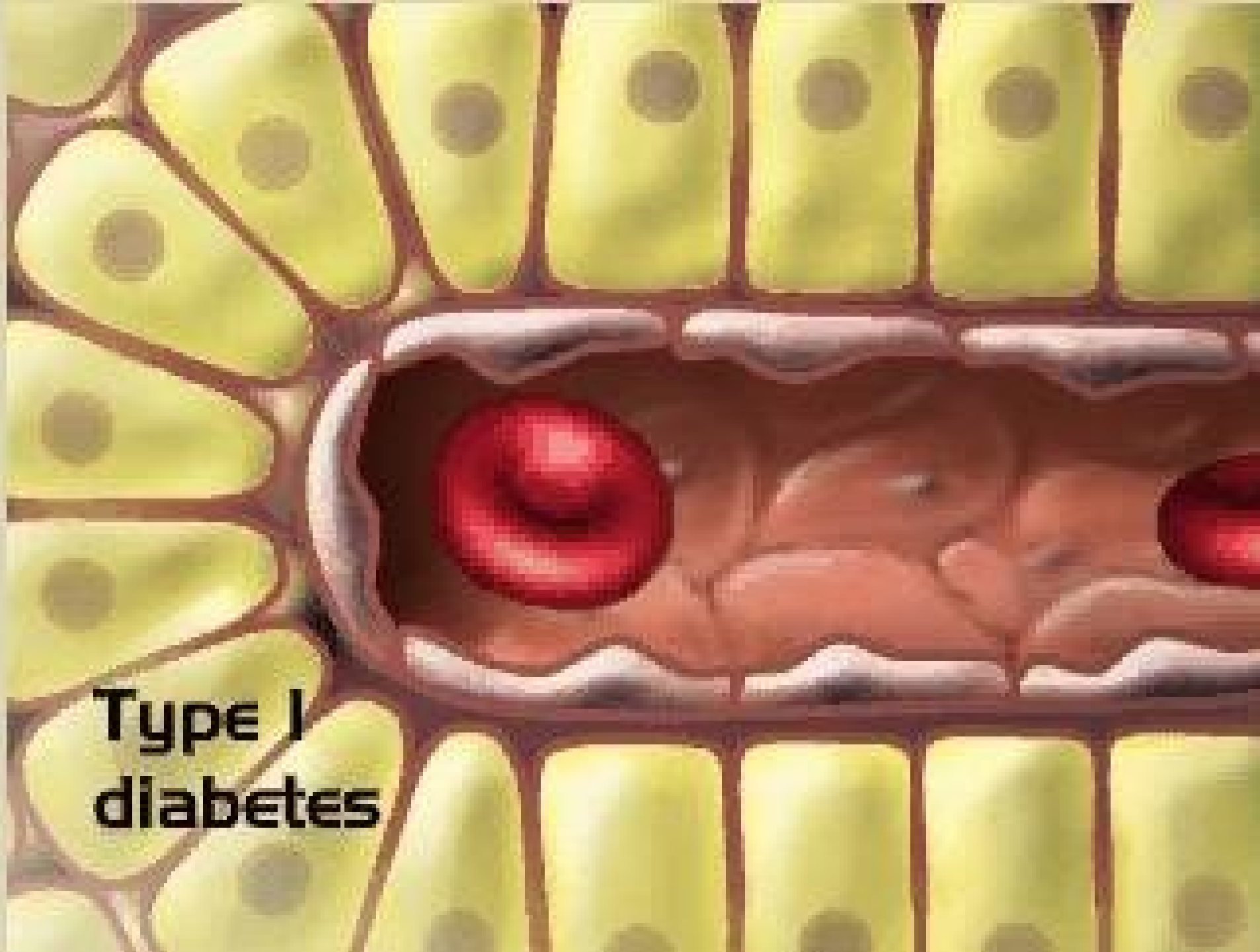
Diabetes: classification

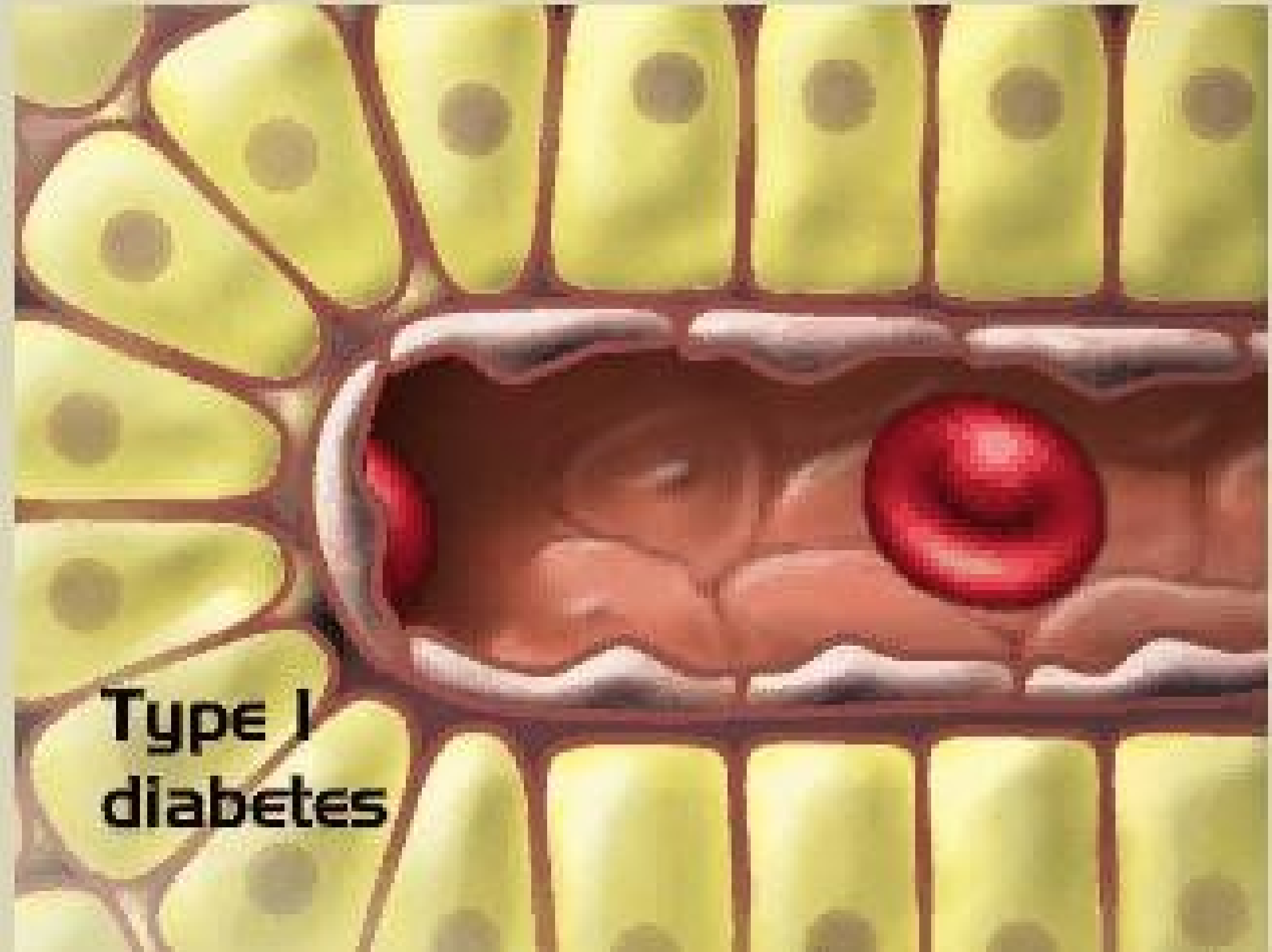
- ✓ ***Type 1***
- ✓ ***Type 2***

Diabetes: classification

- ***Type 1 diabetes*** **10%**

  an absolute deficiency of insulin caused by pancreatic β-cell destruction.


Type I
diabetes


Type I
diabetes

Diabetes: classification

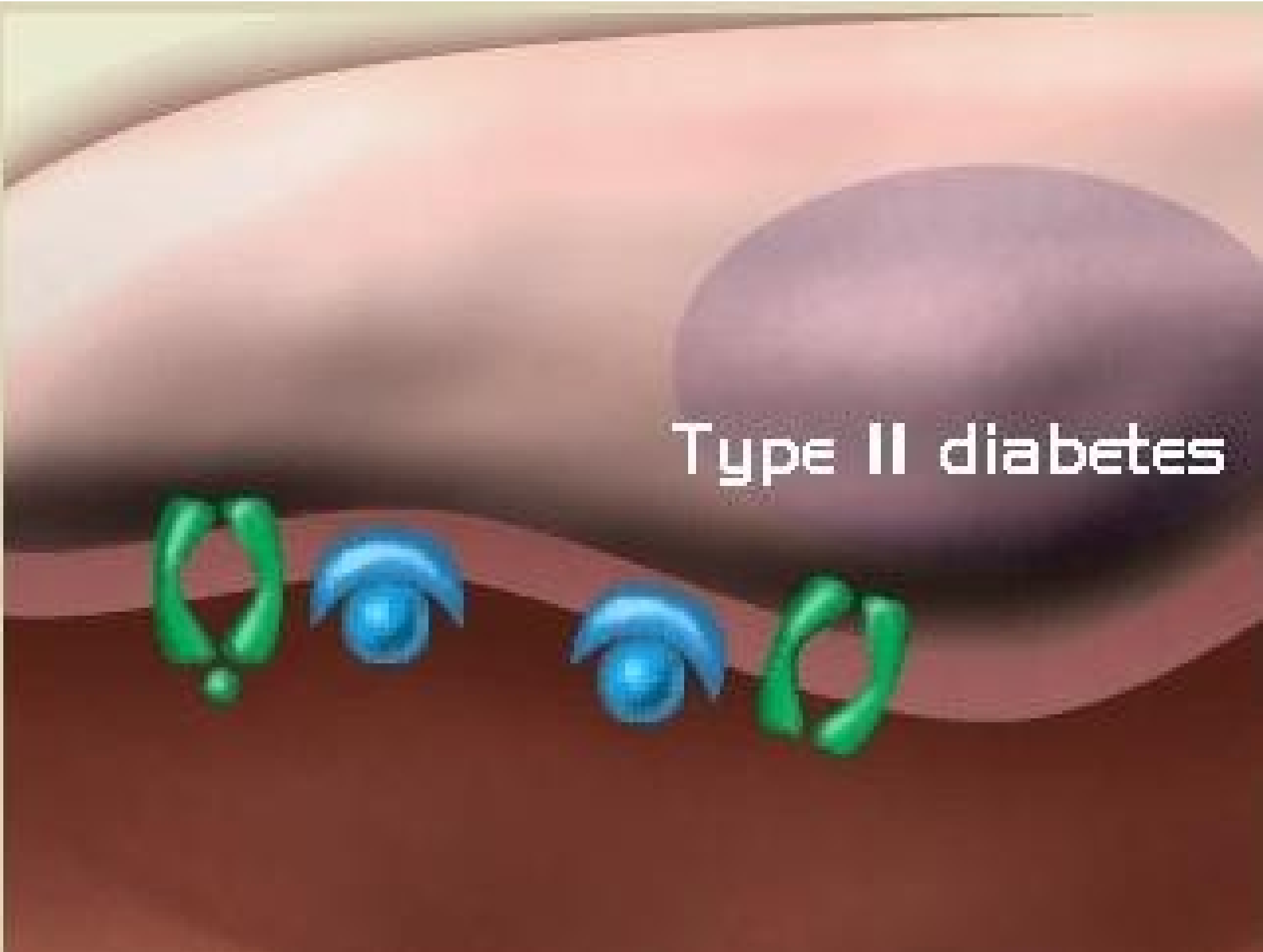
- ***Type 2 diabetes*** **80% to 90%**

  a combination of peripheral resistance to insulin action and an inadequate secretary response by the pancreatic β-cells ("relative insulin deficiency").

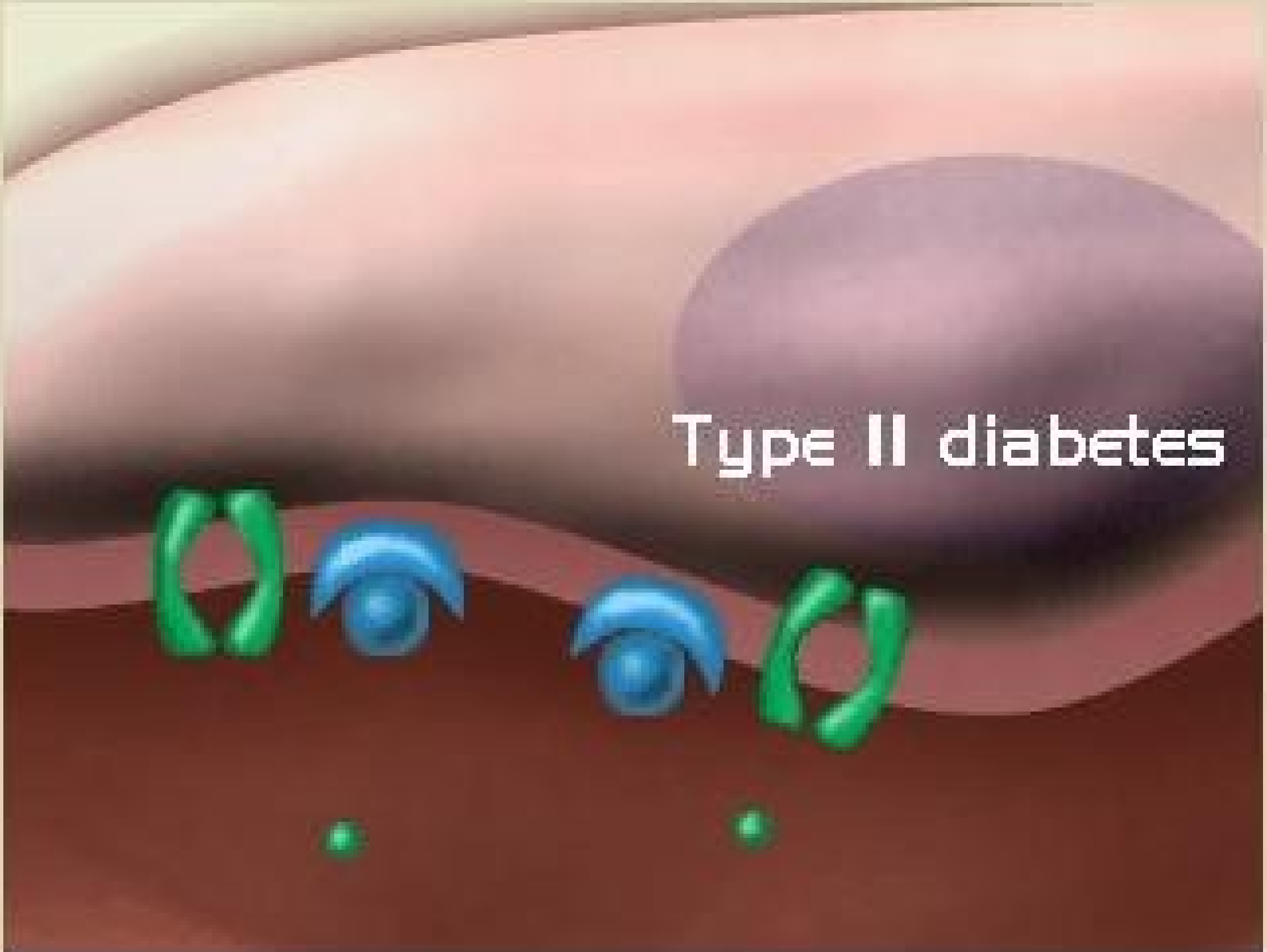

Type II diabetes

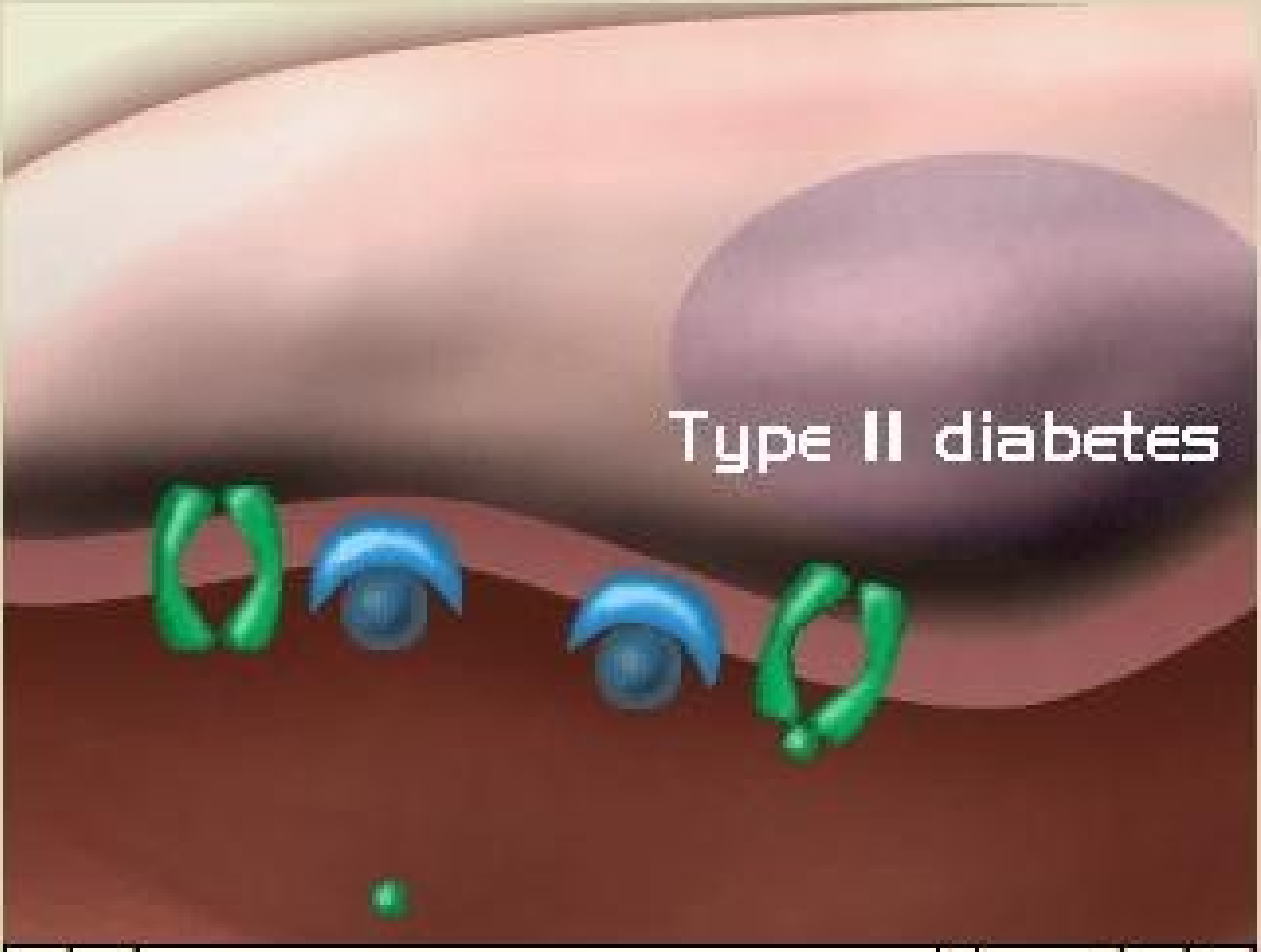

Type II diabetes

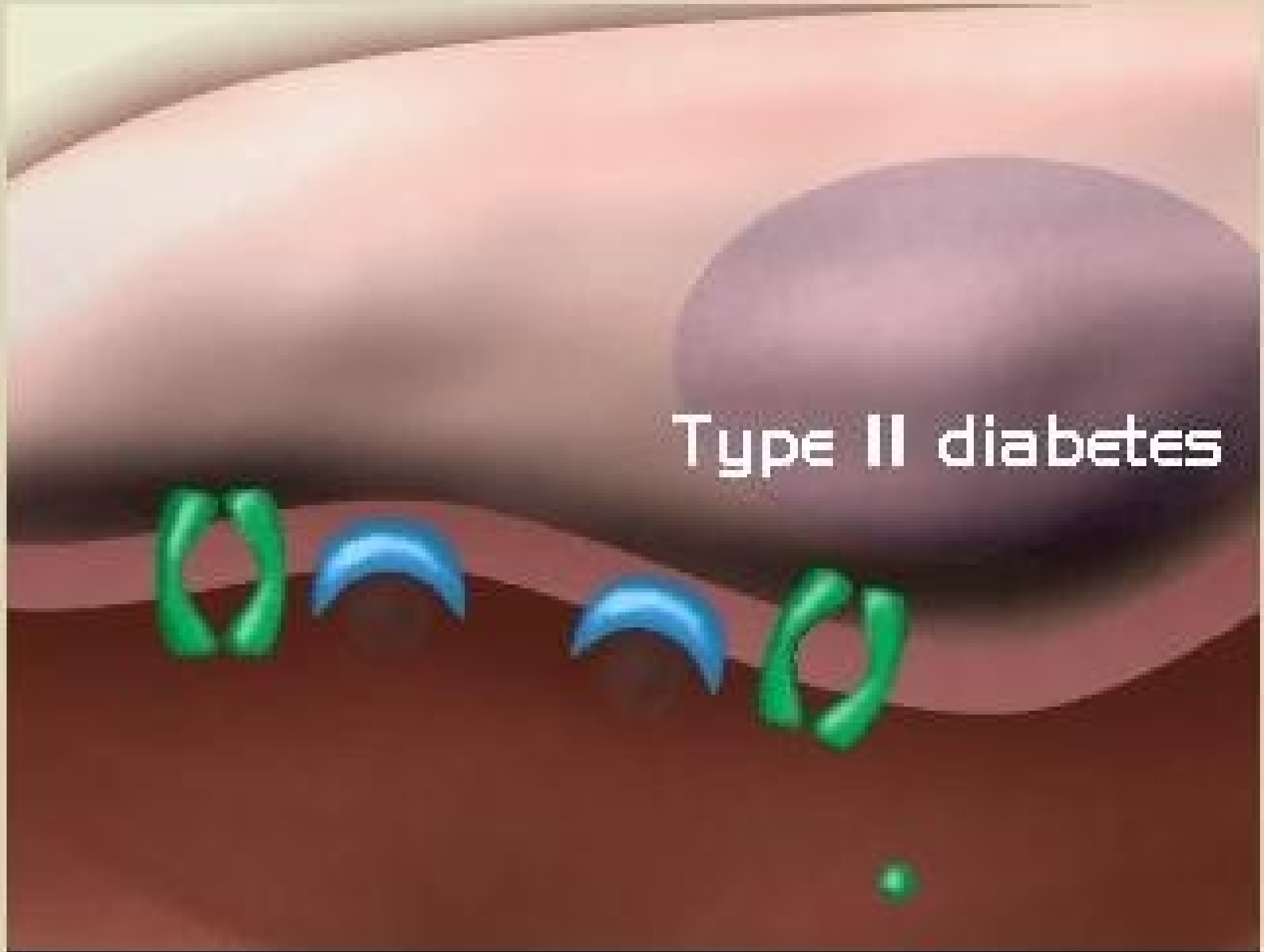

Type II diabetes

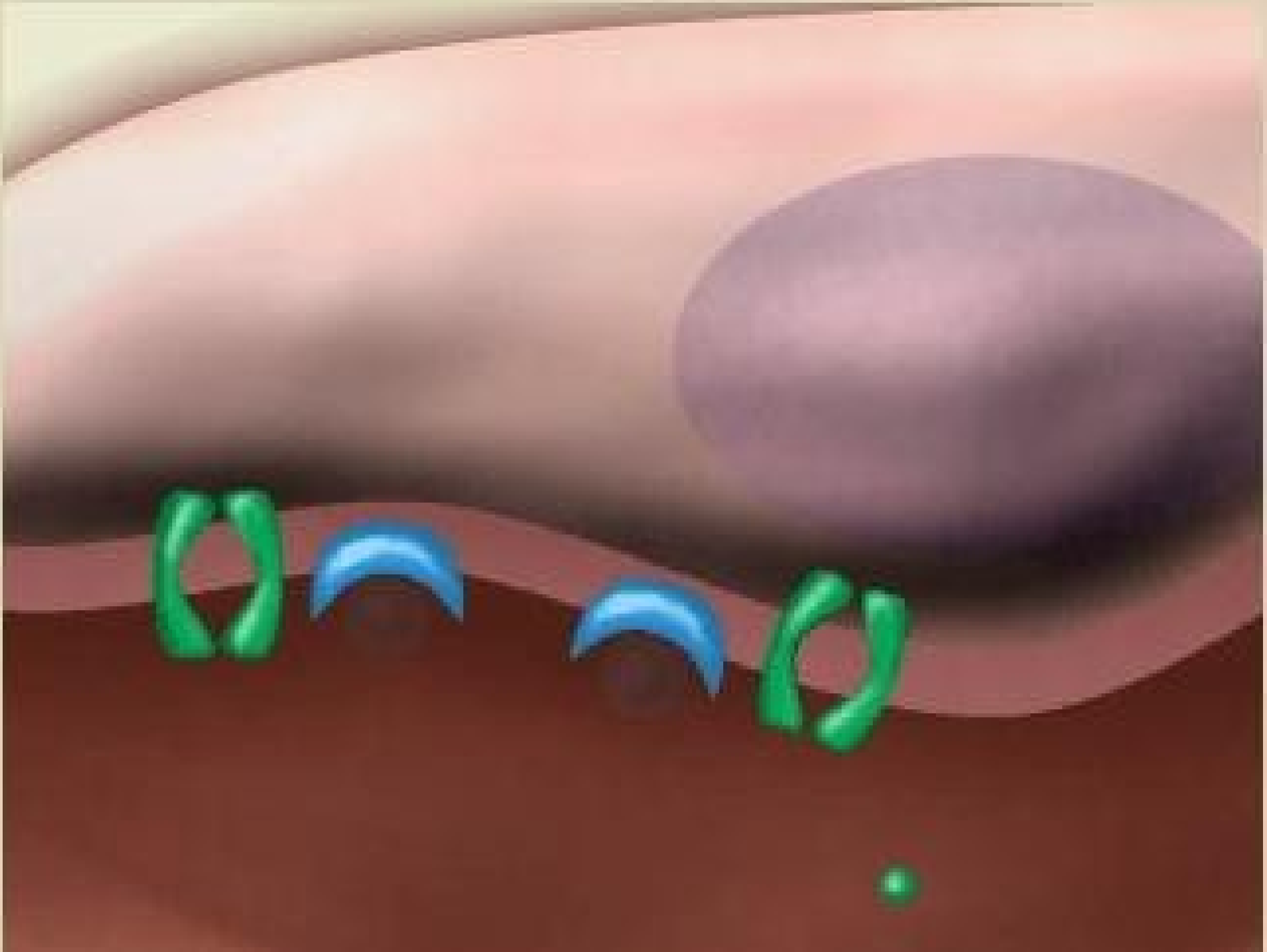

Type II diabetes


Type II diabetes


Type II diabetes


Type II diabetes


Type II diabetes



CAUSES OF DEATH IN PEOPLE WITH DIABETES

Cardiovascular disease
70%

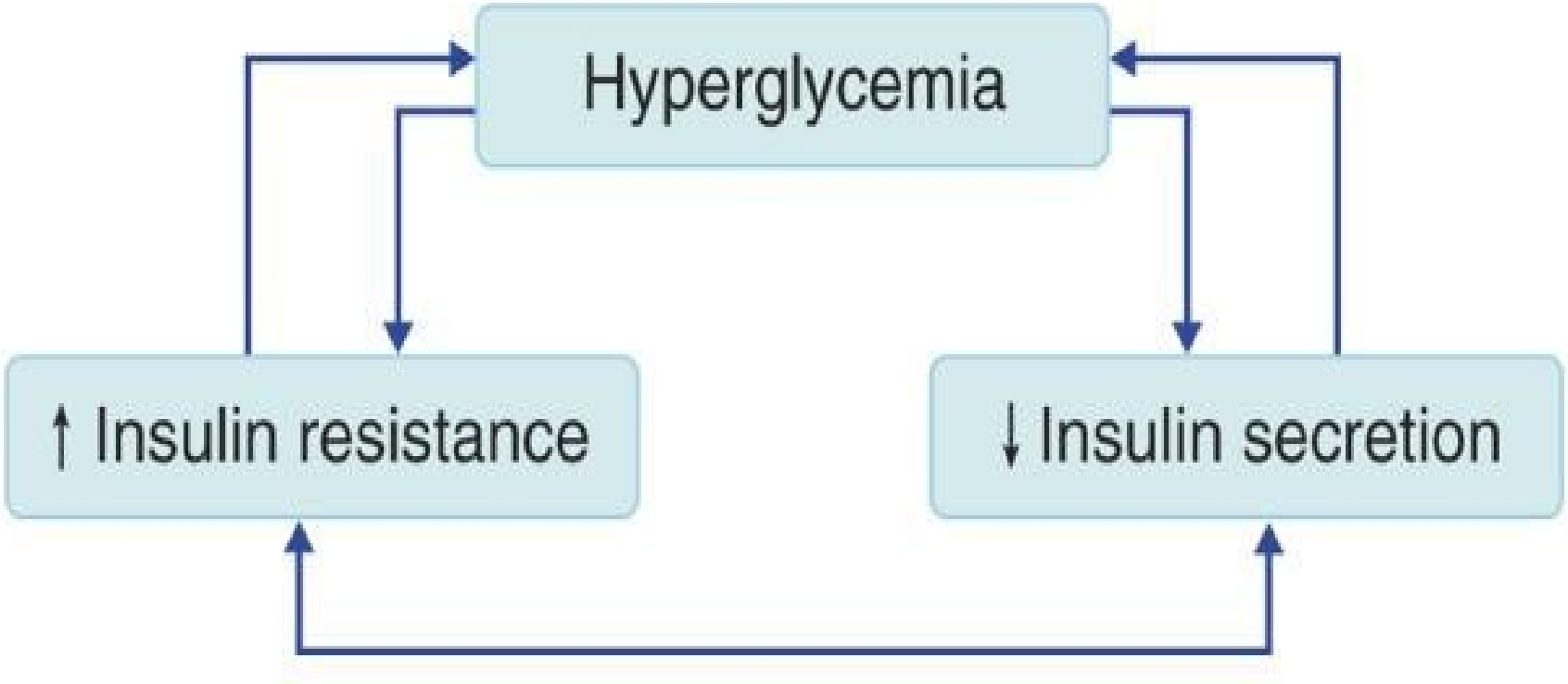
Renal failure
10%

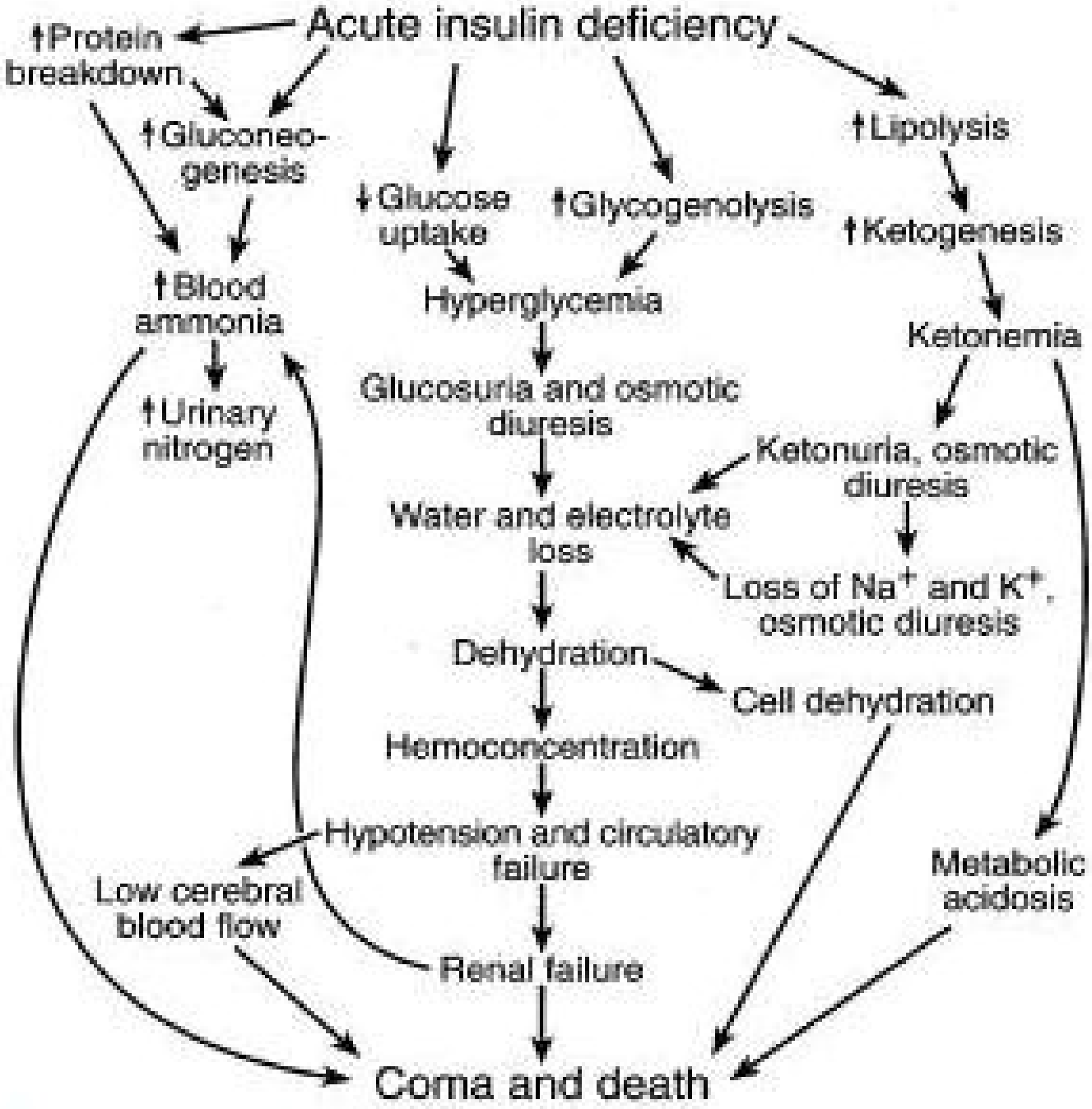
Cancer 10%

Infections
6%

Diabetic ketoacidosis

Diabetes Mellitus – vicious cycle




Acute insulin deficiency
↑Protein breakdown
↑Gluconeo-genesis
↓Glucose uptake
↑Glycogenolysis
↑Lipolysis
↑Ketogenesis
↑Blood ammonia
Hyperglycemia
Ketonemia
↑Urinary nitrogen
Glucosuria and osmotic diuresis
Ketonuria, osmotic diuresis
Water and electrolyte loss
Loss of Na^+ and K^+, osmotic diuresis
Dehydration
Cell dehydration
Hemoconcentration
Hypotension and circulatory failure
Low cerebral blood flow
Metabolic acidosis
Renal failure
Coma and death

COMPLICATIONS OF DIABETES

- Micro vascular
- Macro vascular

COMPLICATIONS OF DIABETES

Microvascular/neuropathic

- **Retinopathy, cataract**
  Impaired vision
- **Nephropathy**
  Renal failure
- **Peripheral neuropathy**
  Sensory loss
  Motor weakness

COMPLICATIONS OF DIABETES

Microvascular/neuropathic

- **Autonomic neuropathy**

  Postural hypotension

  Gastrointestinal problems
- **Foot disease**

  Ulceration

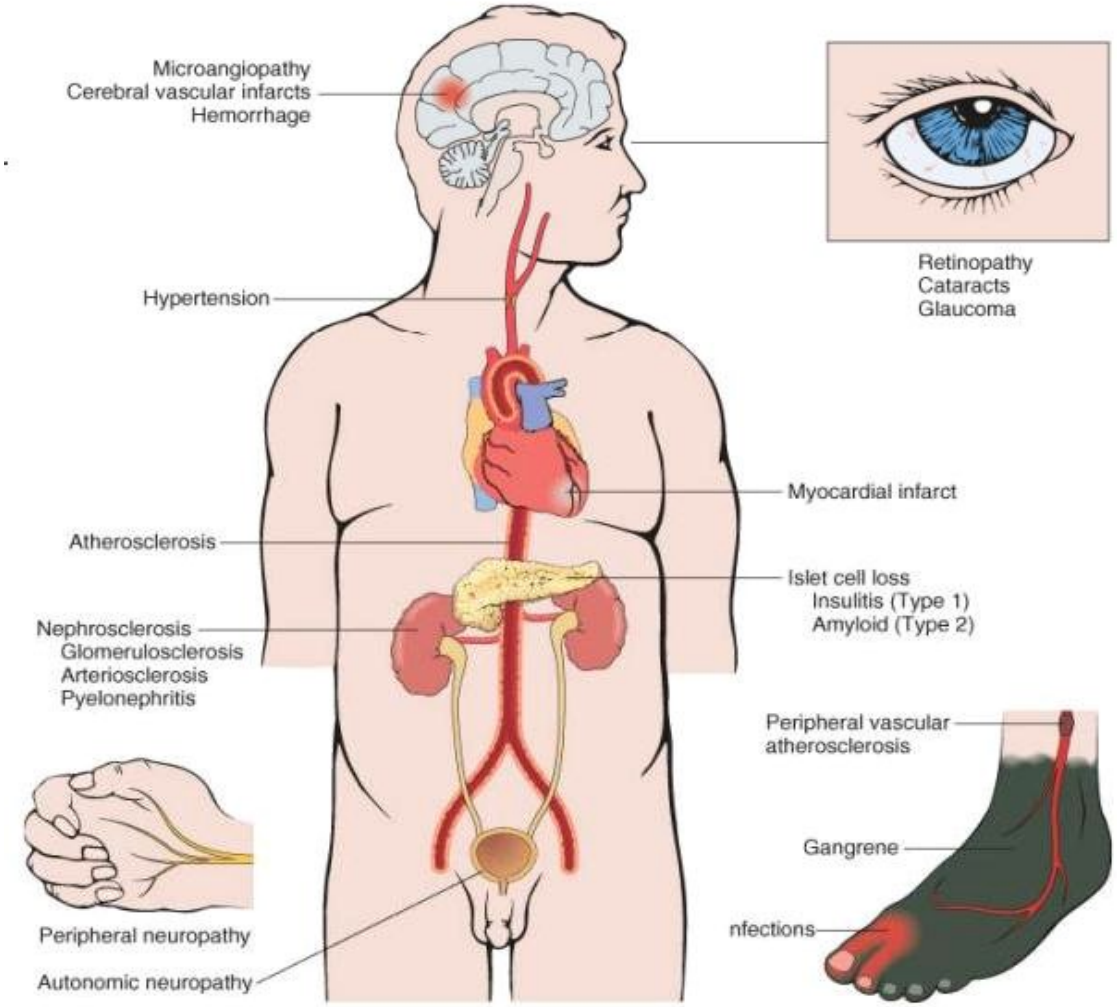
  Arthropathy

COMPLICATIONS OF DIABETES

Macrovascular

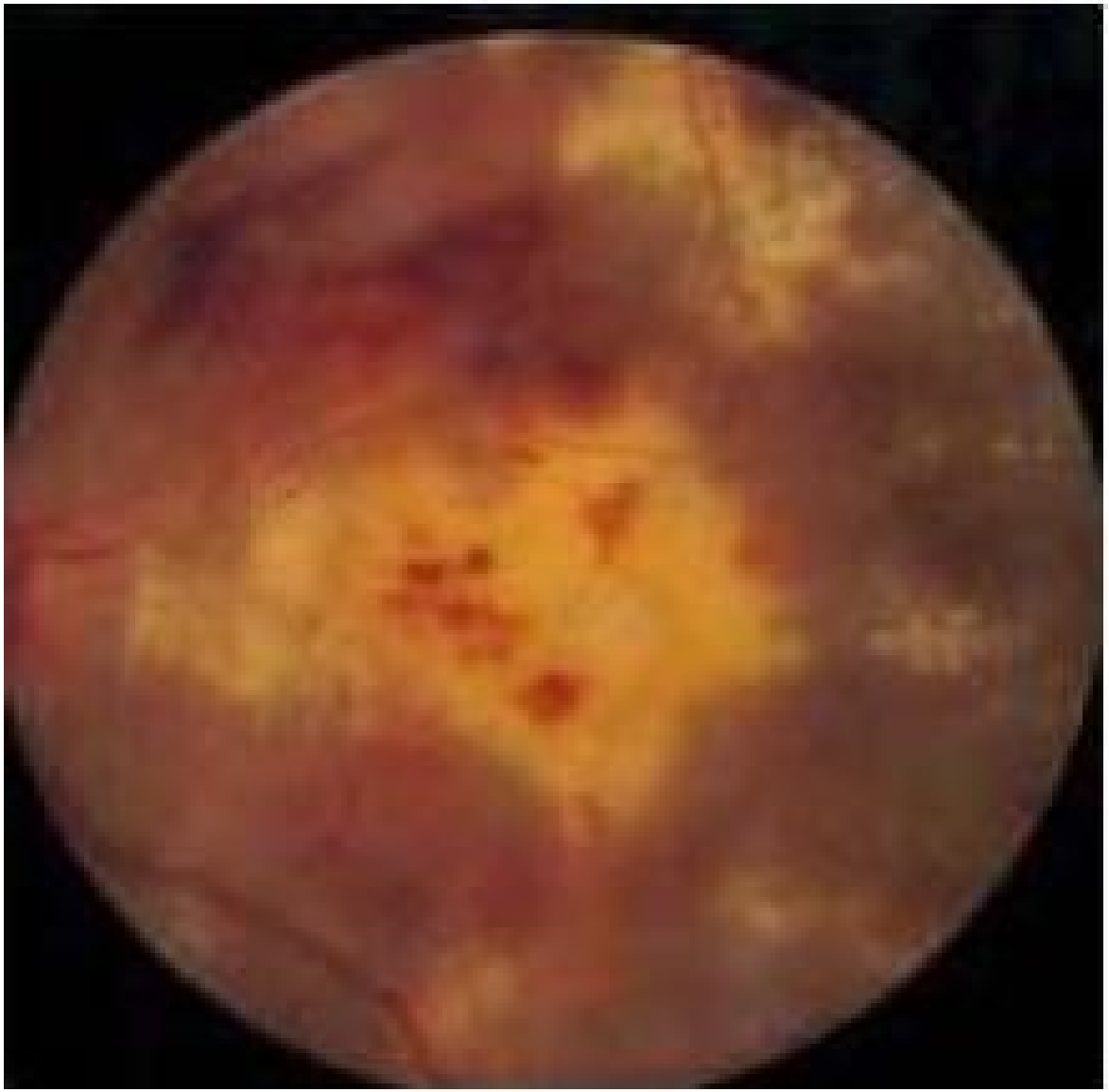
- **Coronary circulation**
  Myocardial ischemia/infarction
- **Cerebral circulation**
  Transient ischaemic attack
  Stroke
- **Peripheral circulation**
  Claudication
  Ischaemia

Diabetes – Complications



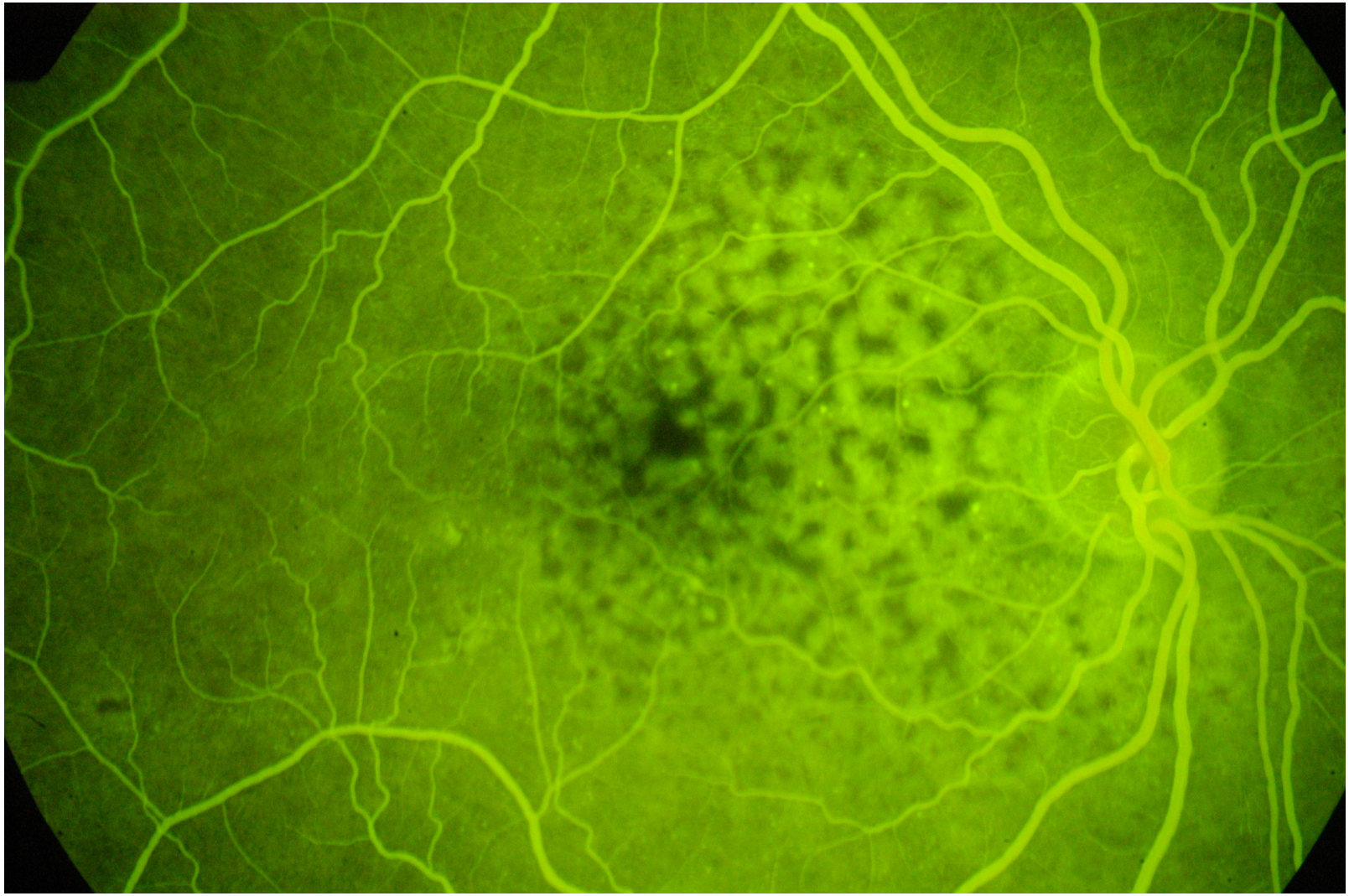
Diabetic Retinopathy

Diabetic Retinopathy



Diabetic Retinopathy

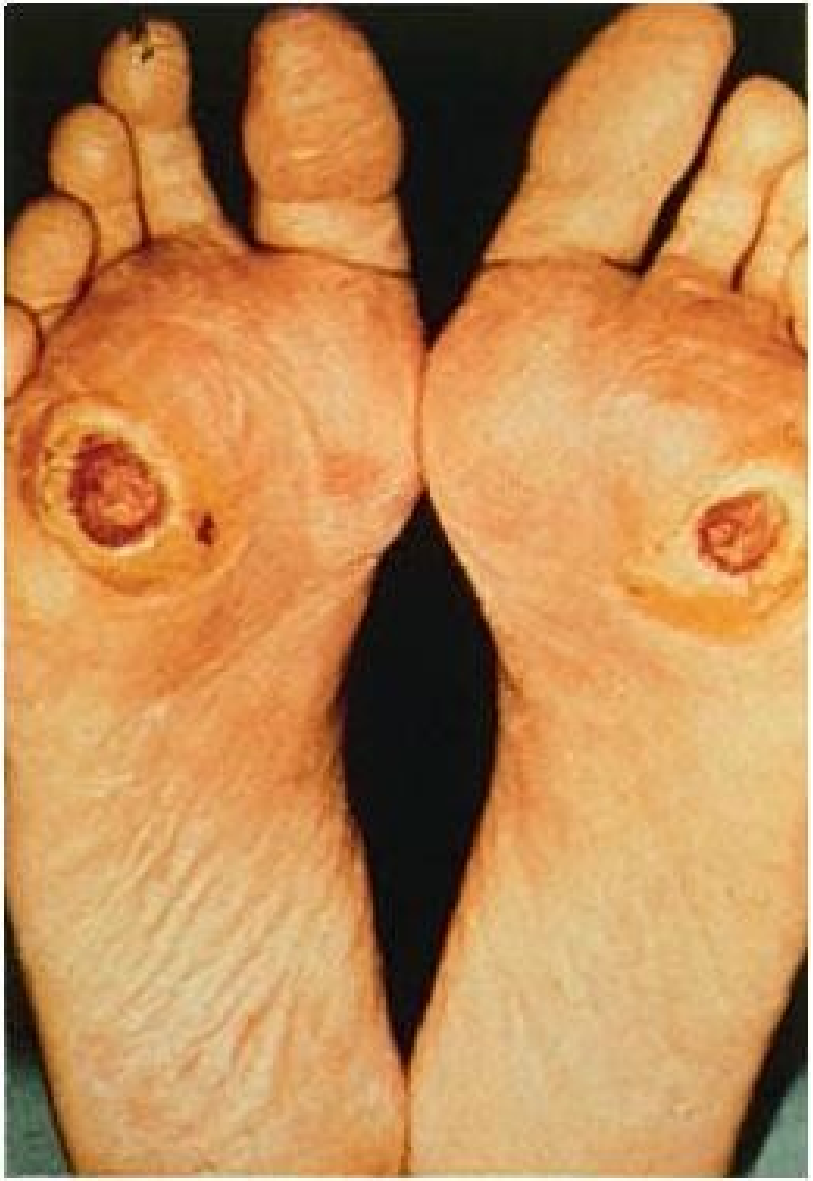
Diabetic Retinopathy



Diabetic Iridis

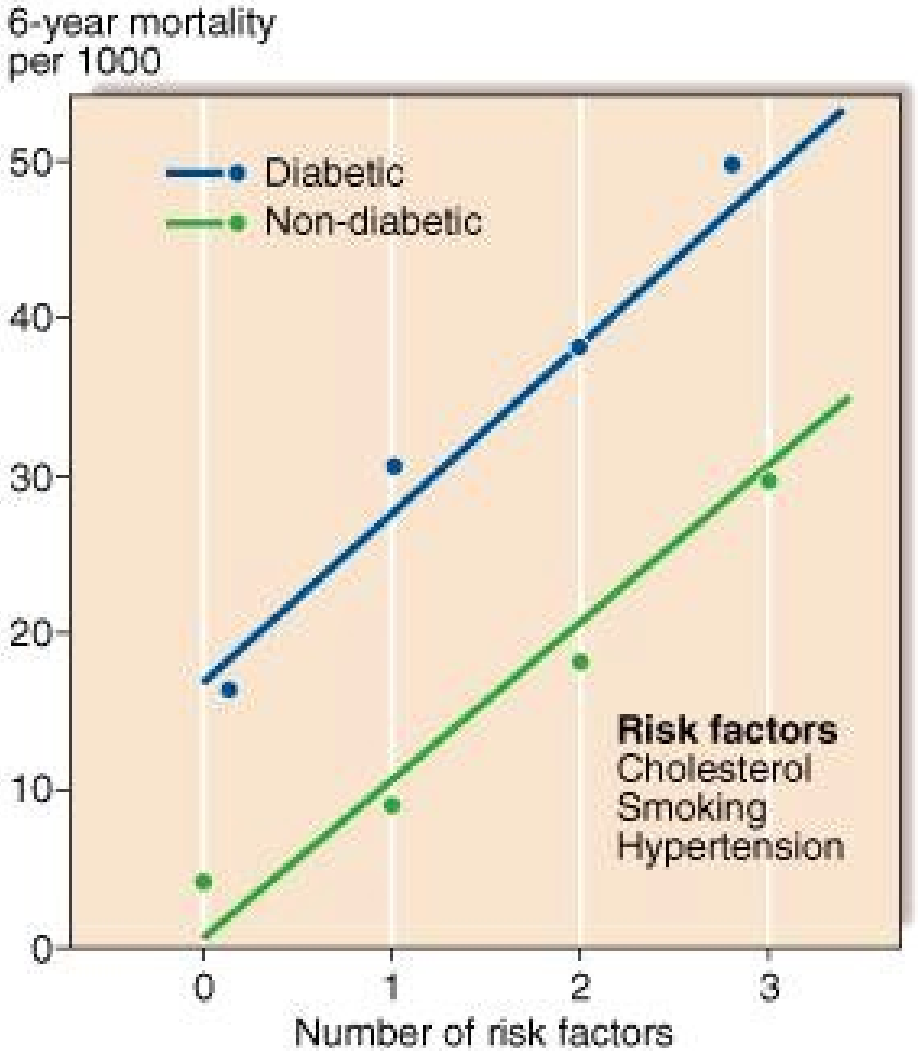
Diabetic Foot

Diabetic Foot ulcer

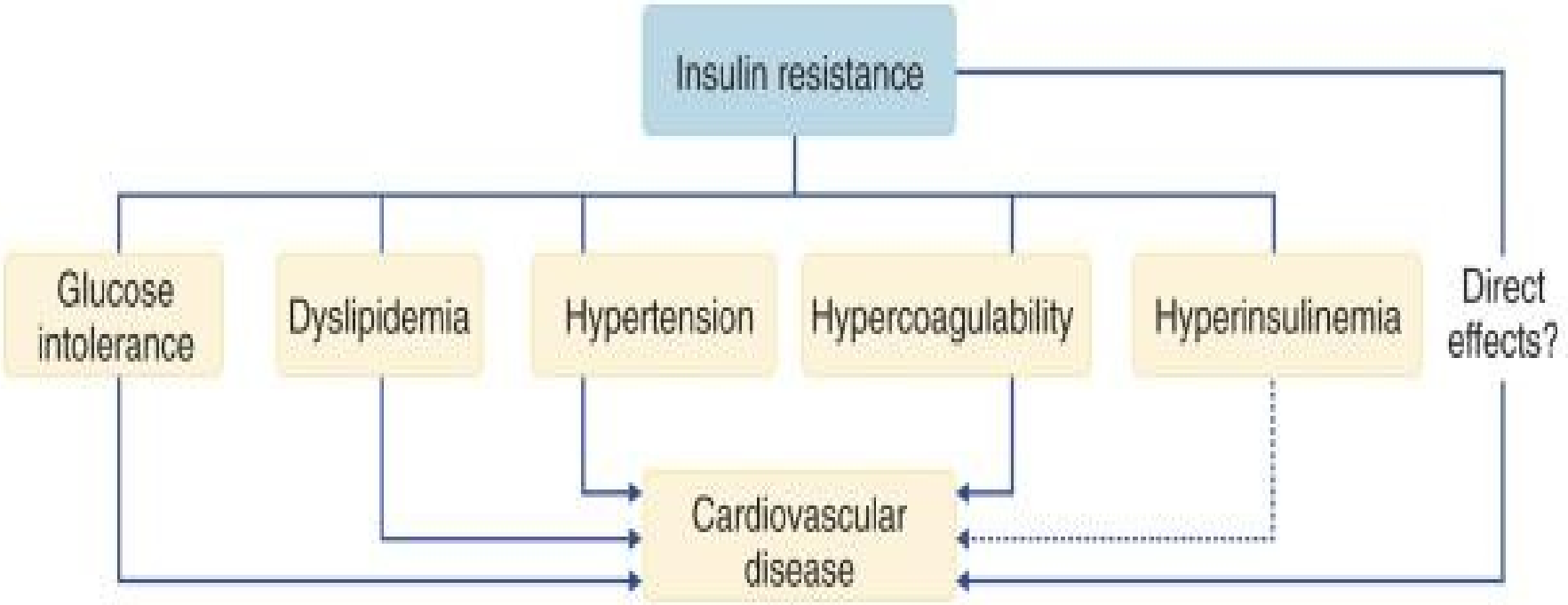


Diabetic Gangrene

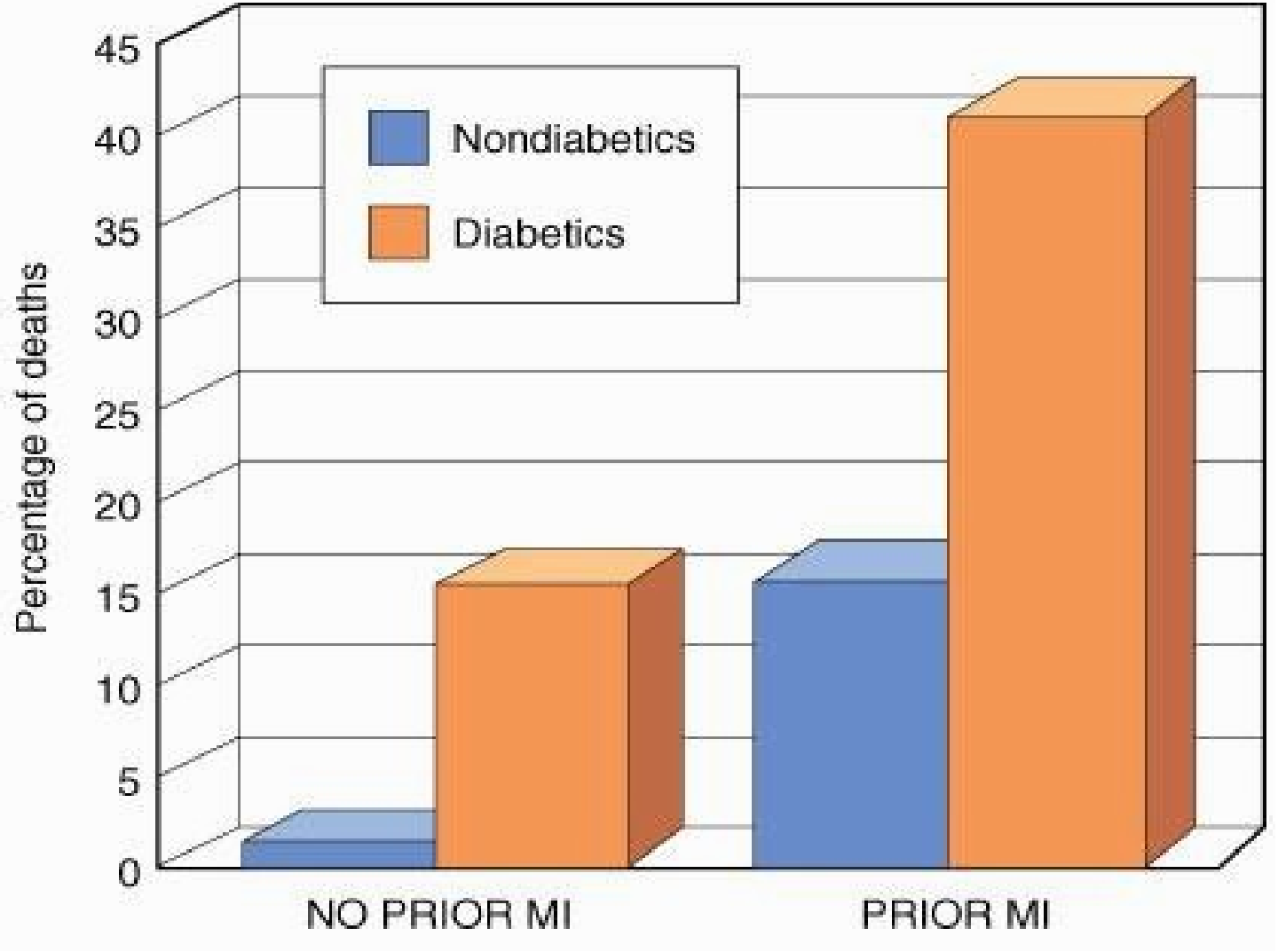
Diabetes & CAD



Diabetes & CV disease



Incidence of Cardiovascular deaths



PRIMARY PREVENTION OF DIABETES

- ✓ From a public health standpoint the only cost-effective way of dealing with diabetes is to **prevent it.**

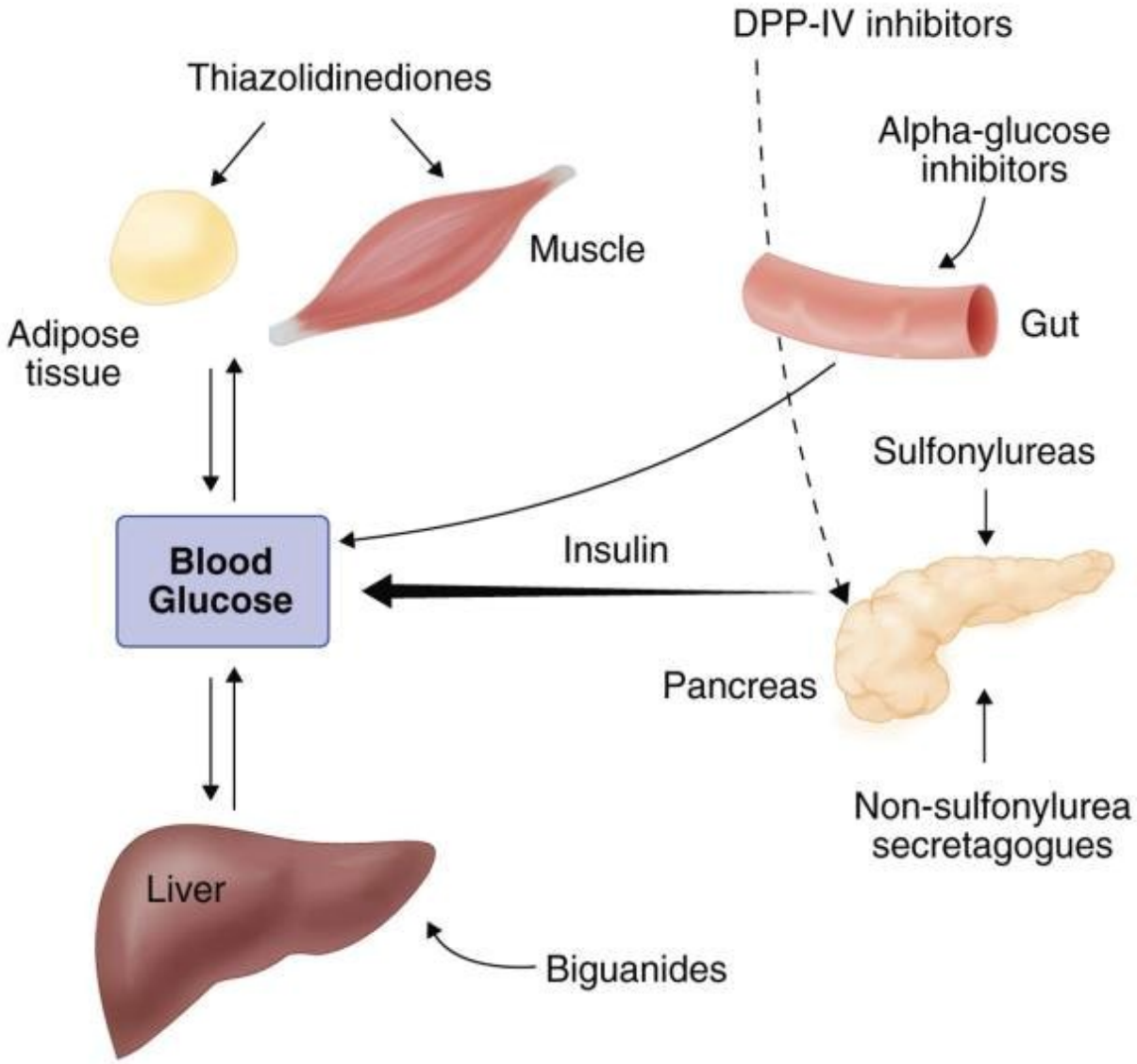
Type 2 diabetes is associated with an affluent lifestyle

Likely to arise in genetically predisposed individuals who eat too much and exercise too little

PREVENTION OF T2DM

- ✓ Effective health education.
- ✓ Screening for diabetes.
- ✓ Vigorous and early treatment.

Anti diabetic drugs



Injection Insulin

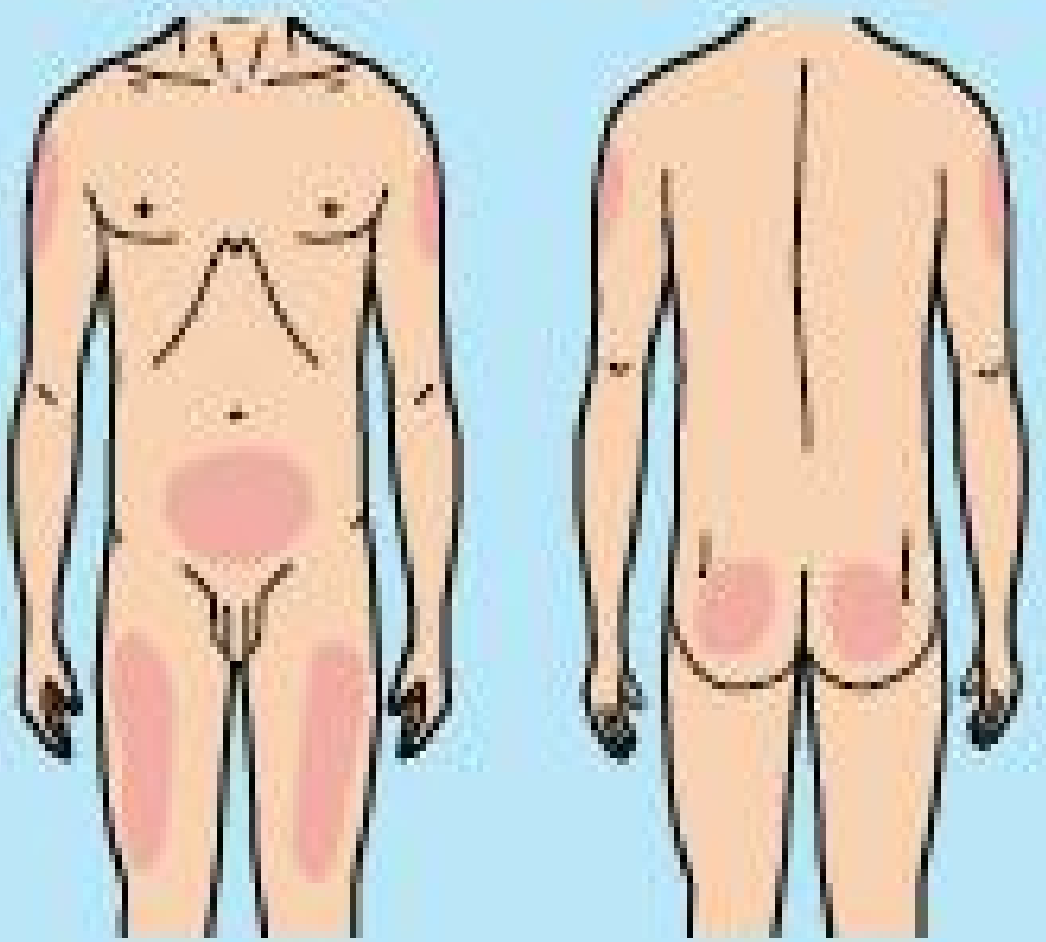
Loading insulin cartridge into pen

Checking dose and expelling the air

Depressing the plunger

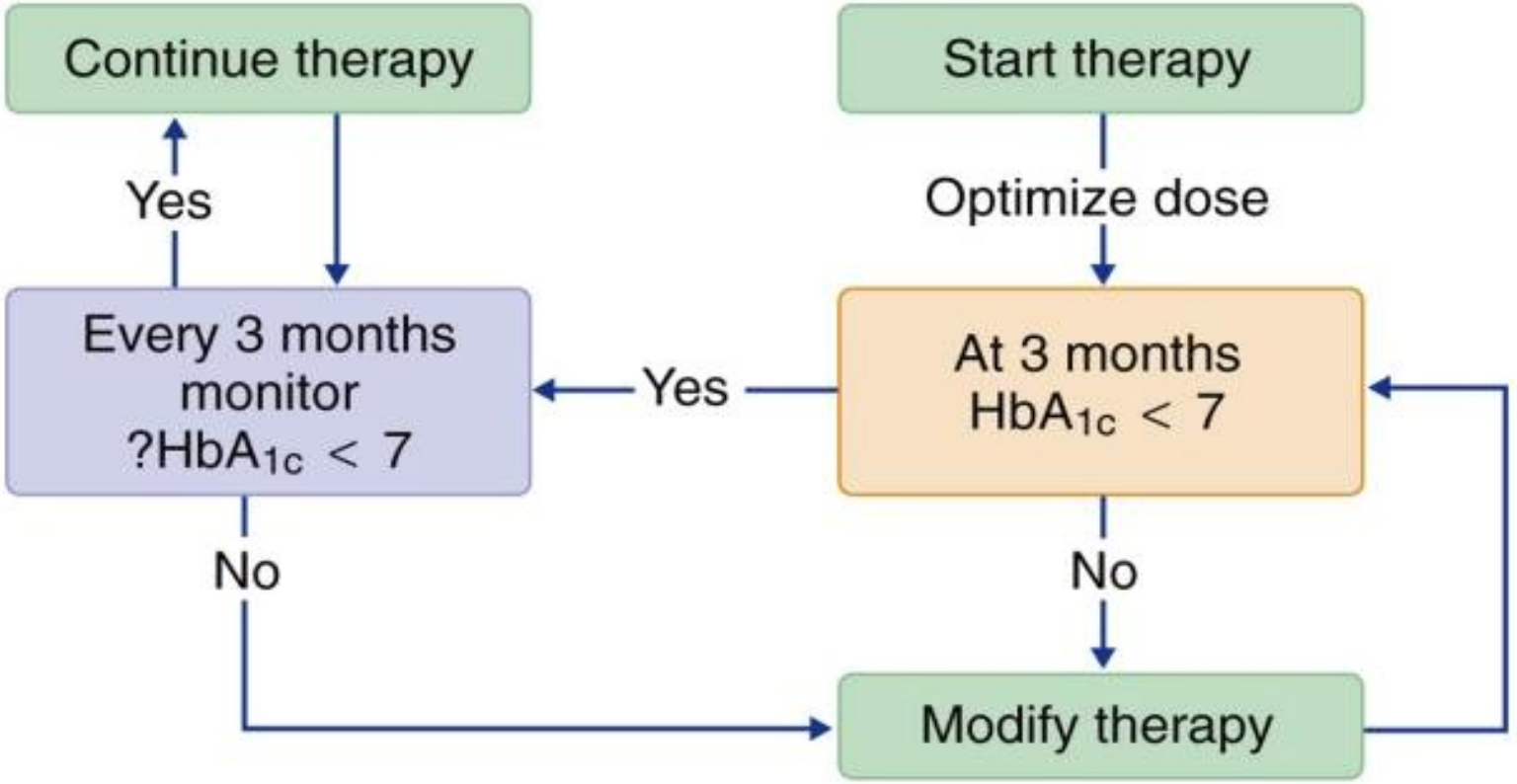
Inserting the needle

Injection Insulin – sites



Diabetes management kits

Treatment strategy



Dietary modification

DIET FOR PEOPLE WITH DIABETES

- ✓ **Carbohydrate** 45-60%
- ✓ **Fat** (total)< 35%
- ✓ **Protein**10-15%

DIET FOR PEOPLE WITH DIABETES

- ✓ **Carbohydrate** 45-60%

  Sucrose Up to 10%

DIET FOR PEOPLE WITH DIABETES

- ✓ **Fat** (total)< 35%
  - n-6 Polyunsaturated< 10%
  - n-3 Polyunsaturated Eat oily fish once or twice weekly
  - Monounsaturated10-20%
  - Saturated< 10%

DIET FOR PEOPLE WITH DIABETES

- ✓ **Protein** 10-15%

  (do not exceed 1 g/kg body weight)

Exercise

Improves,

- ✓ insulin sensitivity,
- ✓ reduces fasting and postprandial blood glucose, and
- ✓ offers numerous metabolic, cardiovascular, and psychological benefits in diabetic patients.

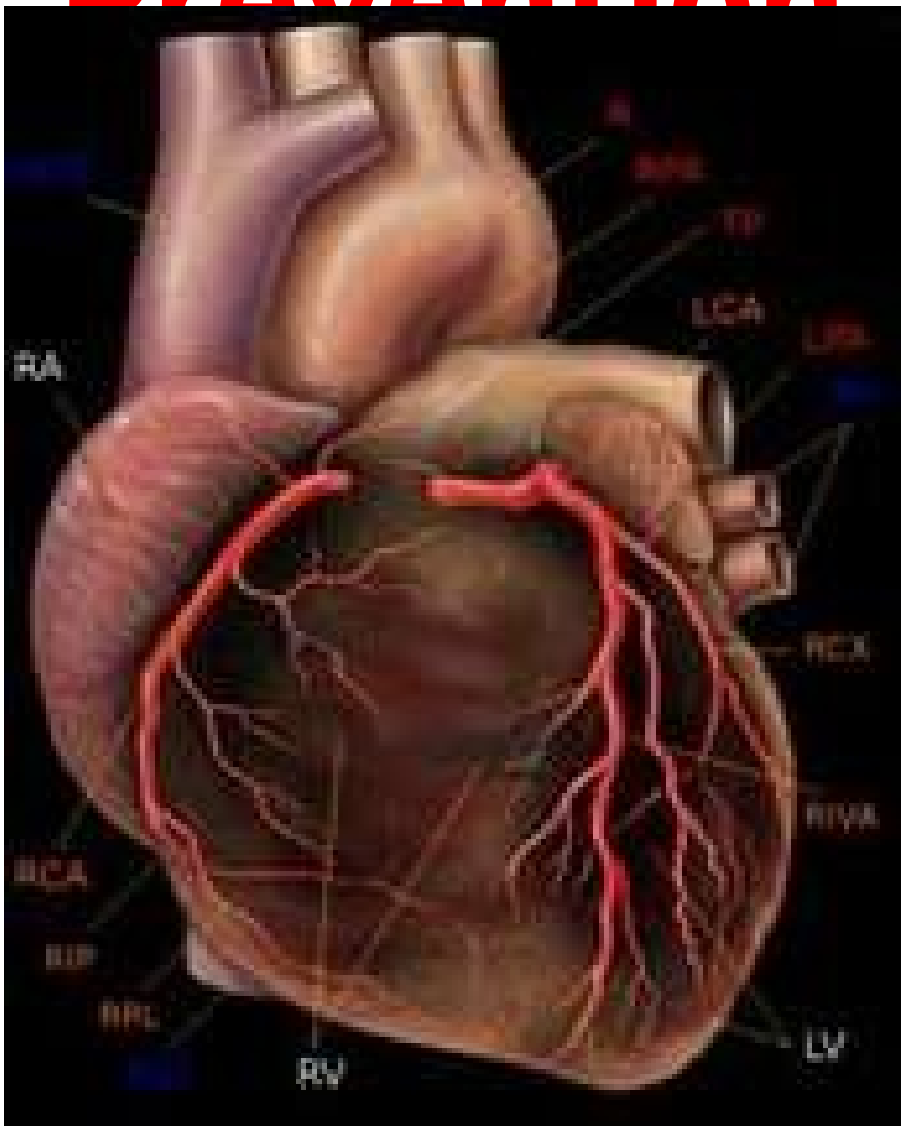
Assessment of glycemic control

- ✓ Self-monitoring of capillary blood glucose (SMBG)
- ✓ HbA1c
- ✓ Ketonuria

Heart Attack

Biology & Prevention

Heart Attack – Biology & Prevention



CAD Epidemic in India : A cause of concern & a **cry** for action

CAD Epidemic in India

Cardiovascular Diseases are becoming major health burden in developing countries

- In 2000 : 16.7 Million died worldwide on Cardiovascular Diseases(30.3% of all death).
- >50% of these death are in Developing Countries.

CAD Epidemic In India

Prevalence

- **In 1960: 4%(Every 25th Individual)**
- **In 2001: 11%(Every 9th Individual)**

Factors causing rise of CAD in India

- Genetic Determination.
- Life style Changes.
- Rapid Urbanization.
- Insulin Resistance.
- Central Obesity.
- Cultural Changes.

CAD India – A cause of Concern

- A Quarter of World's Population.
- Increased Susceptibility.
- Unrecognized Target.
- Restricted access to high cost tertiary cardiovascular care.
- Does not feature prominently in the Health Care Agenda of the Country.

CAD

A group of closely related syndromes caused by imbalance between Cardiac Oxygen Demand & the blood supply

CAD – *Etiology*-CAUSATION

- **Coronary artery obstruction**

  OR

- **Narrowing of the Lumina of Coronary arteries**

CAD - *Member Diseases*

- **Angina Pectoris**
- **Acute Myocardial Infarction**
- **Sudden Cardiac Death**
- **Heart Failure**

CAD - Underlying Factors

- In 90% Cases
  Atherosclerosis
- In 10% Cases
  - Vasospasm
  - Stenosis of the coronary ostia.
  - Arteritis
  - Embolisms
  - Thrombotic disorders.
  - Trauma
  - Aneurysms
  - Compression

Atherosclerosis - the commonest & most dangerous cause of CAD

- Athero - Porridge / Gruel, accumulation of lipid materials.
- Sclerosis - Hardening.

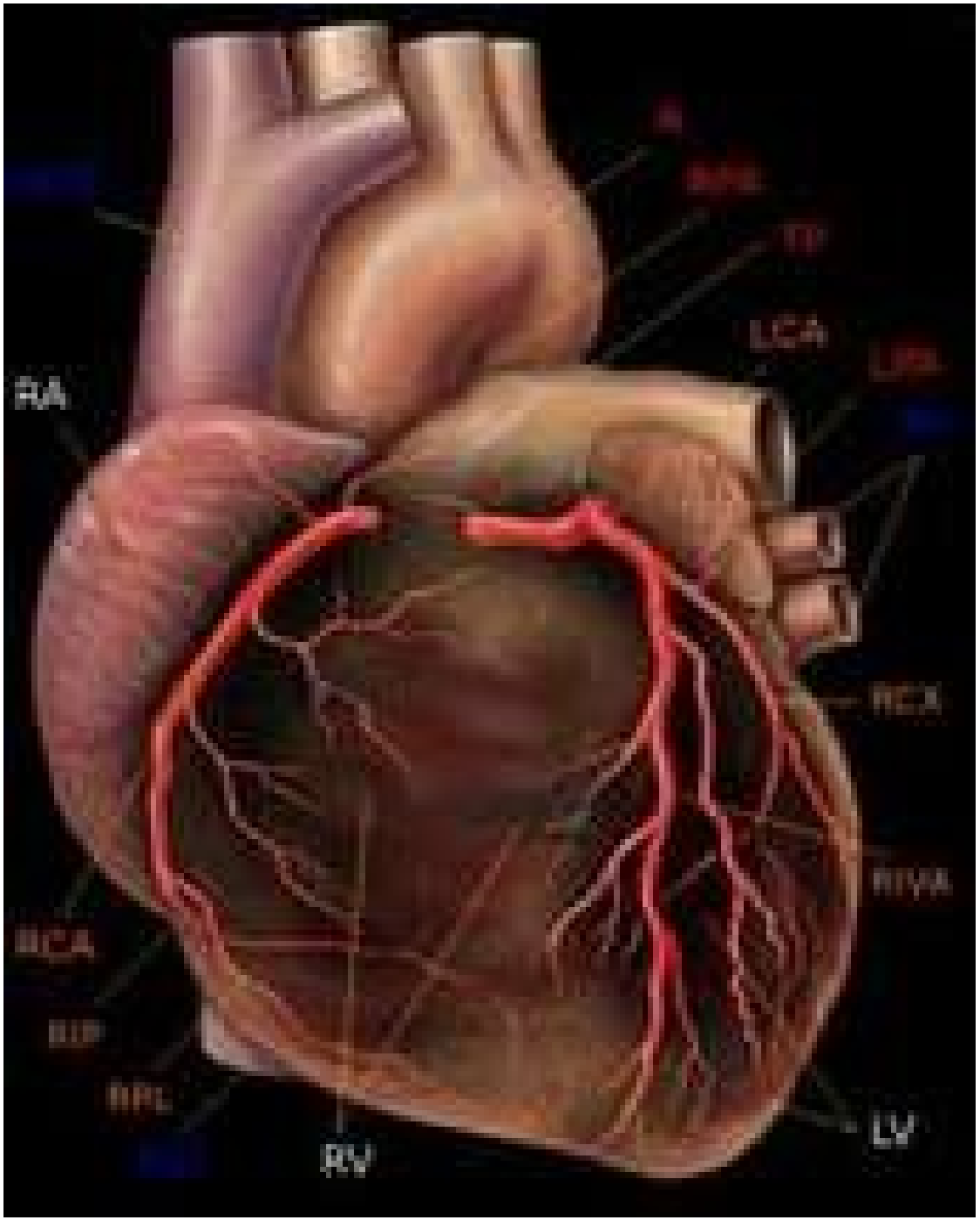
Anatomic Consideration

Coronary Artery

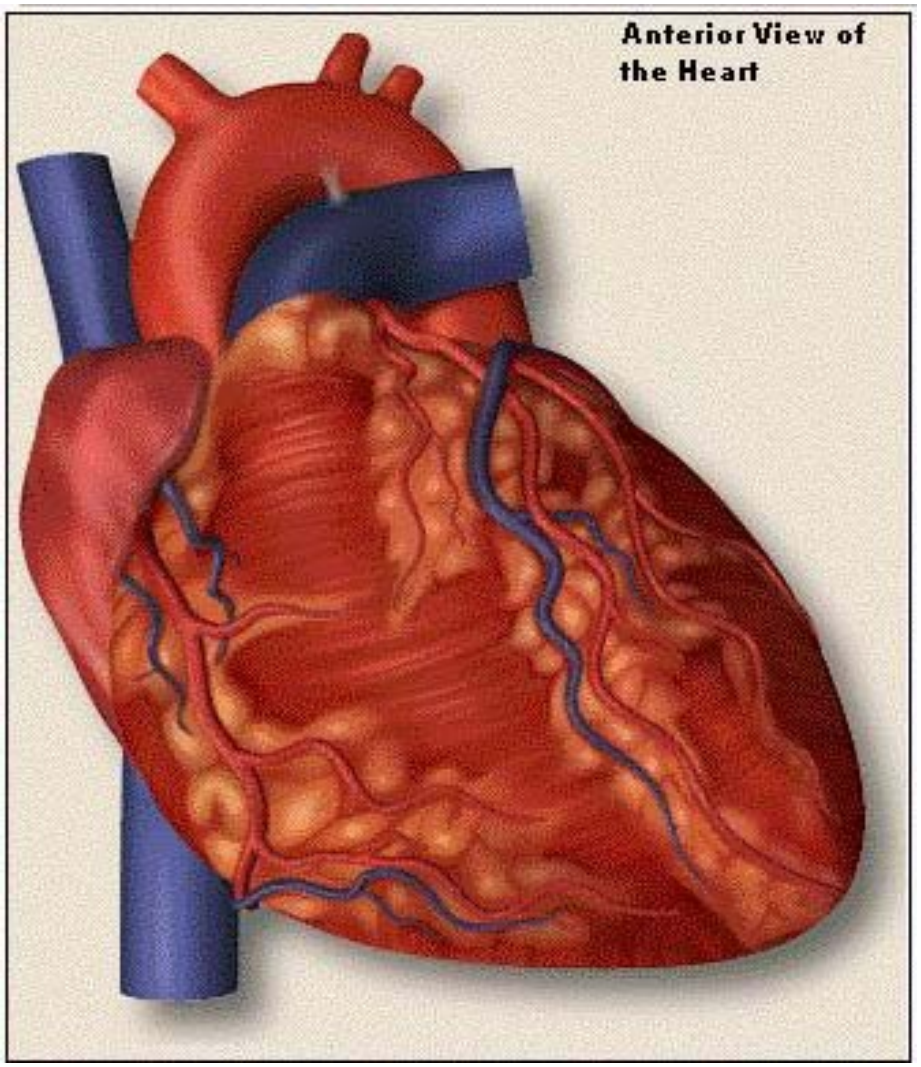
- Arise from Aortic Sinus of Aorta
- Chief supplier of Myocardium

Number

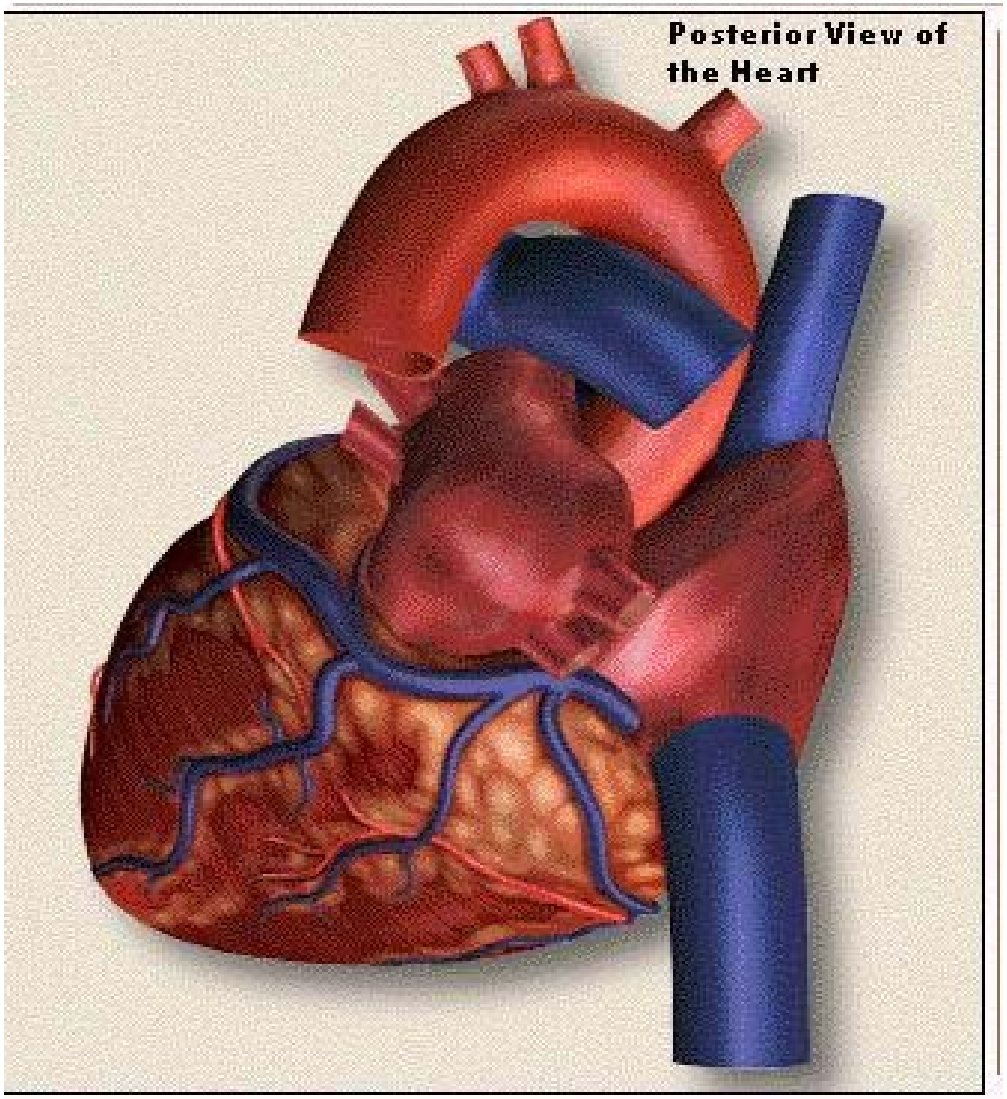
- Two - Right & Left.


RA
LCA
RCA
RIVA
BCA
RV
LV

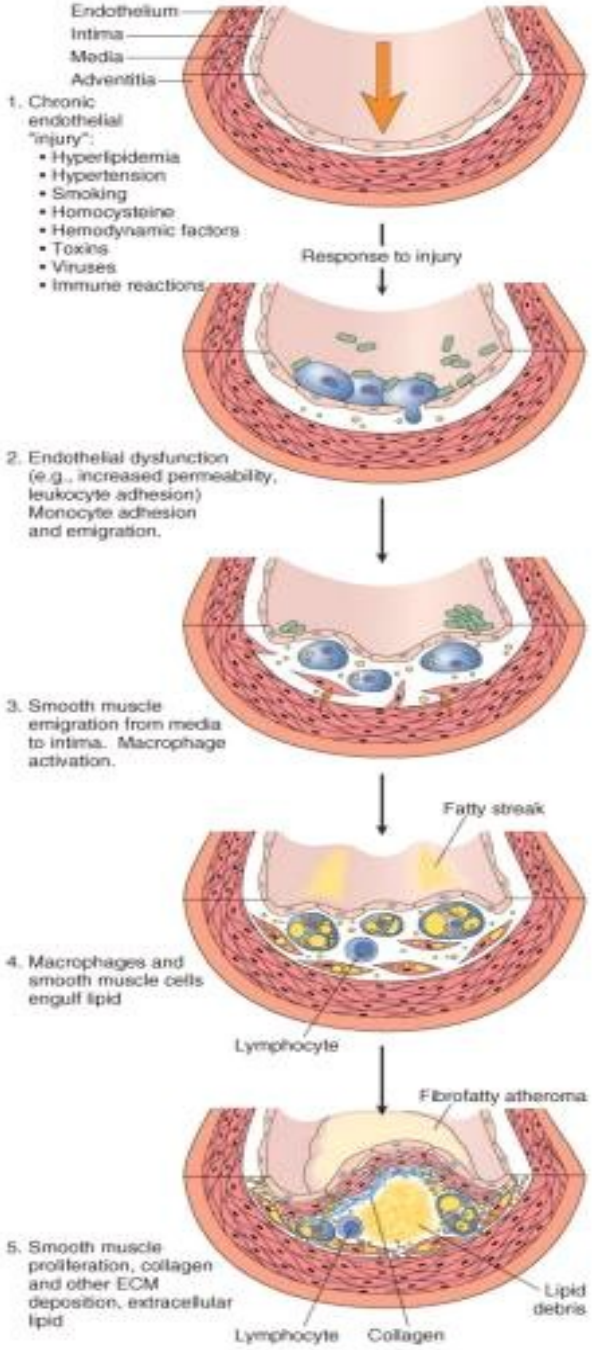
Coronary Circulation



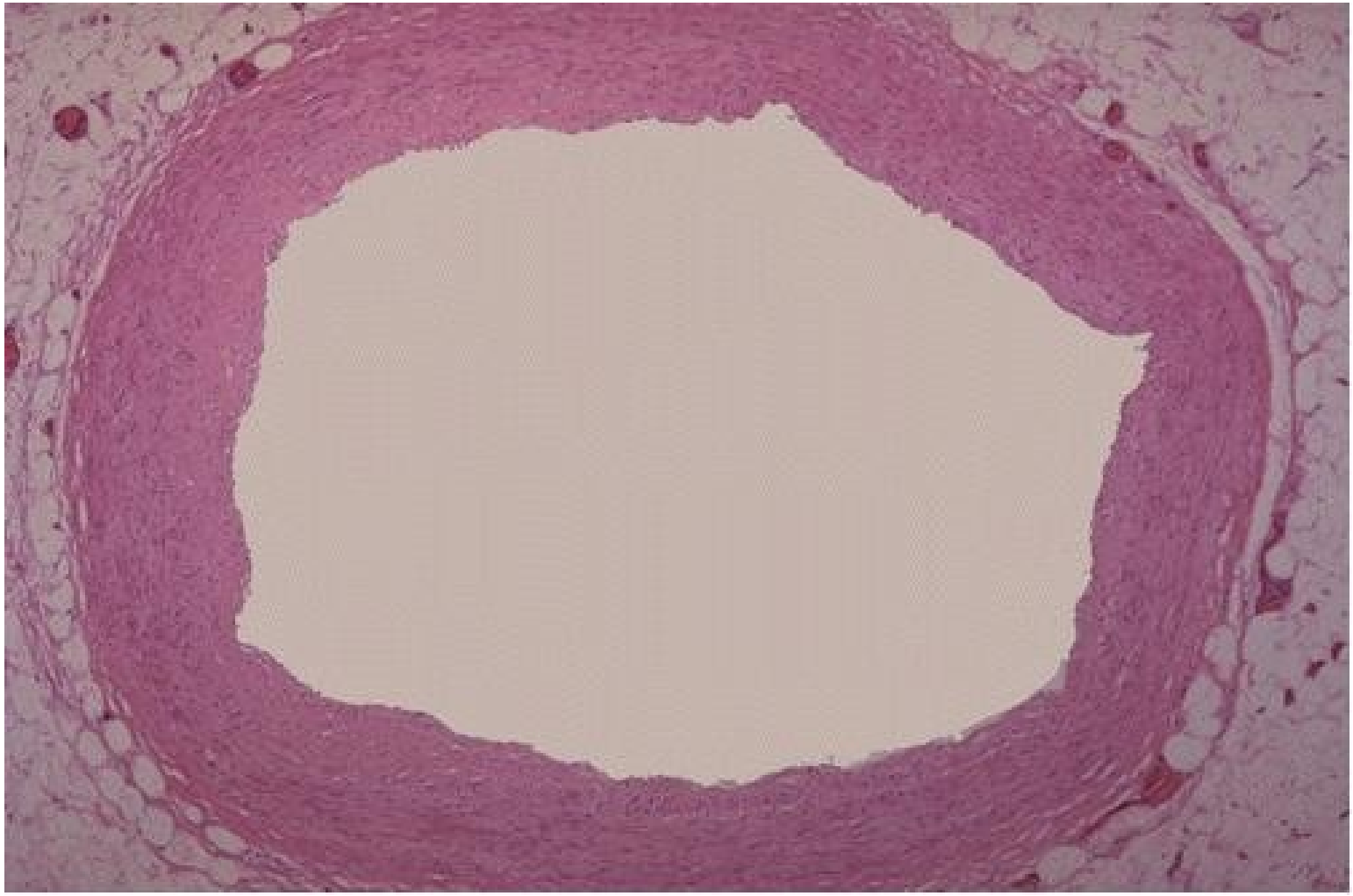
Coronary Circulation



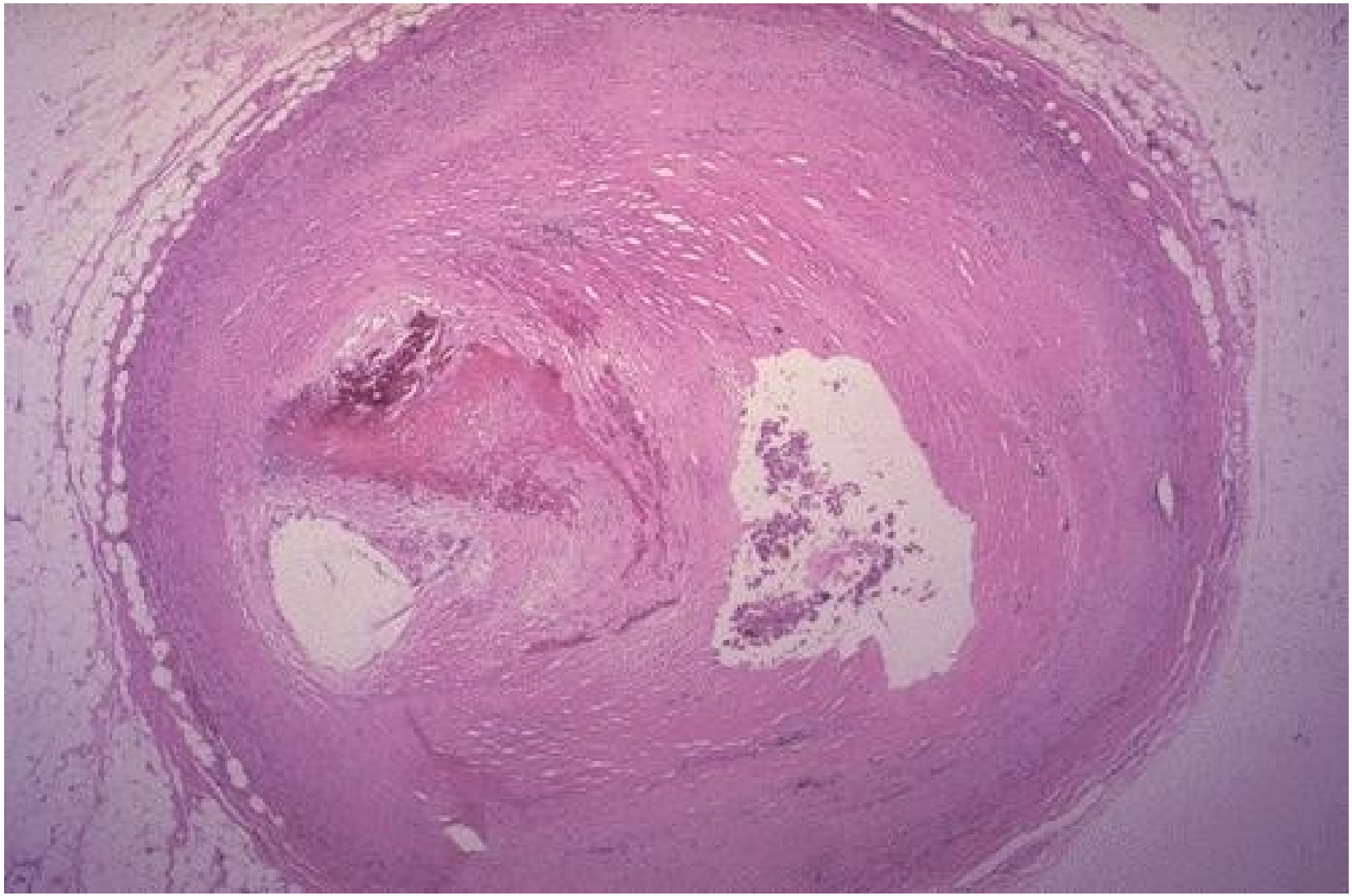
Genesis of Atherosclerosis


Endothelium
Intima
Media
Adventitia
1. Chronic endothelial "injury":
• Hyperlipidemia
• Hypertension
• Smoking
• Homocysteine
• Hemodynamic factors
• Toxins
• Viruses
• Immune reactions
Response to injury
2. Endothelial dysfunction (e.g., increased permeability, leukocyte adhesion) Monocyte adhesion and emigration.
3. Smooth muscle emigration from media to intima. Macrophage activation.
Fatty streak
4. Macrophages and smooth muscle cells engulf lipid
Lymphocyte
Fibrofatty atheroma
5. Smooth muscle proliferation, collagen and other ECM deposition, extracellular lipid
Lipid debris
Lymphocyte
Collagen

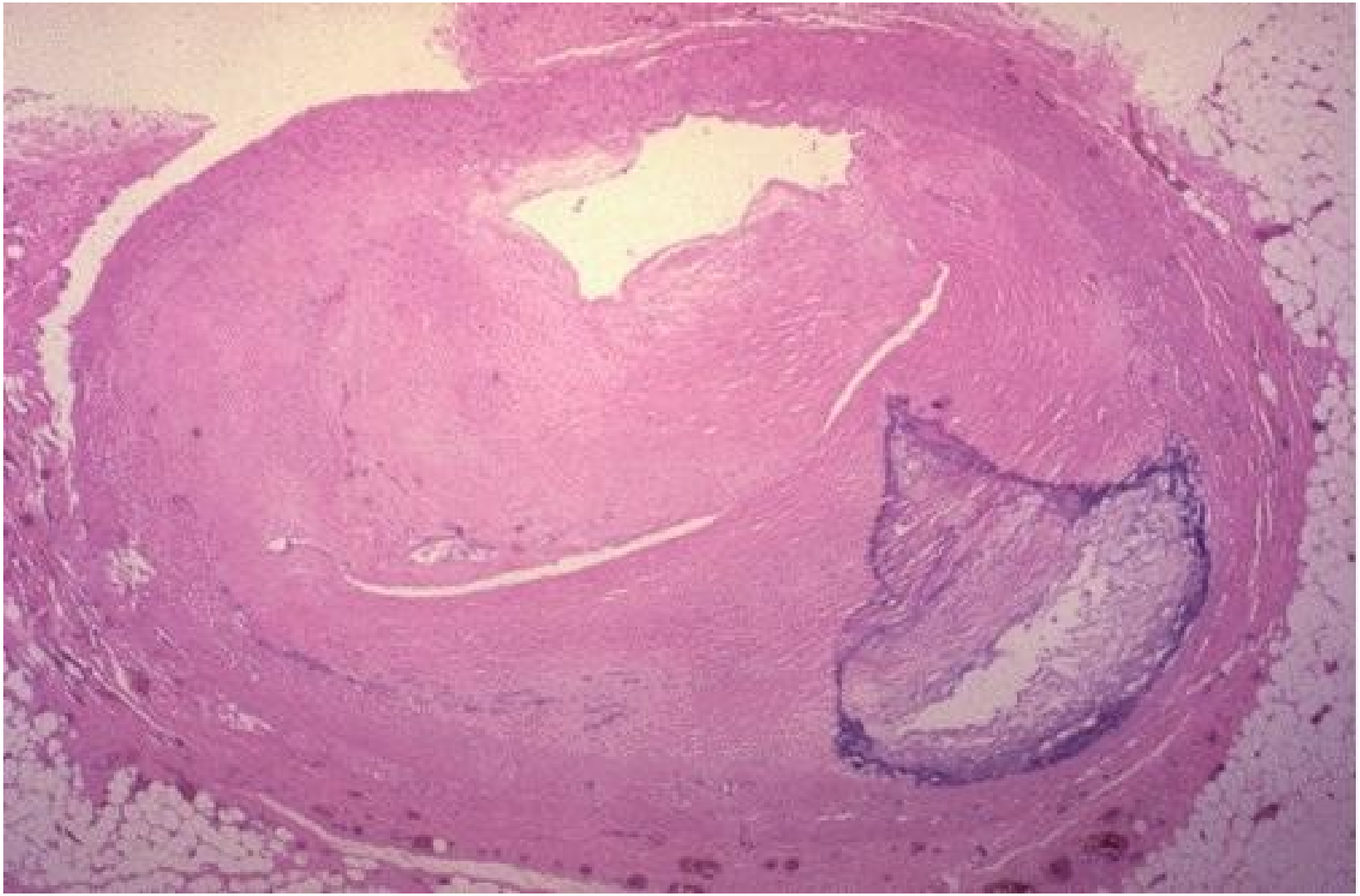
Normal Coronary Artery



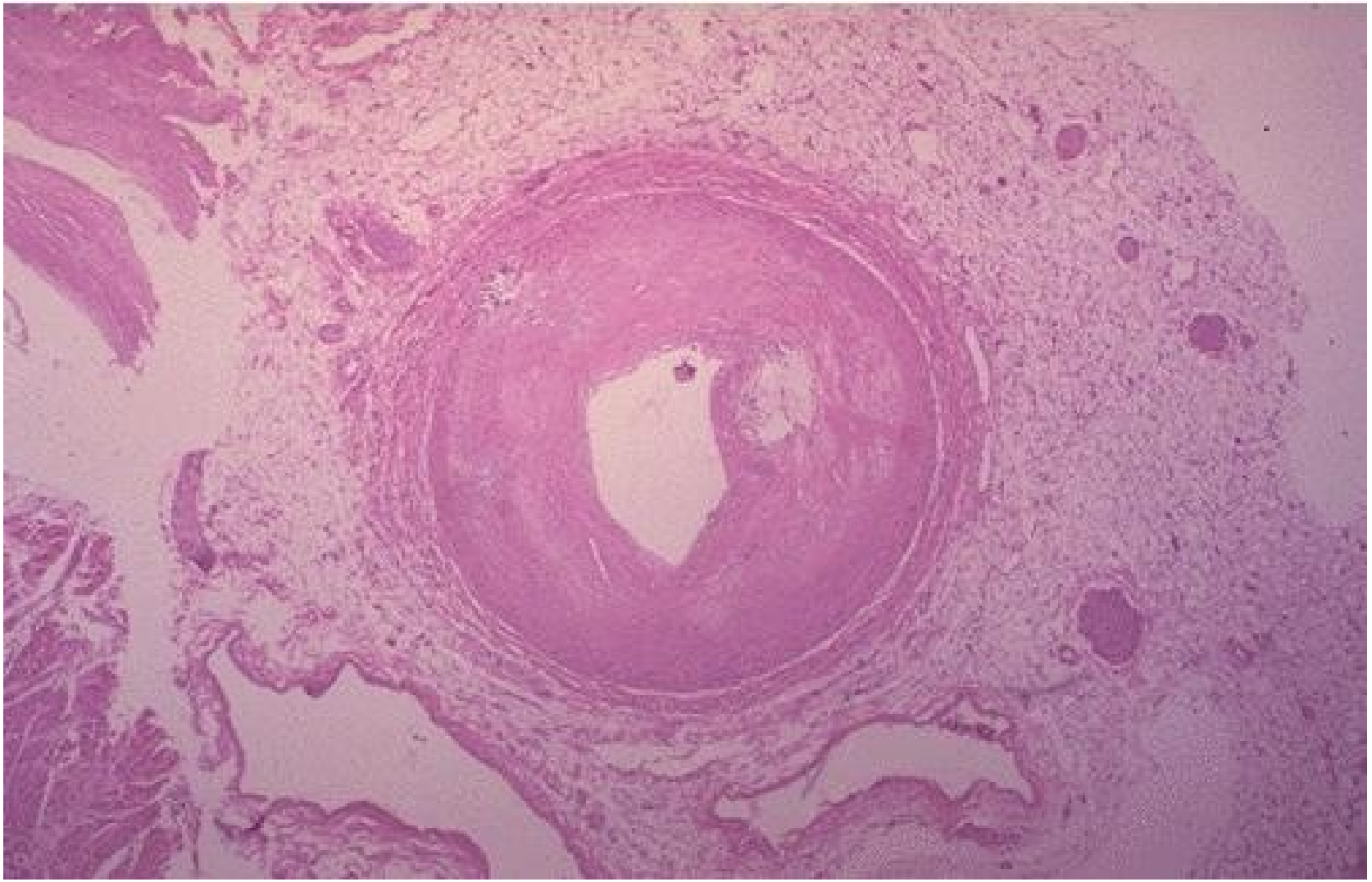
Coronary Artery – Luminal narrowing



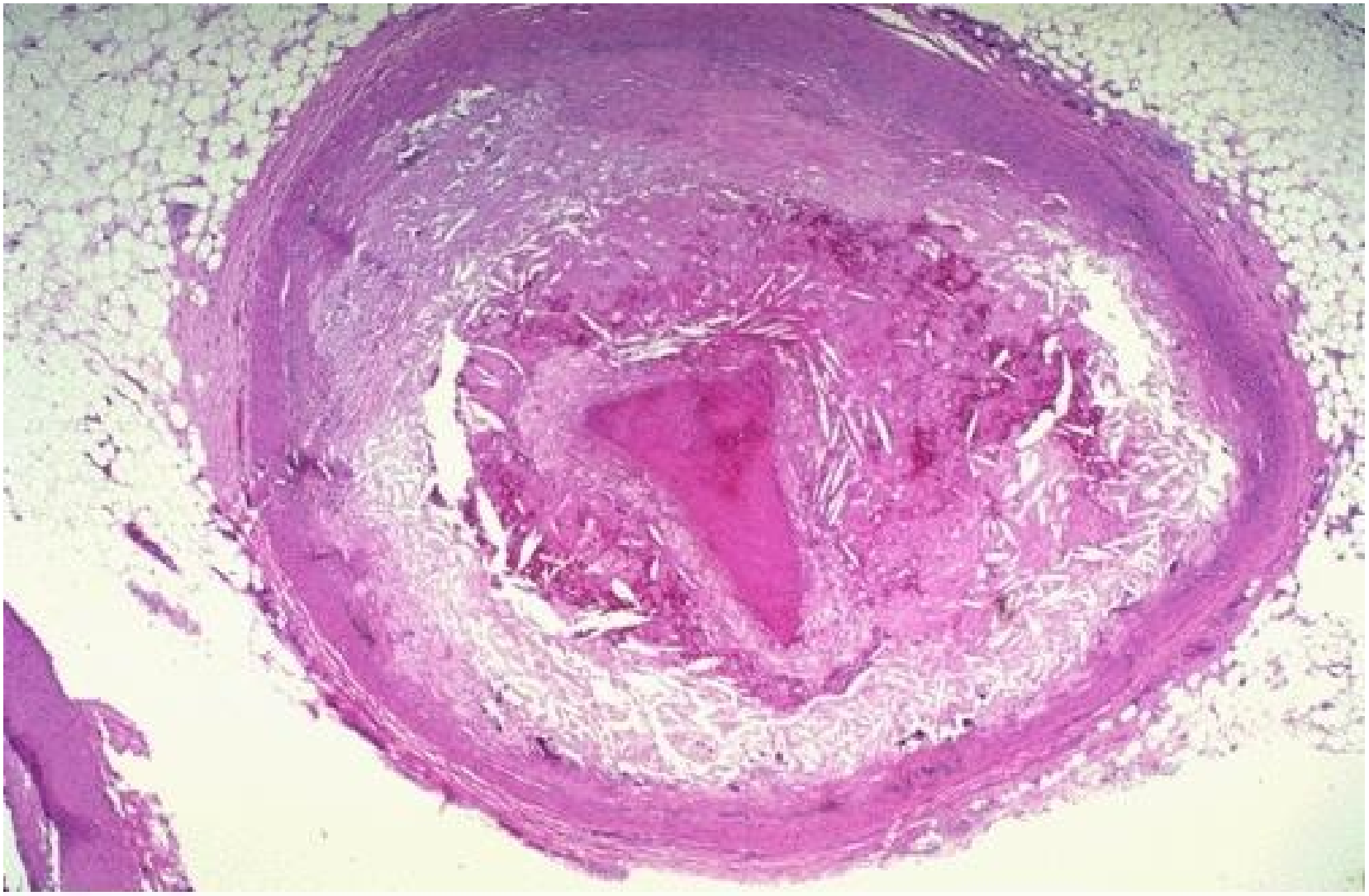
Coronary Artery – Luminal narrowing



Coronary Artery – Luminal narrowing



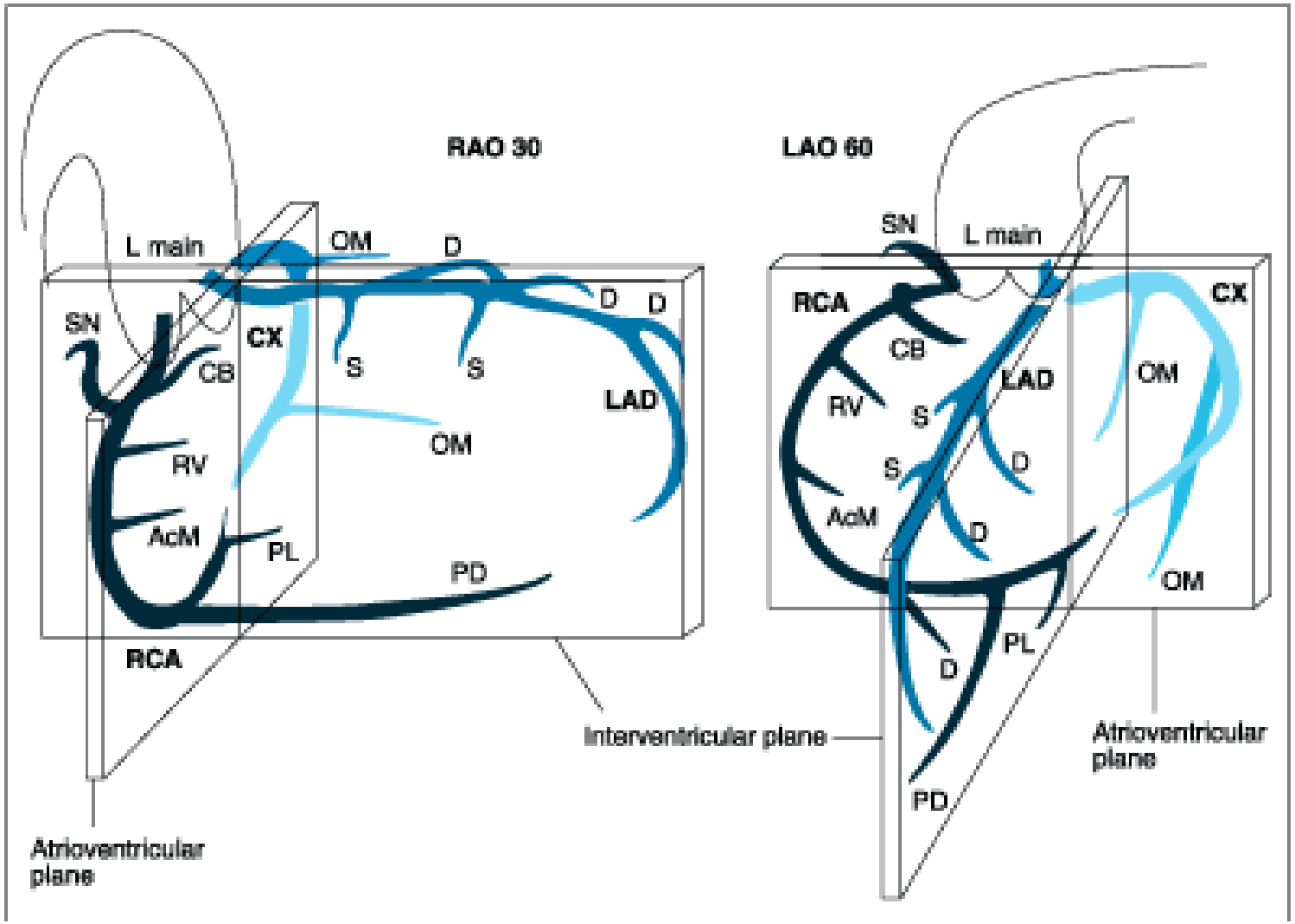
Coronary Artery – Recent thrombosis

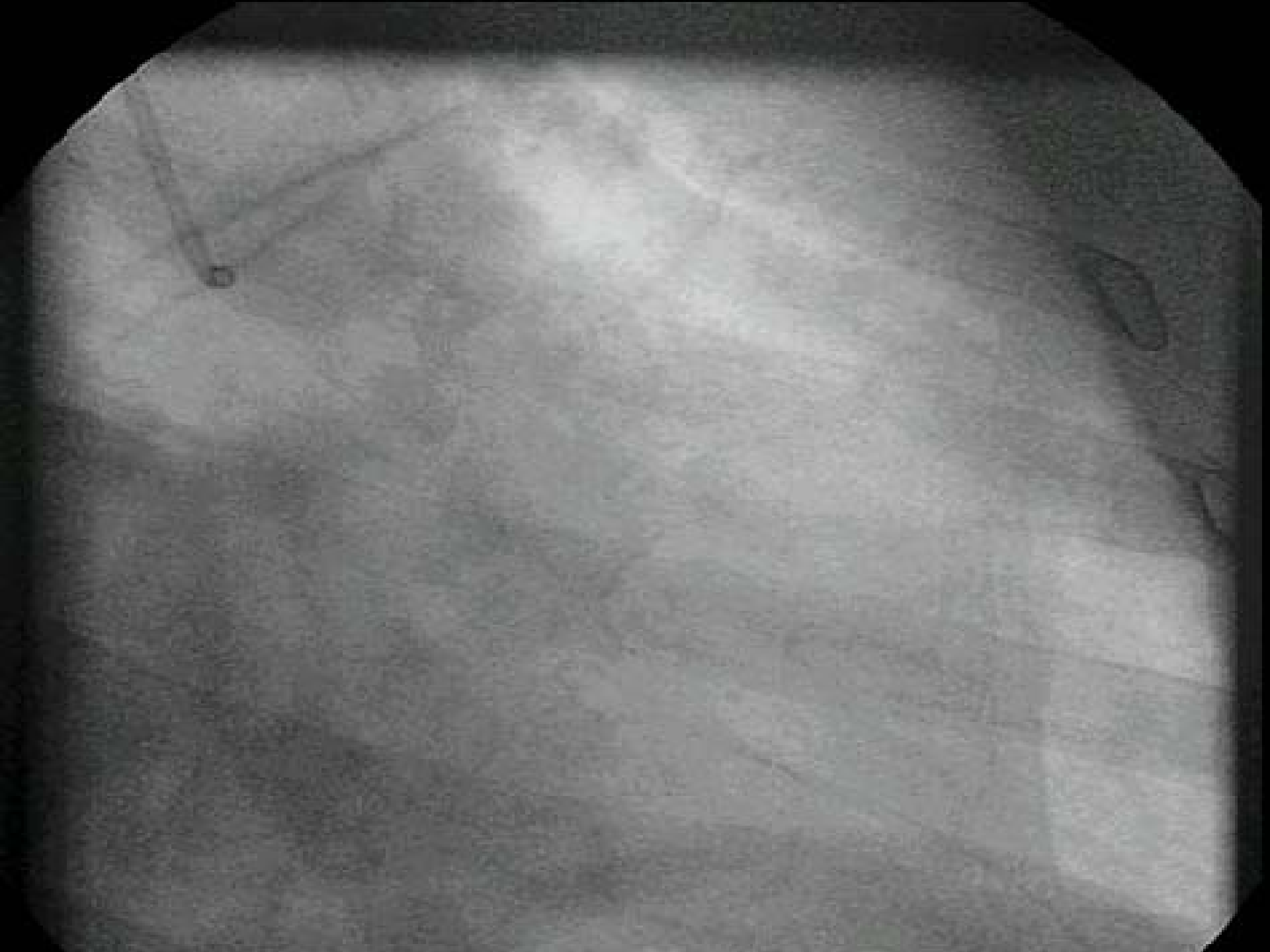


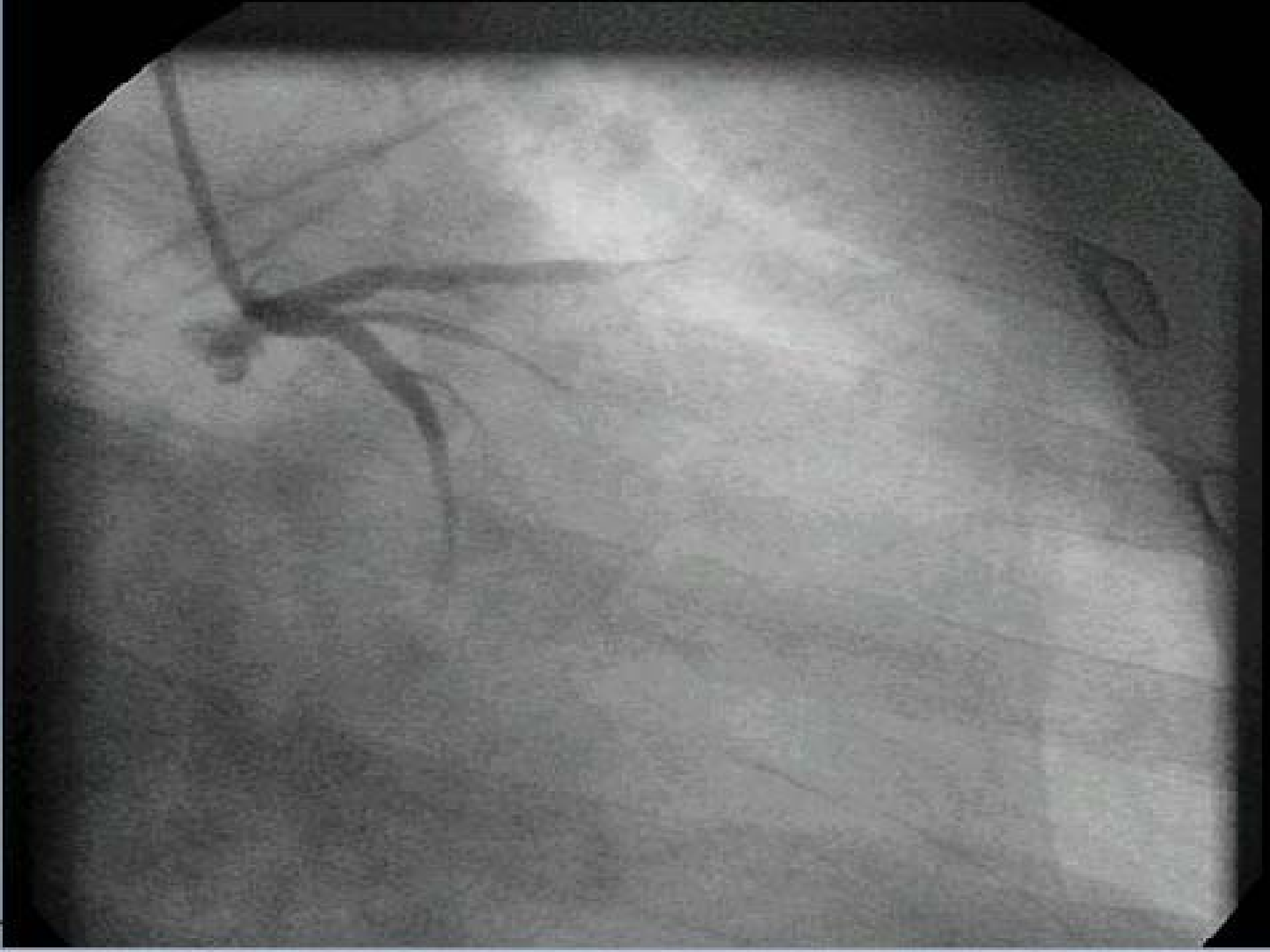
Coronary Artery – *visualization*

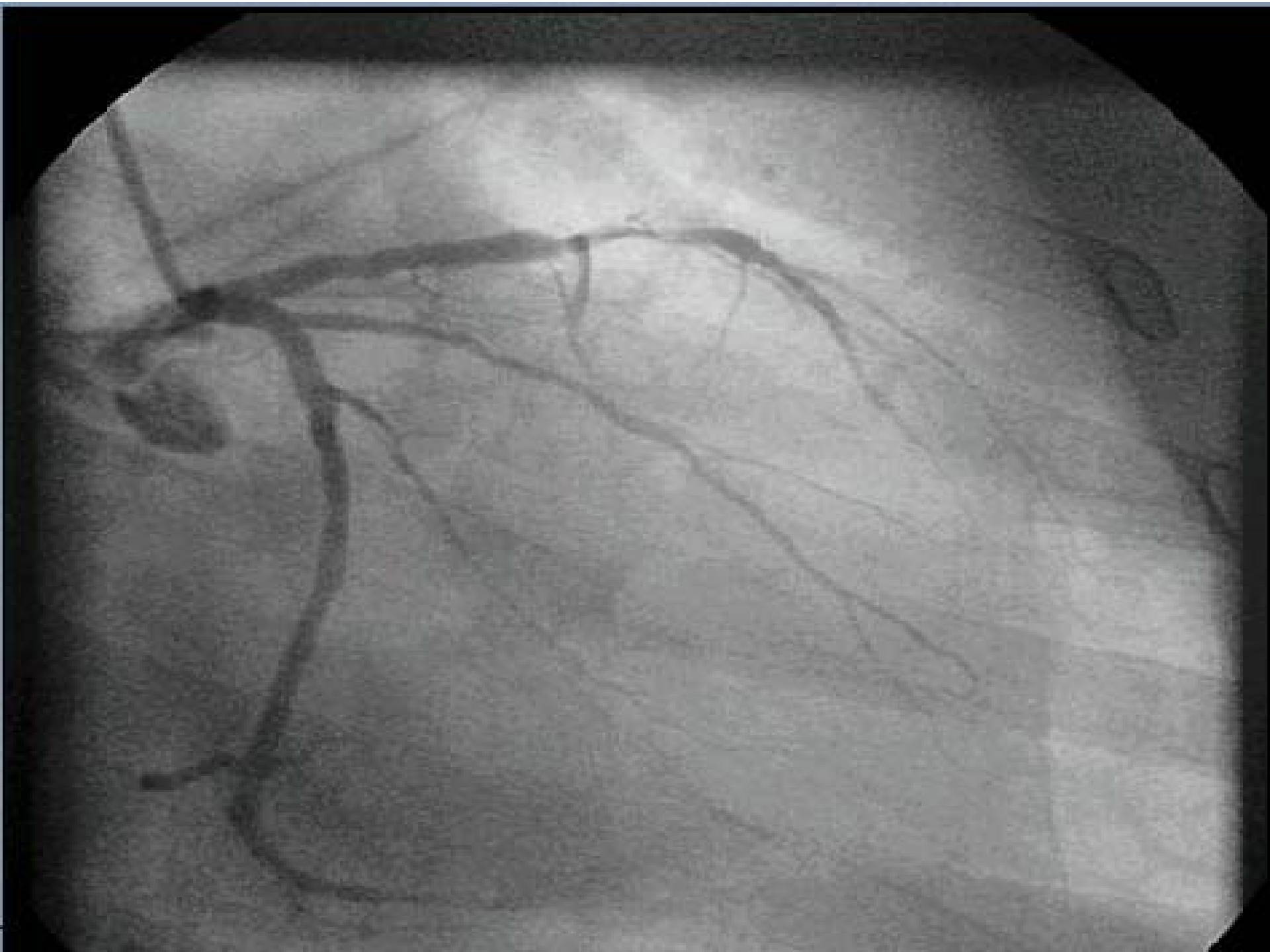
Coronary angiogram

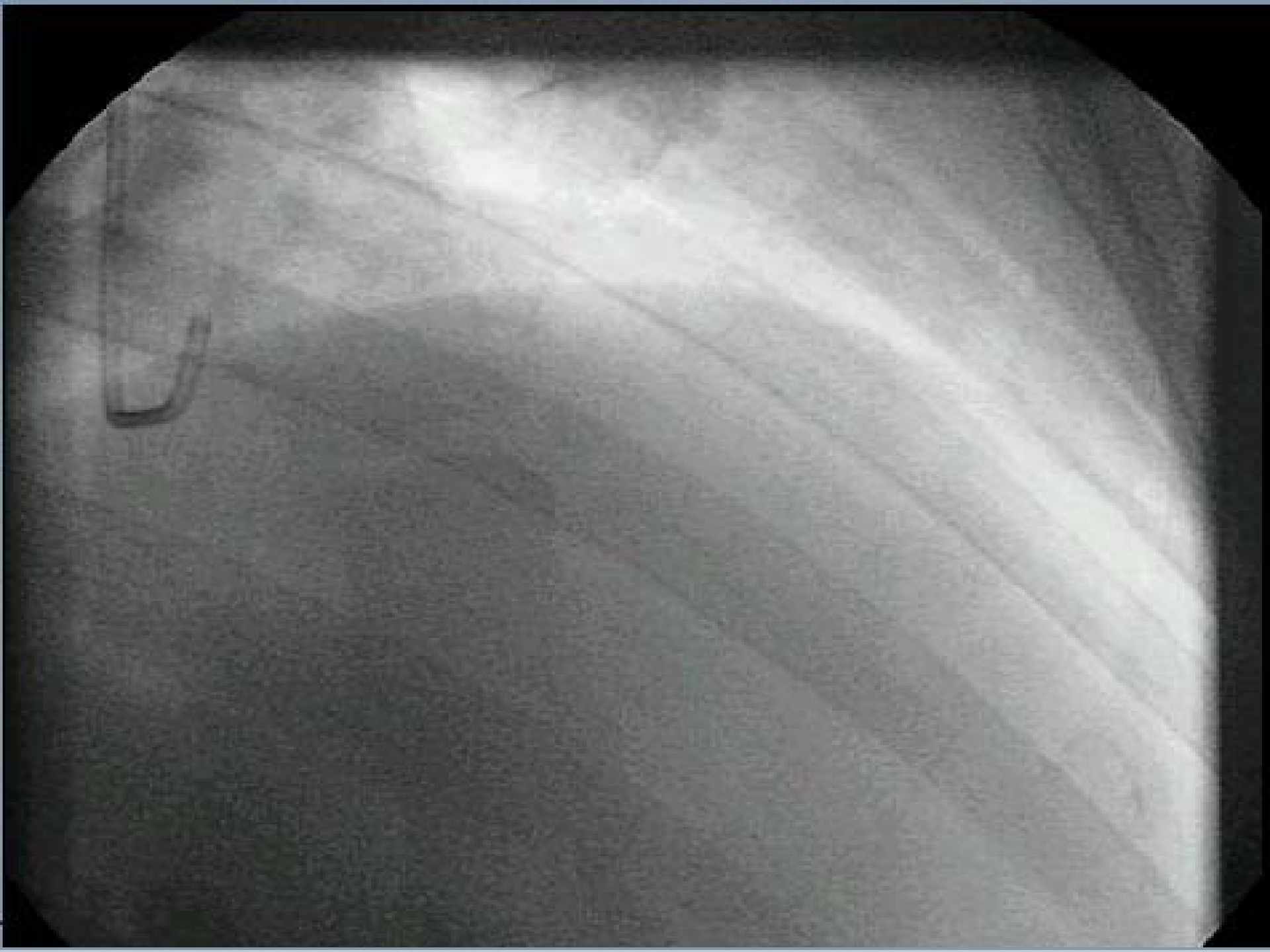
Spatial Orientation

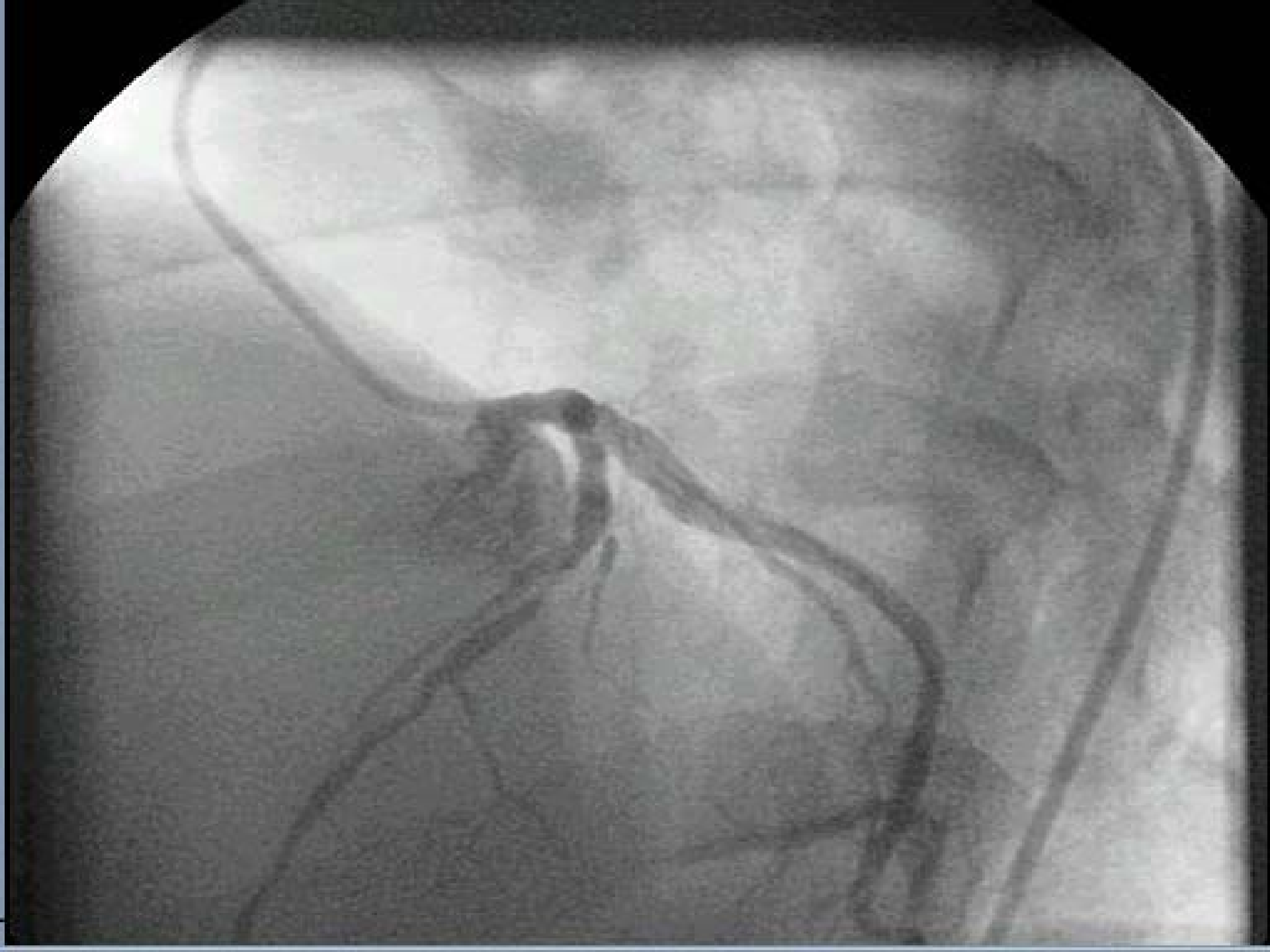


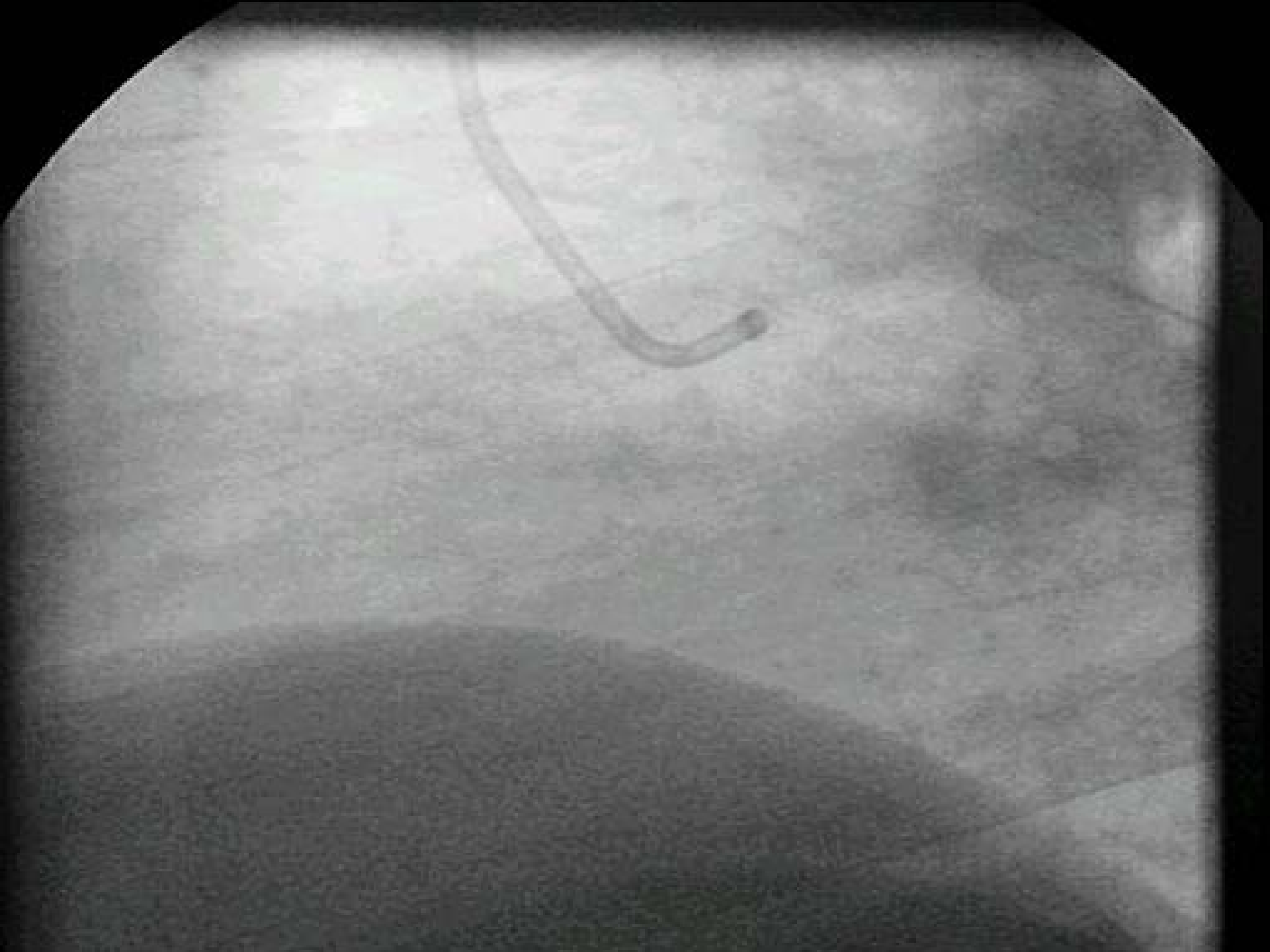


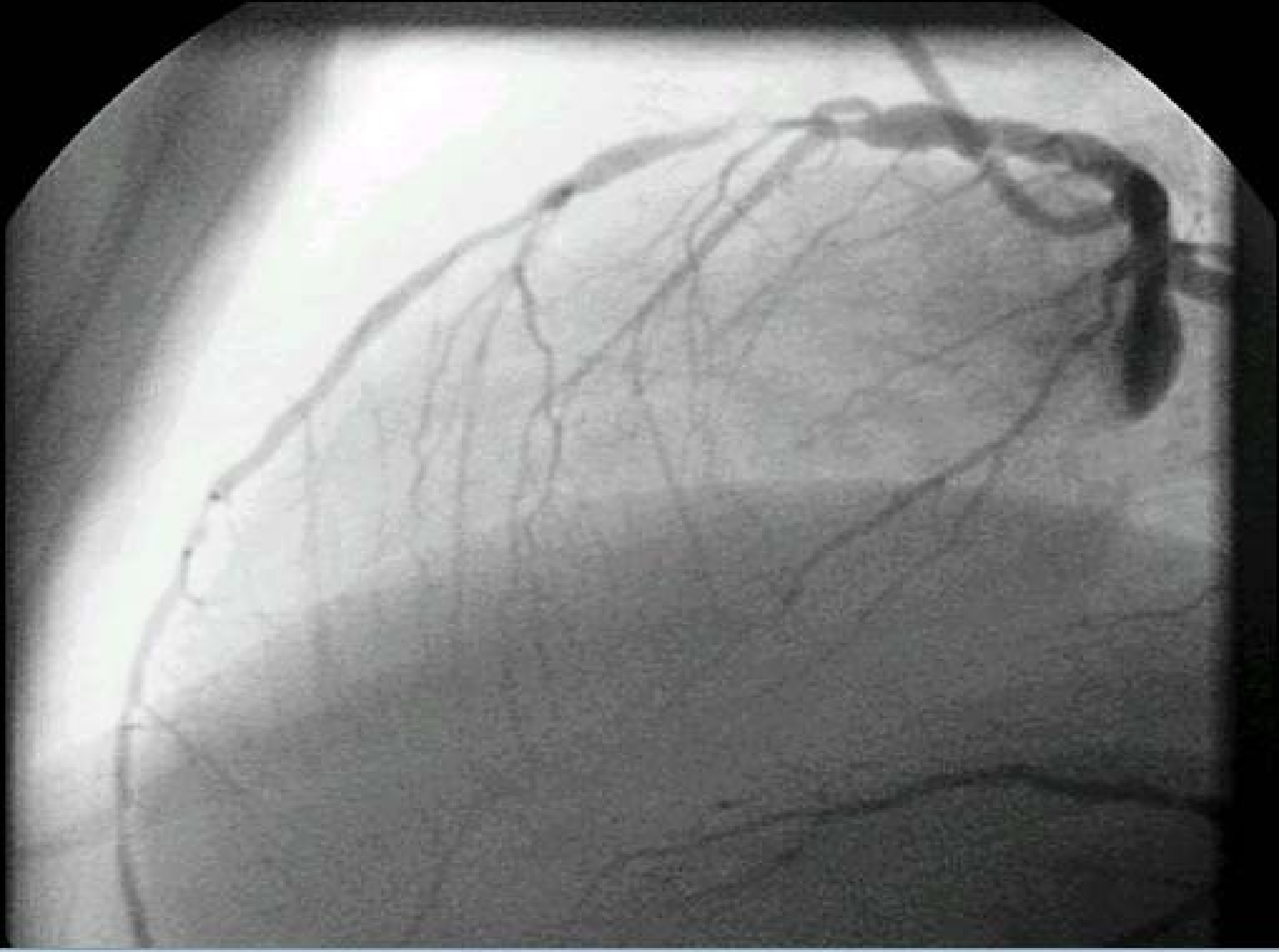


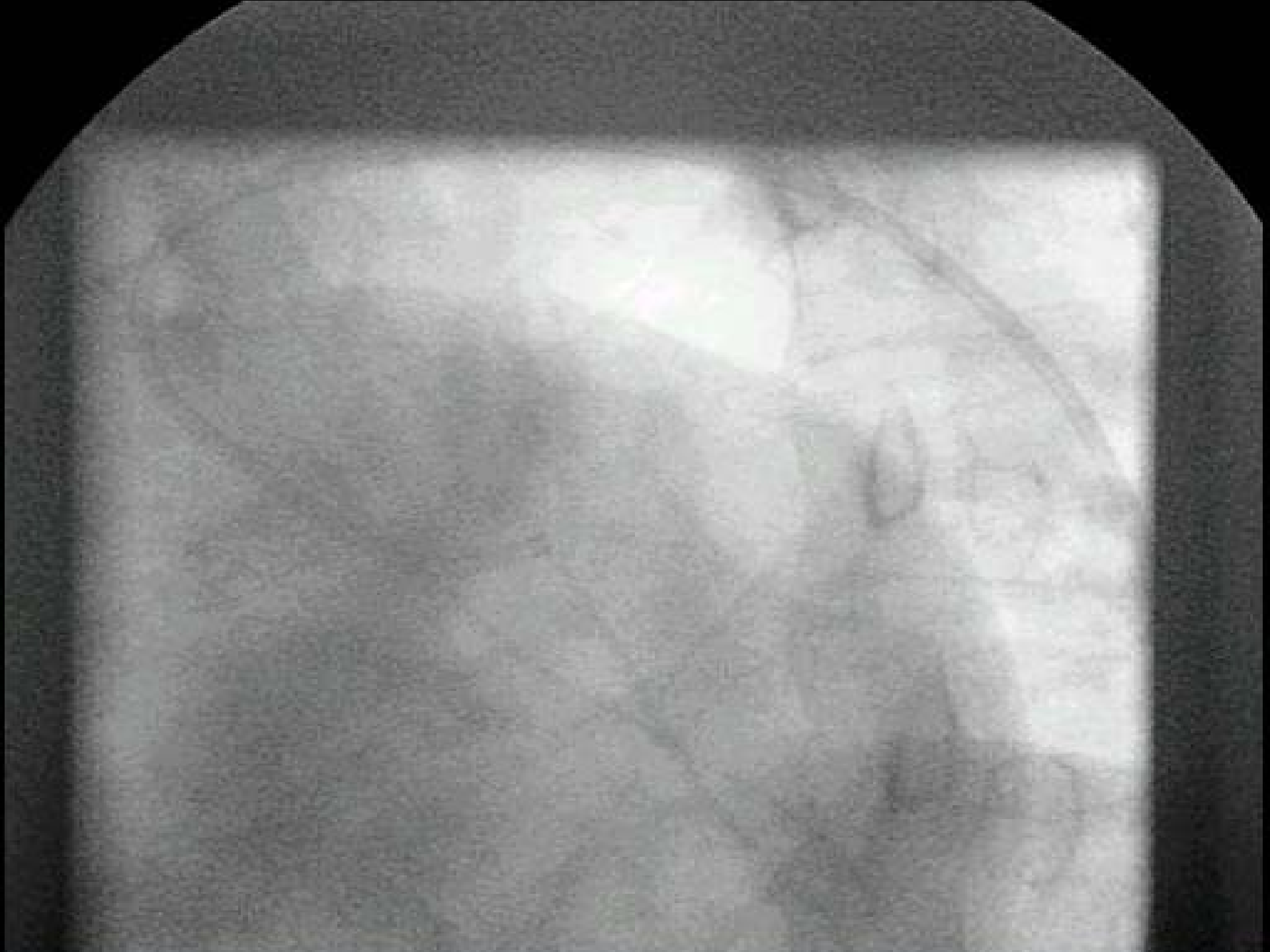


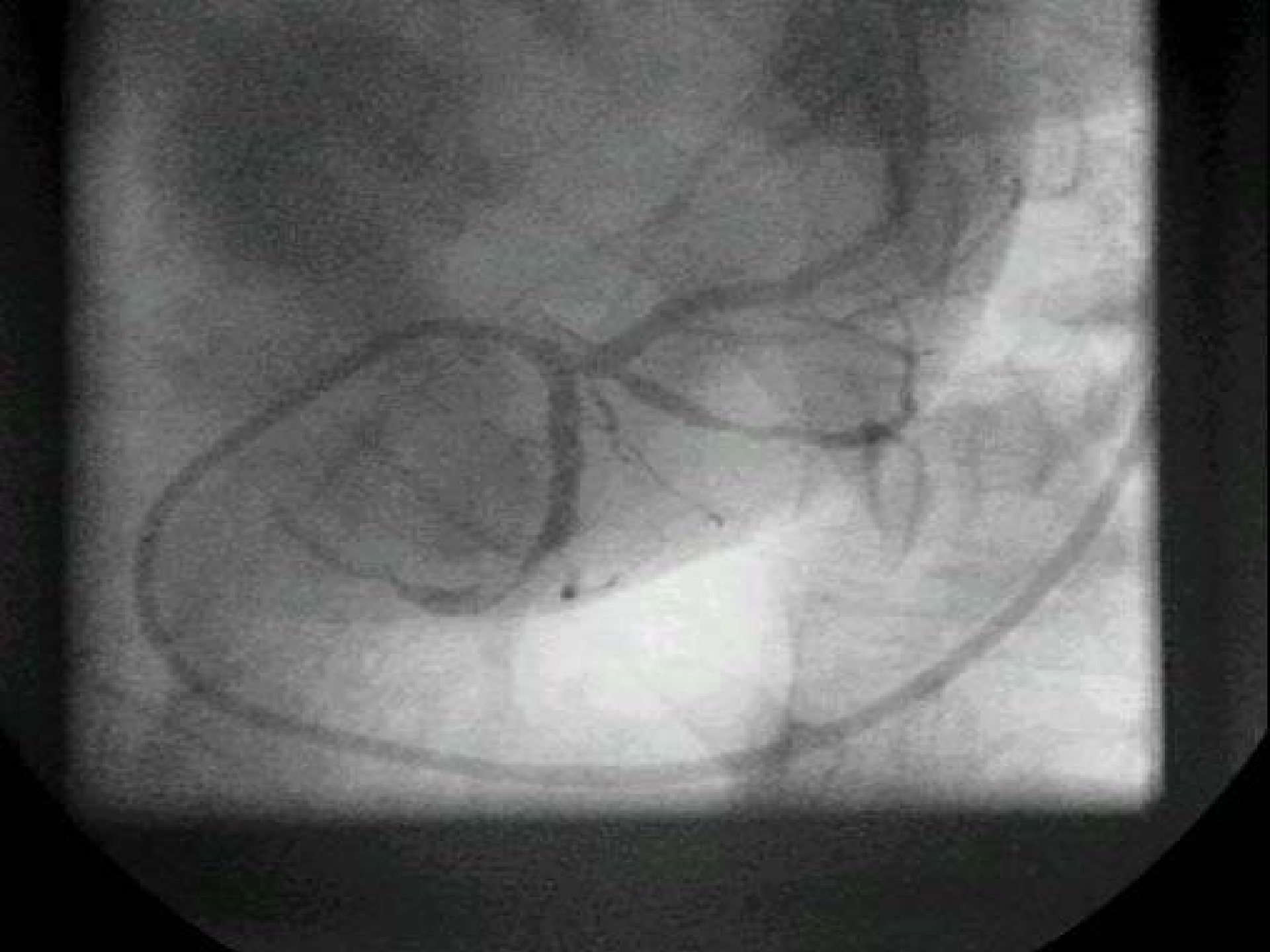


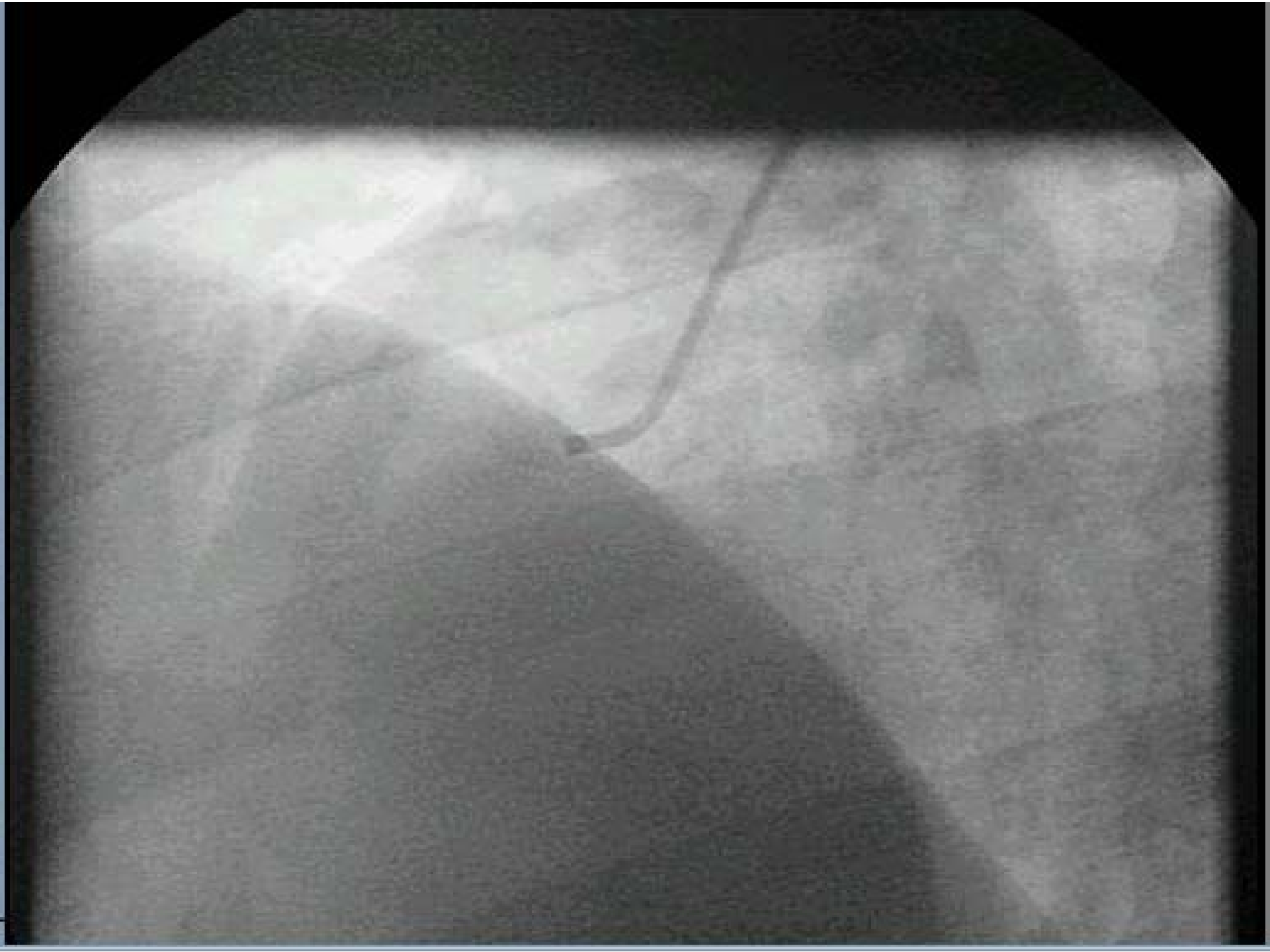


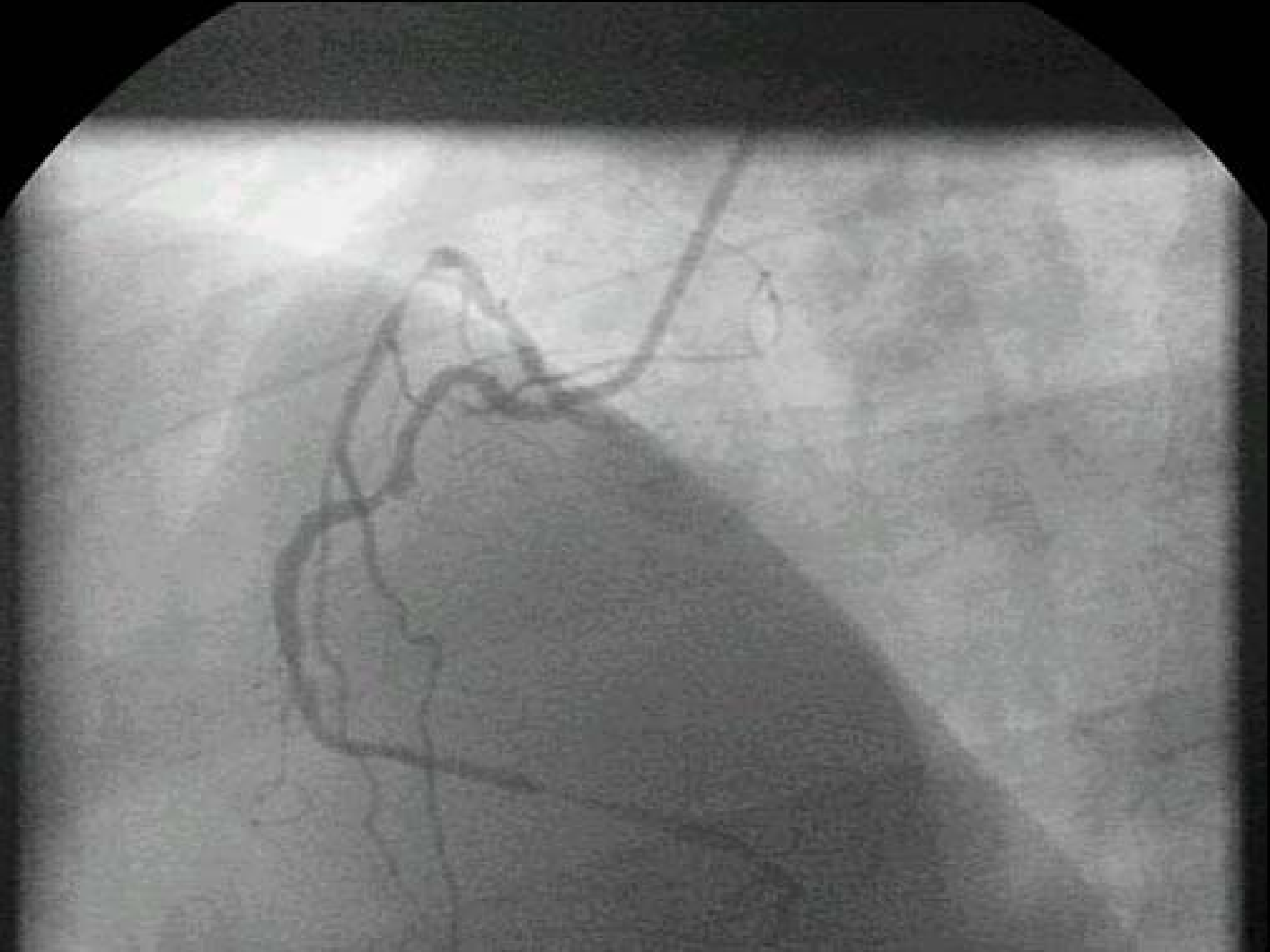




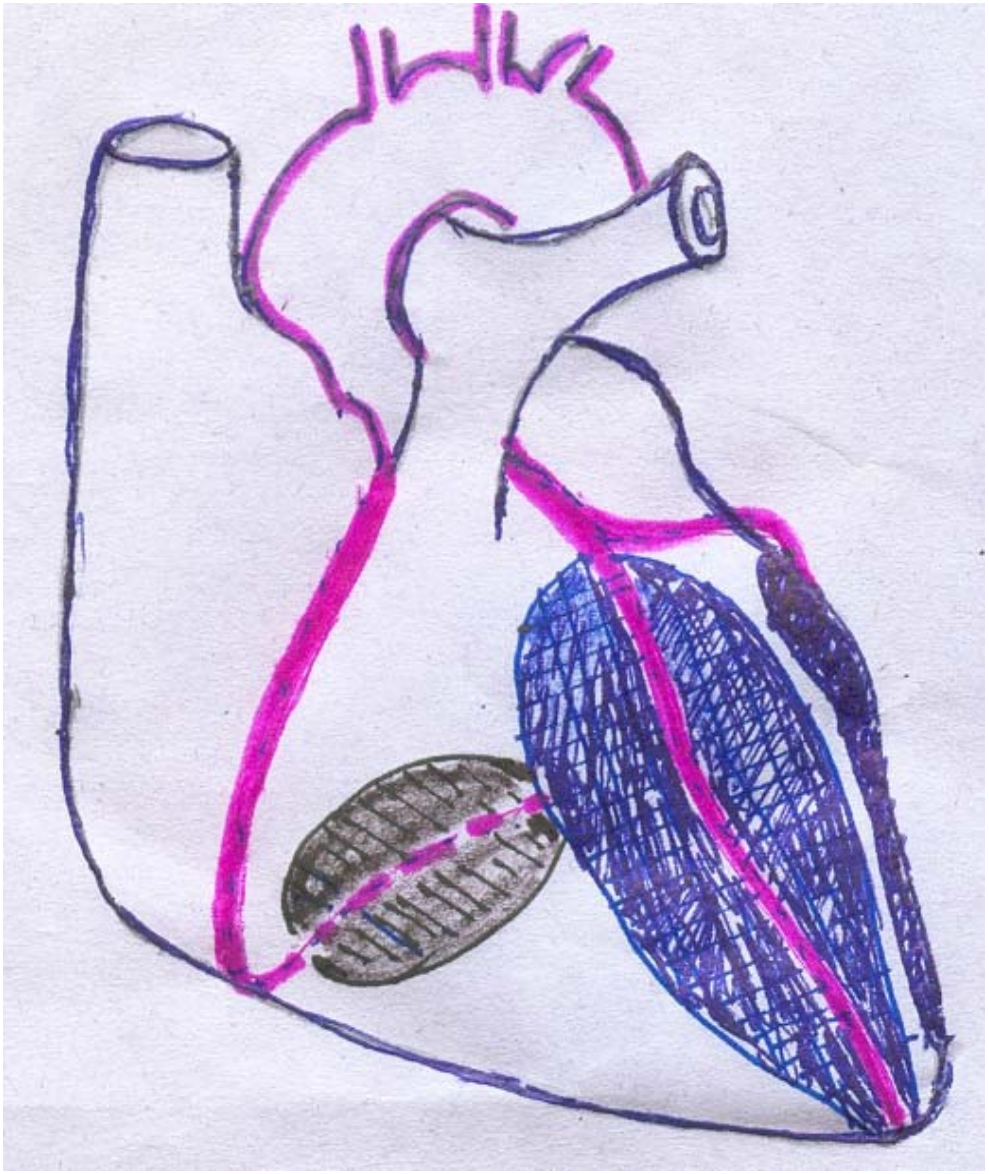




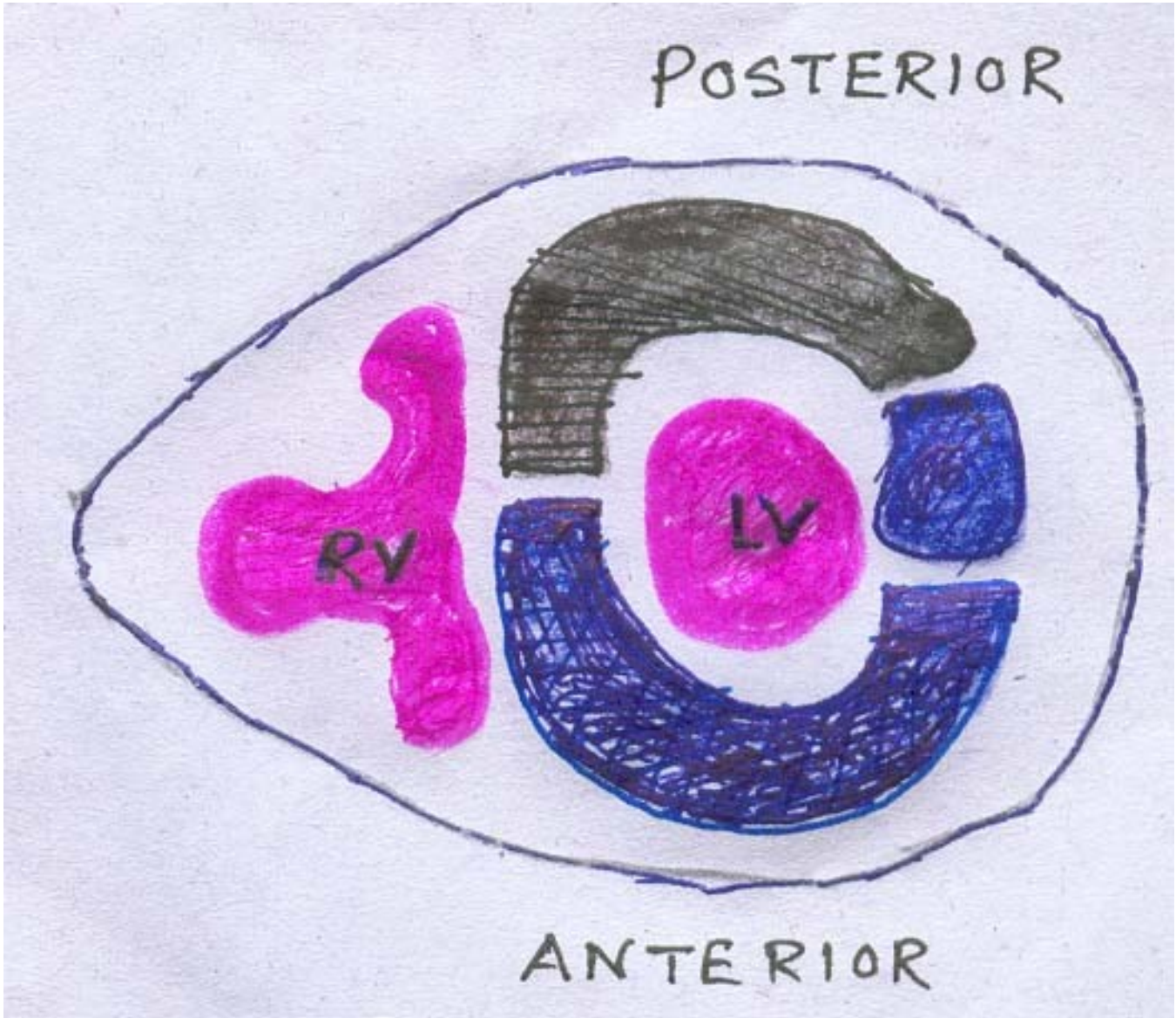




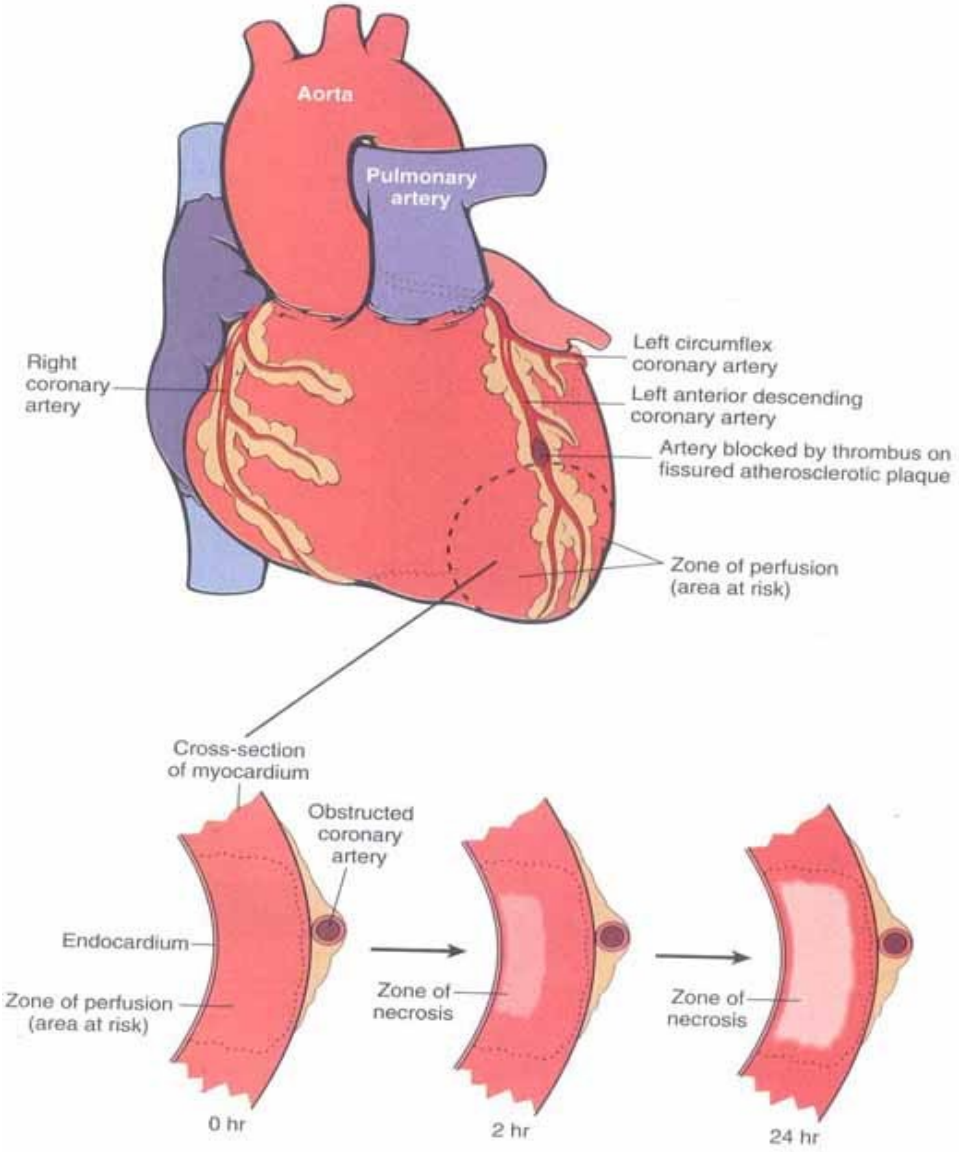
Common Location of The Infarct



Common Location of the Infarct

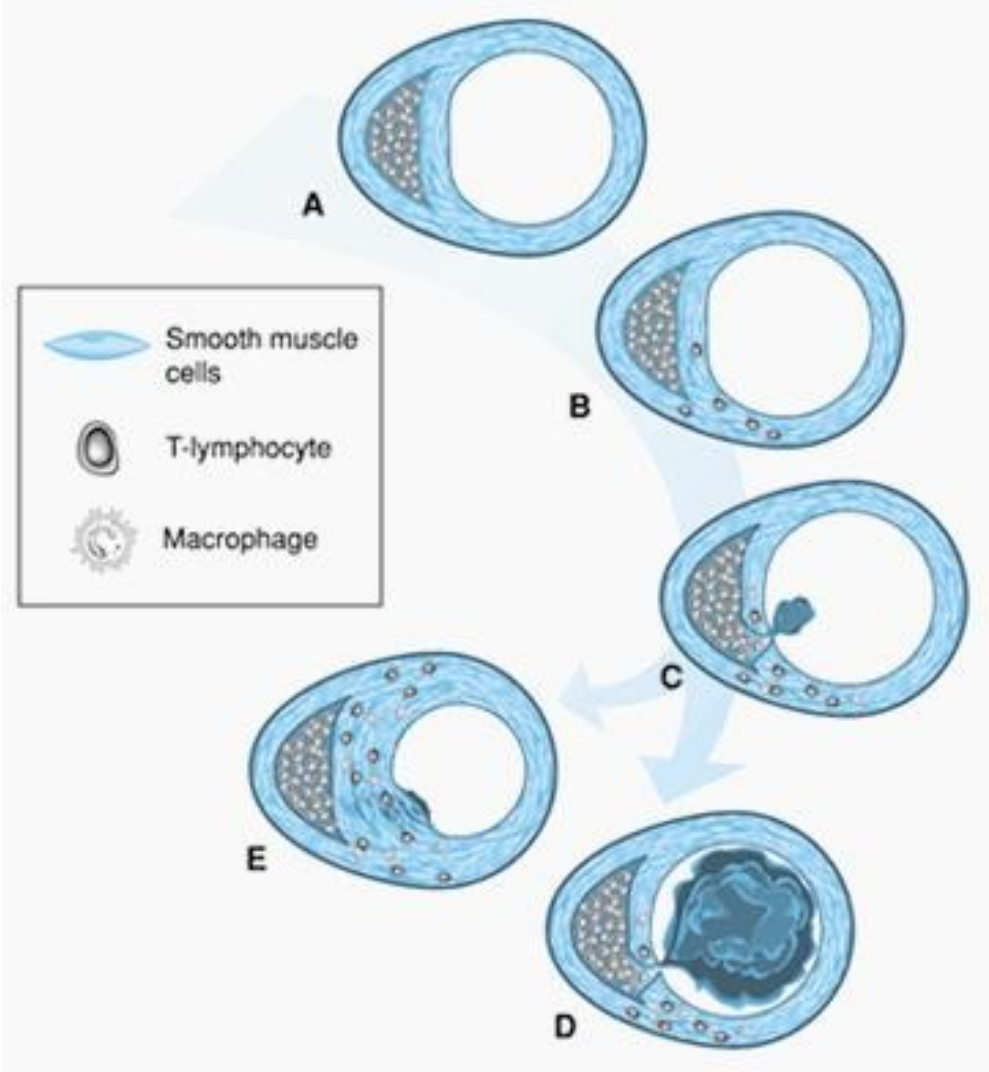


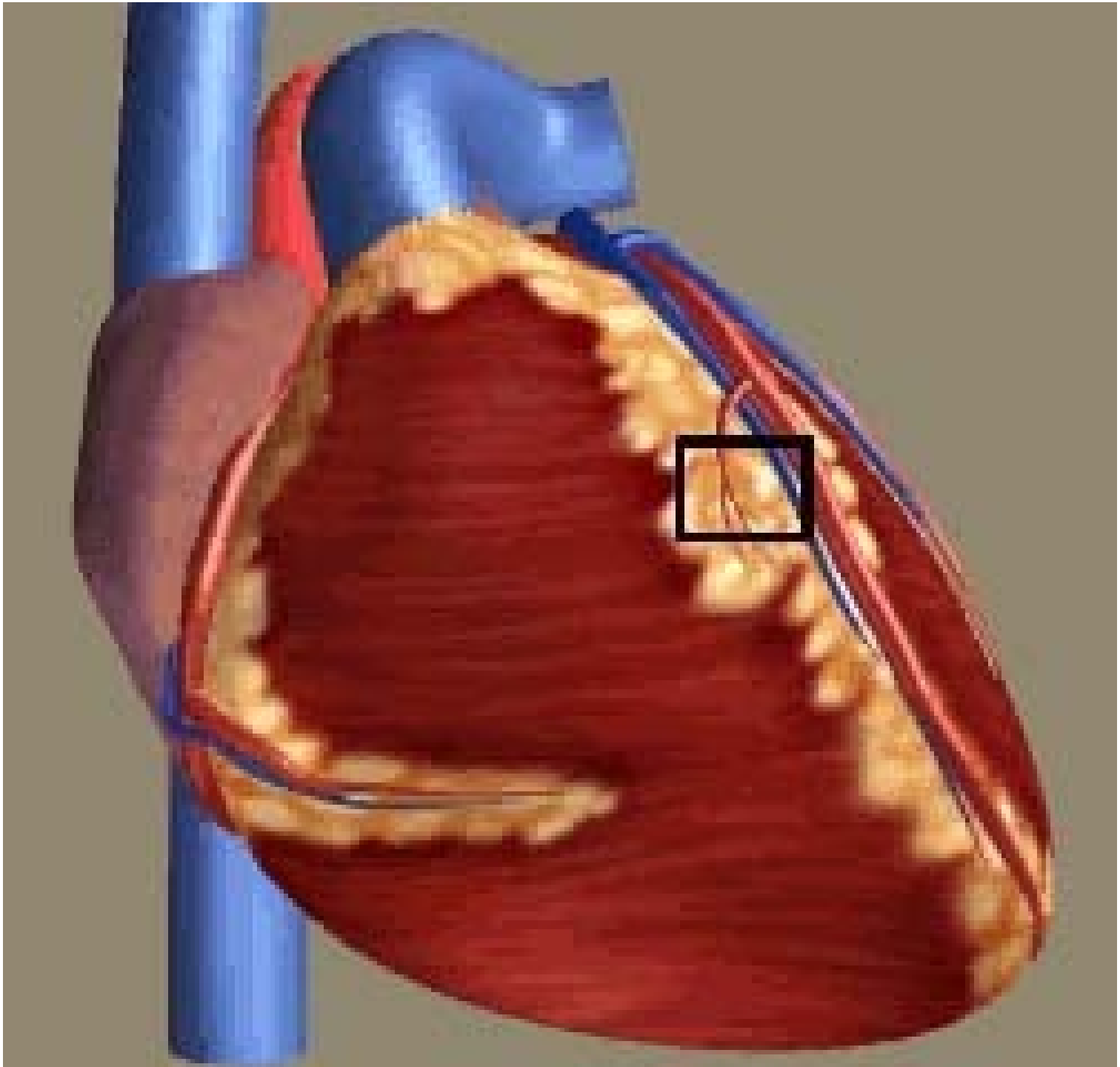
Sequence of changes in MI

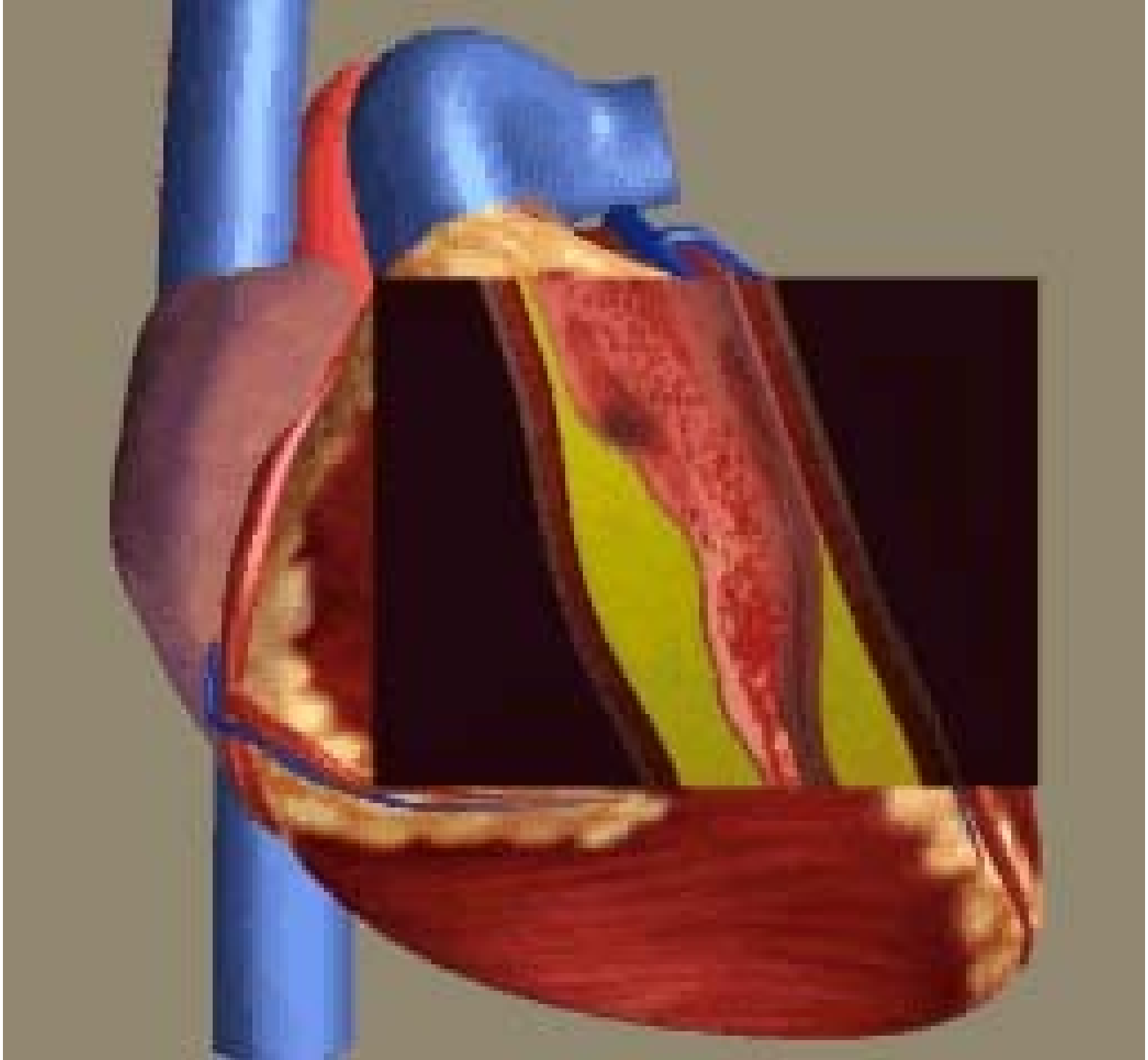


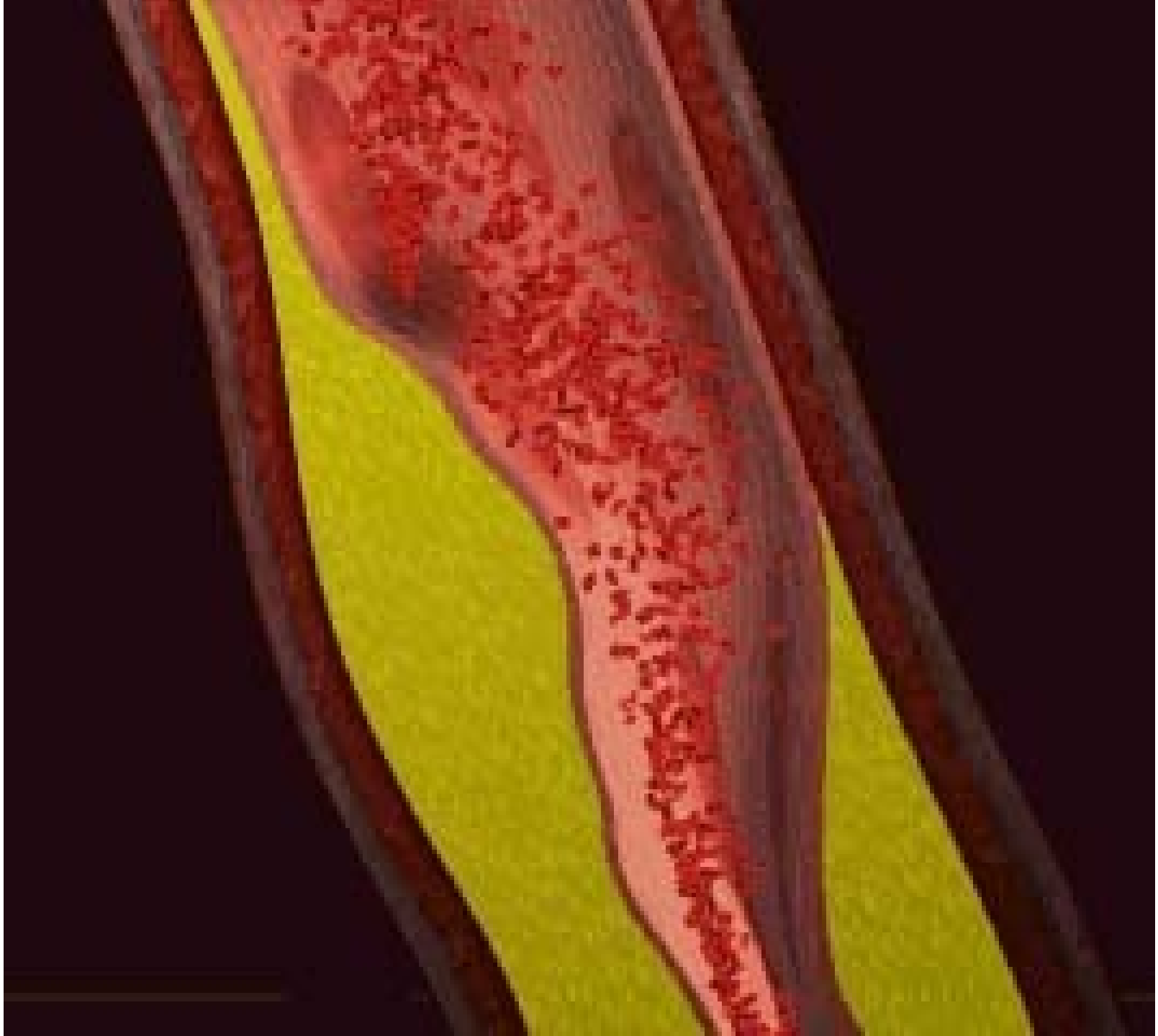
Plaque Rupture : Thrombus & Healing

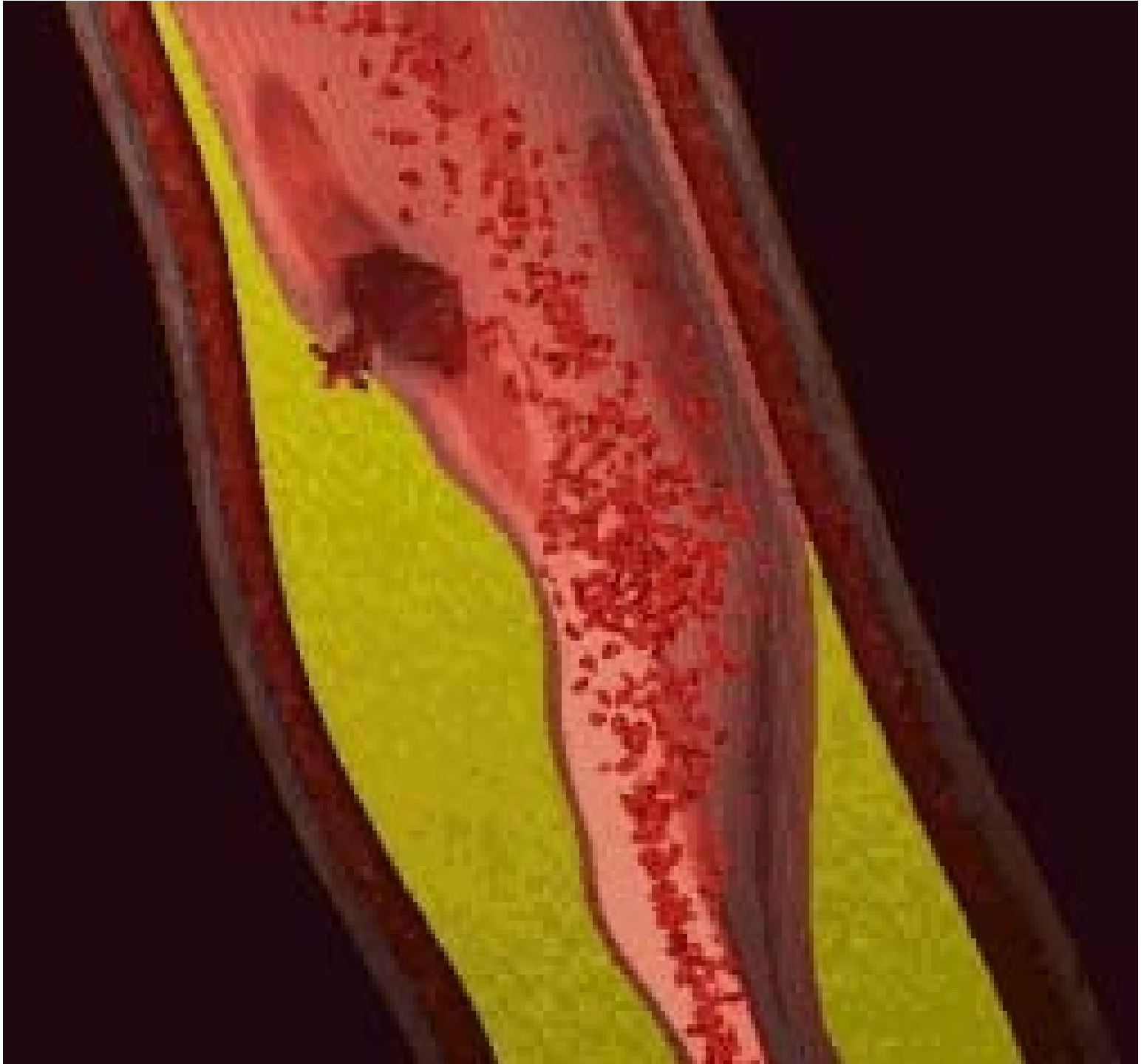
Plaque Rupture

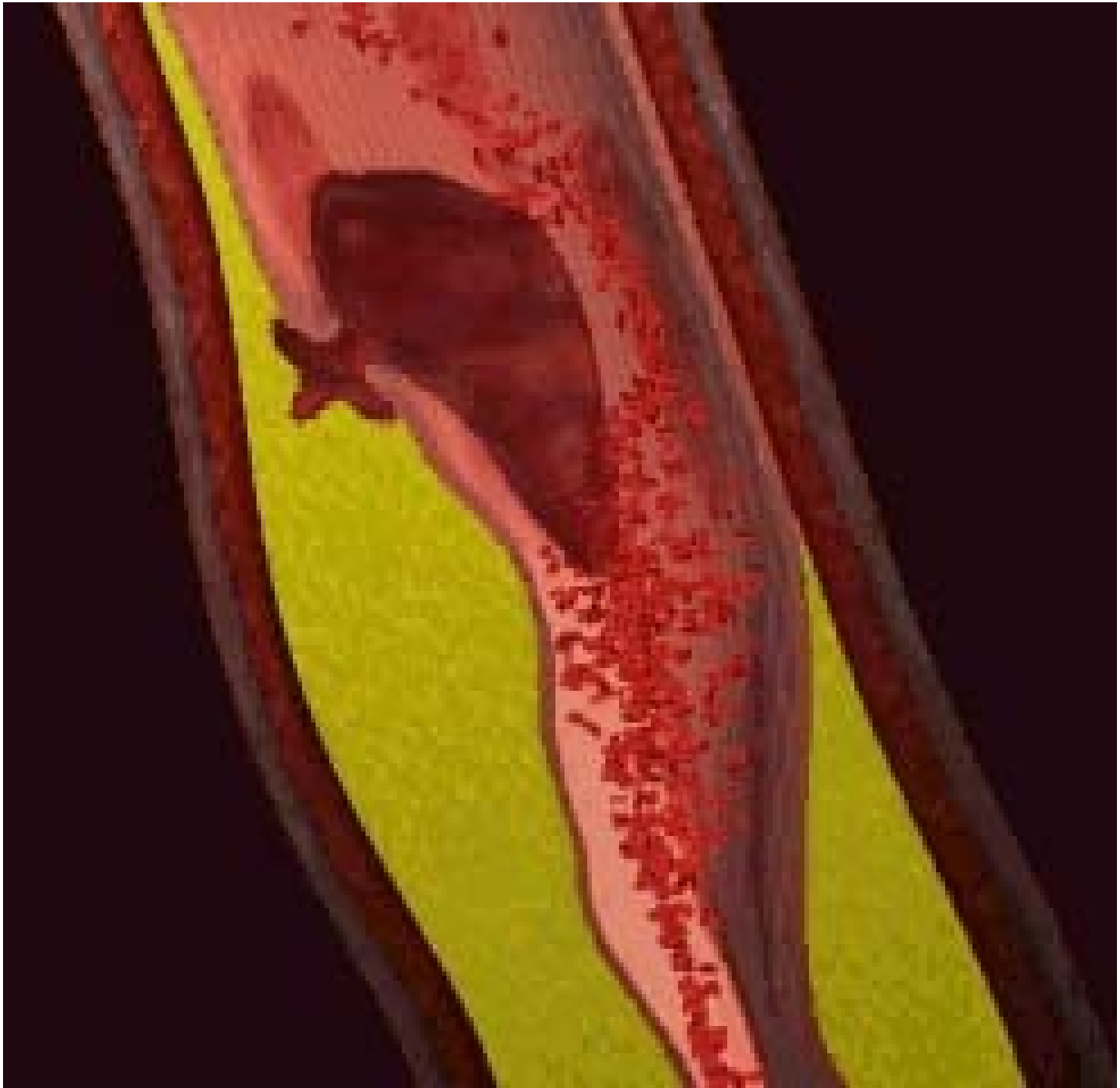


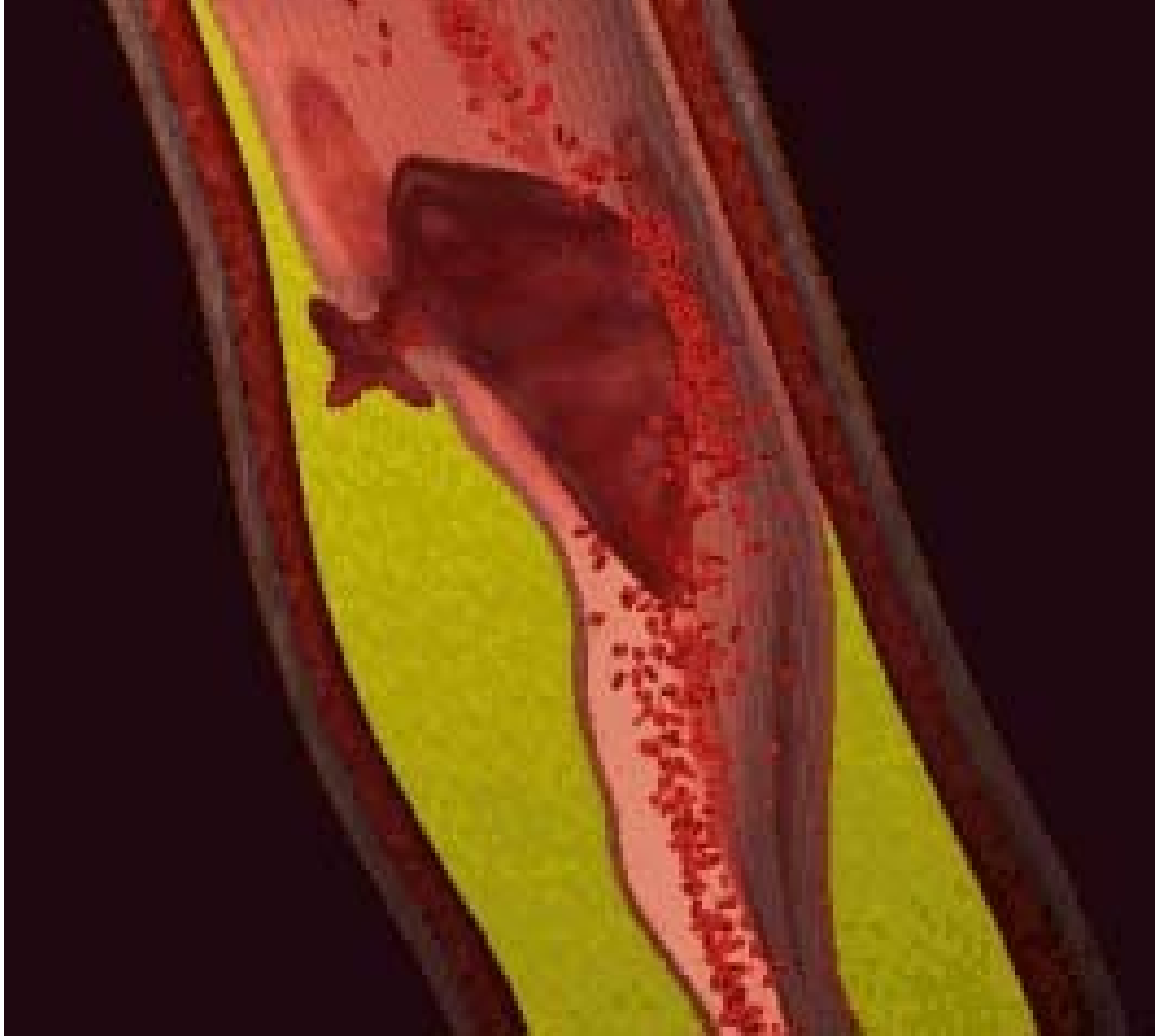


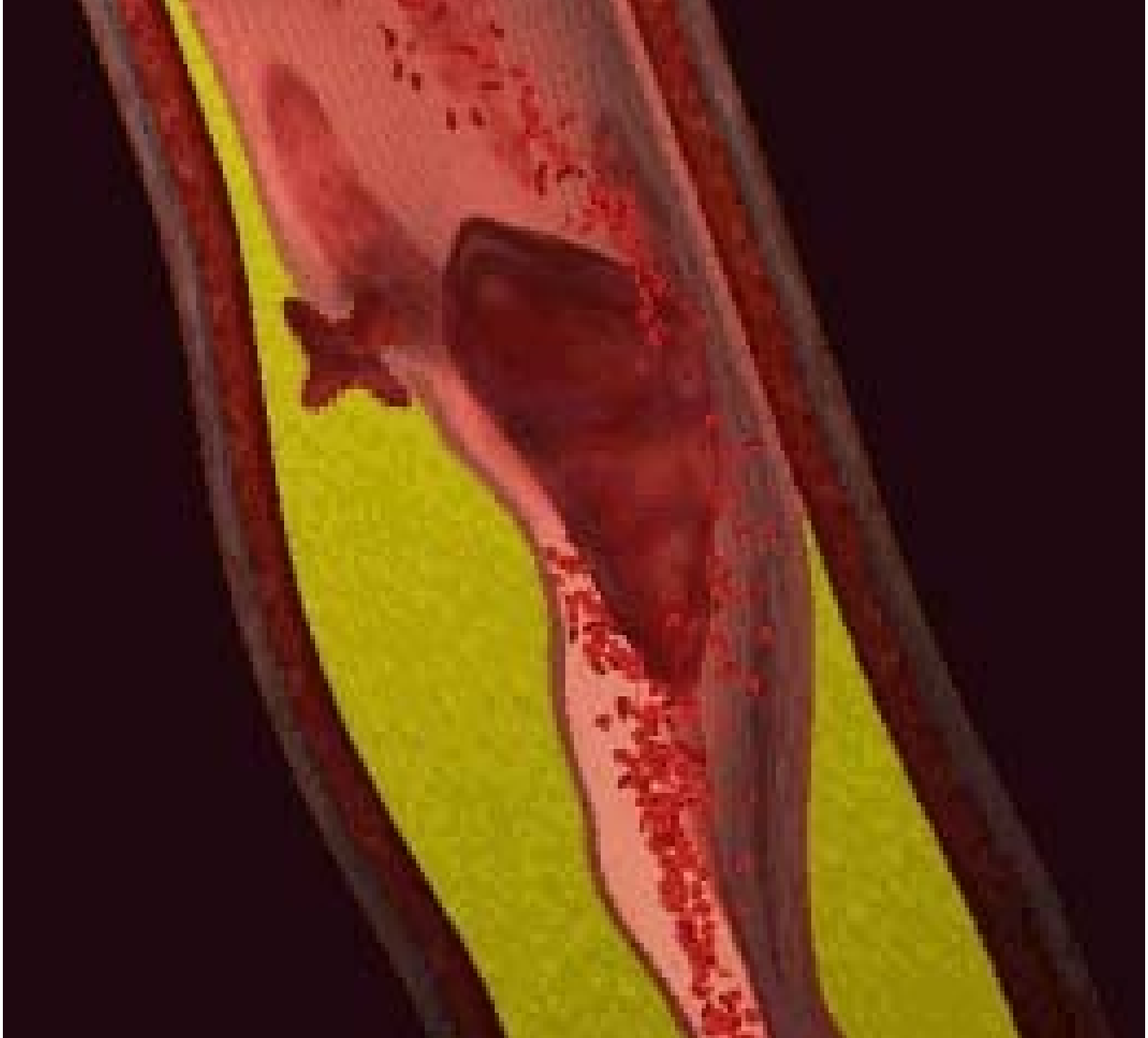


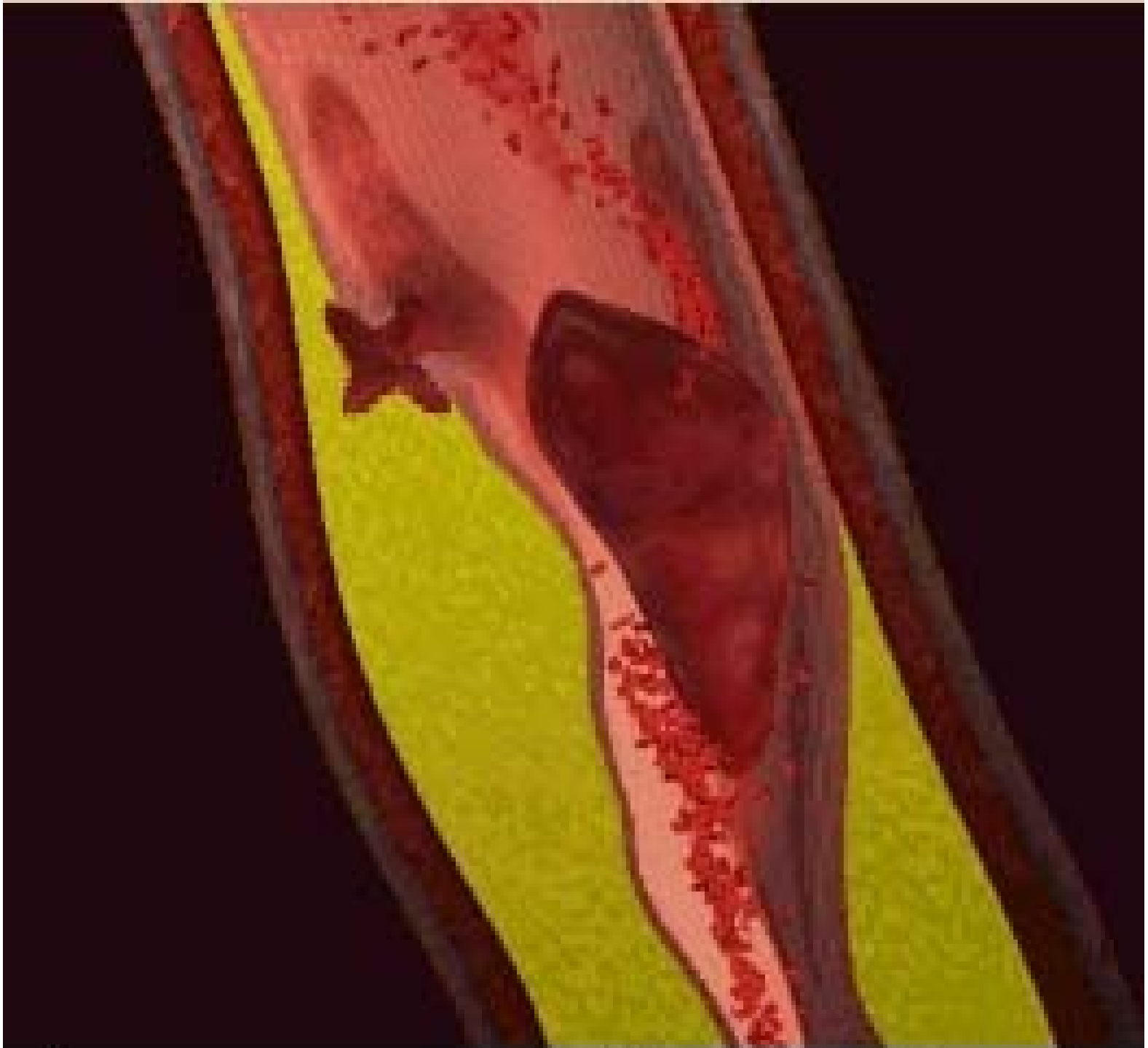


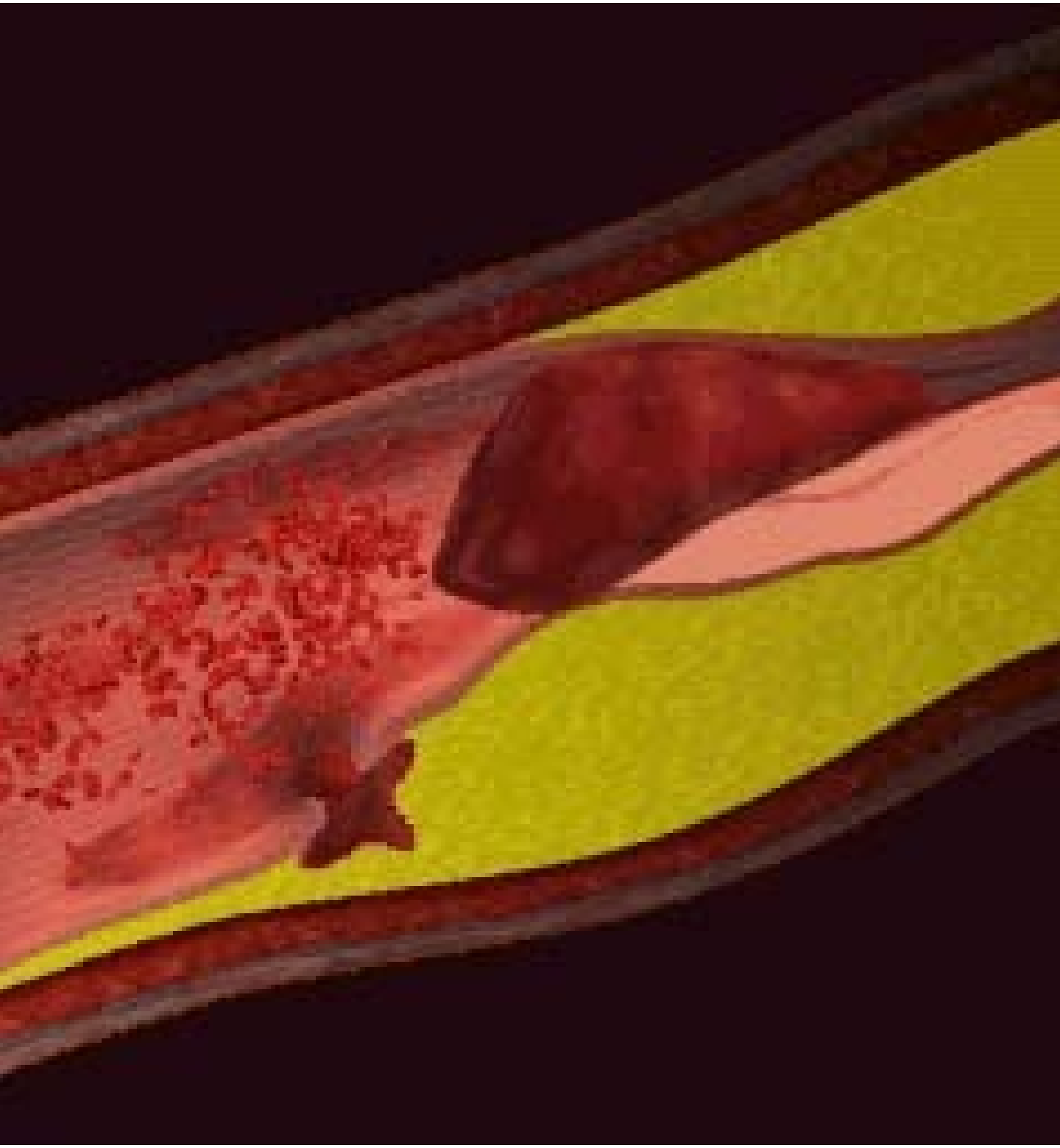


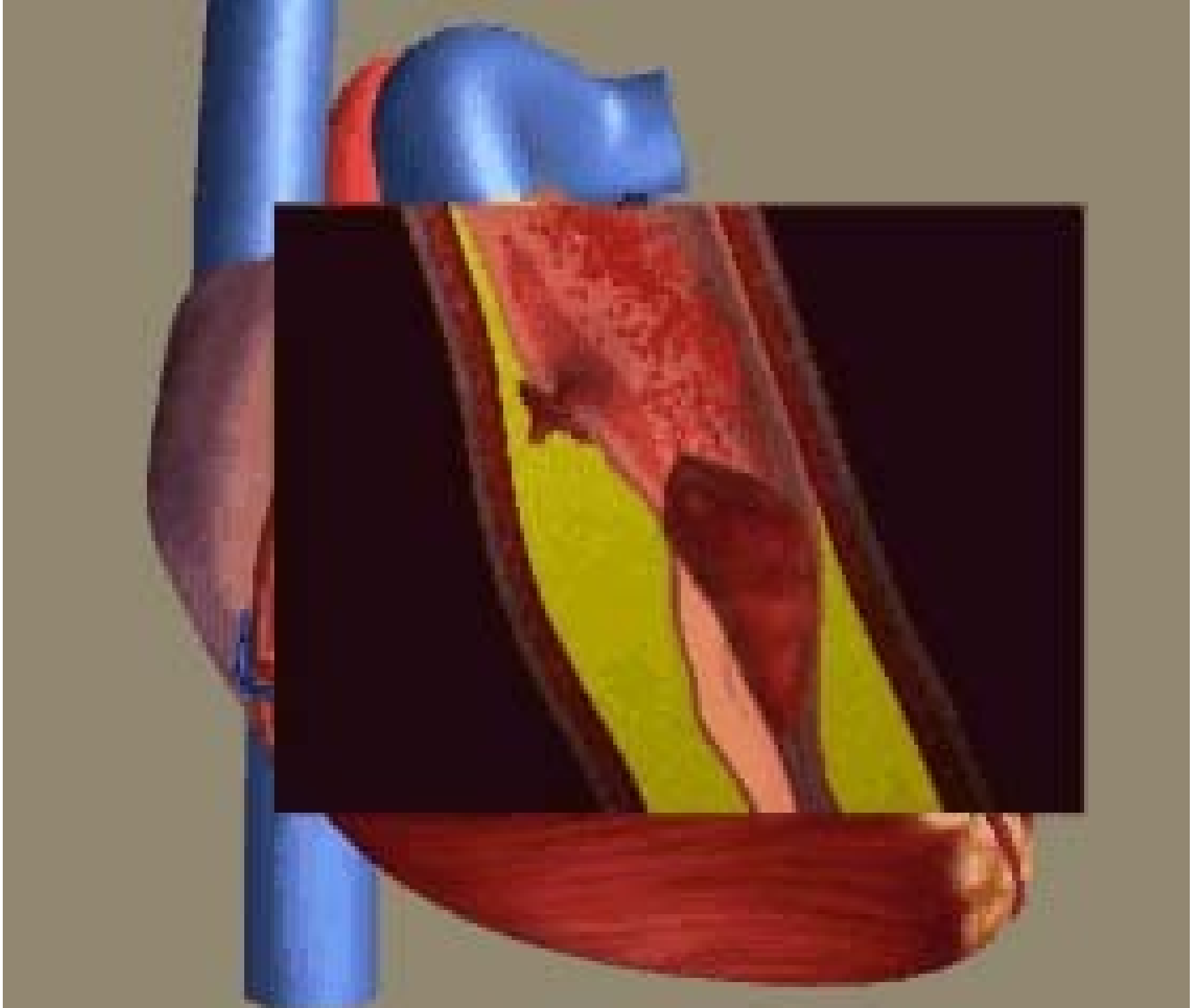


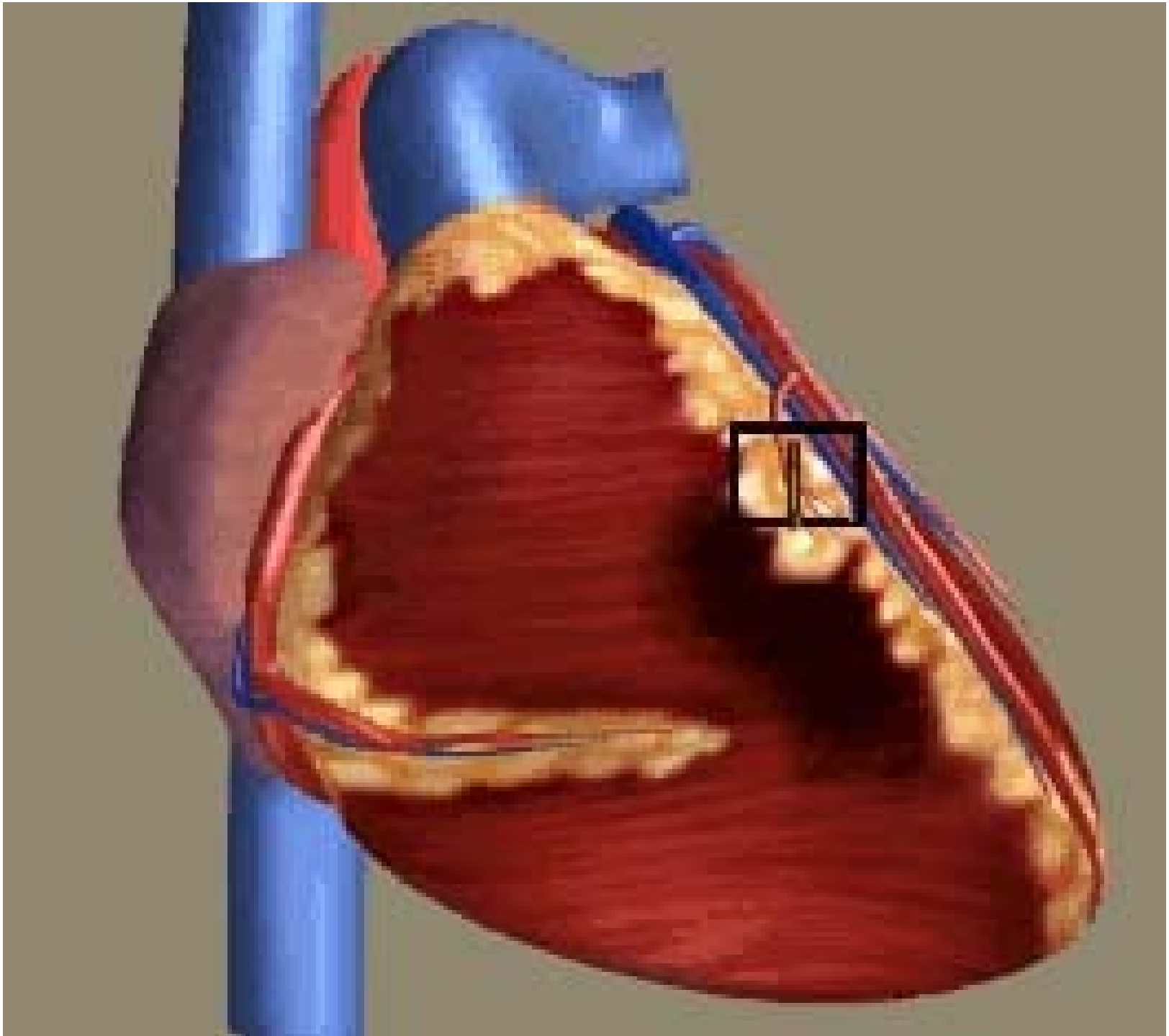


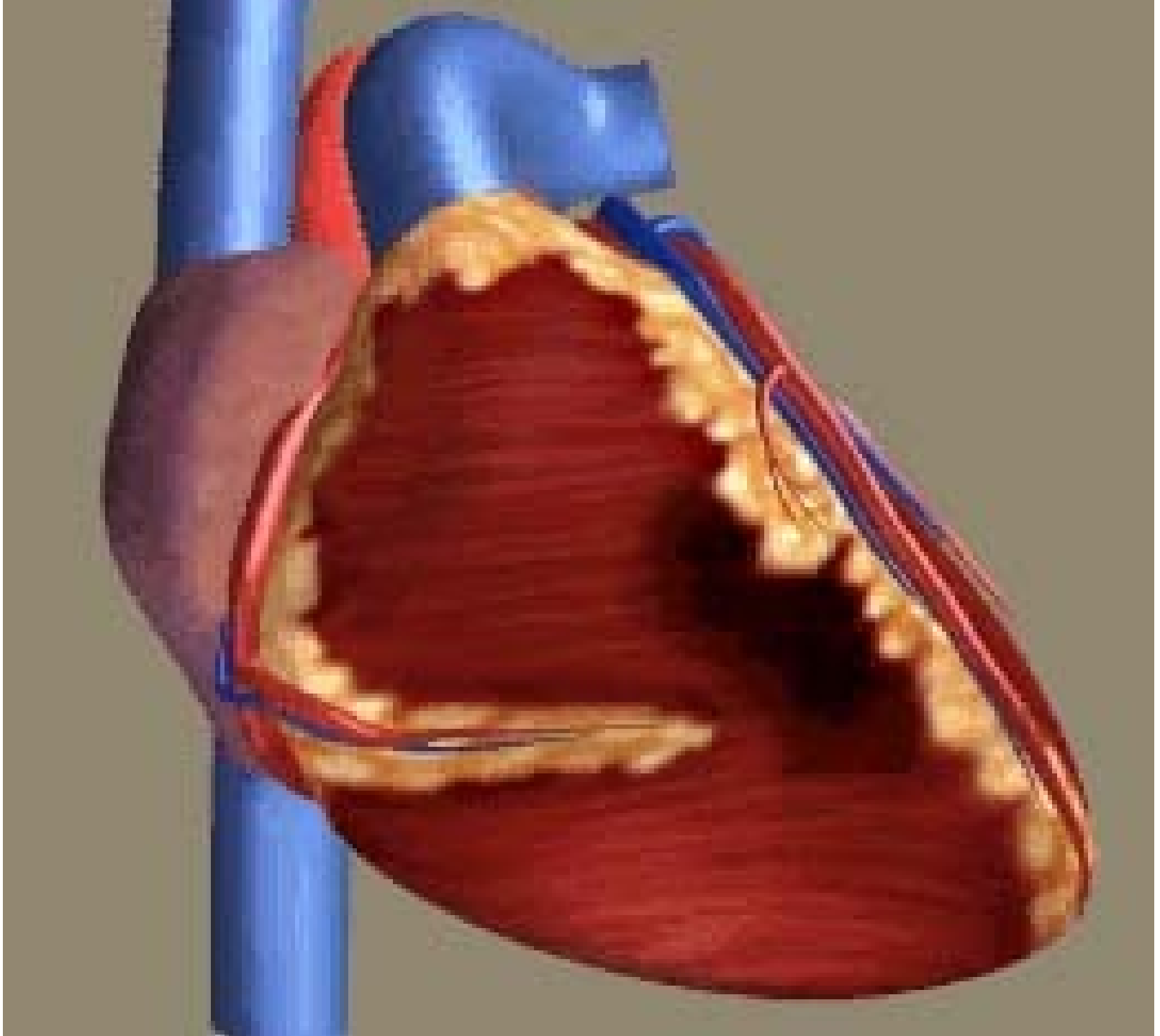












MI - Complications

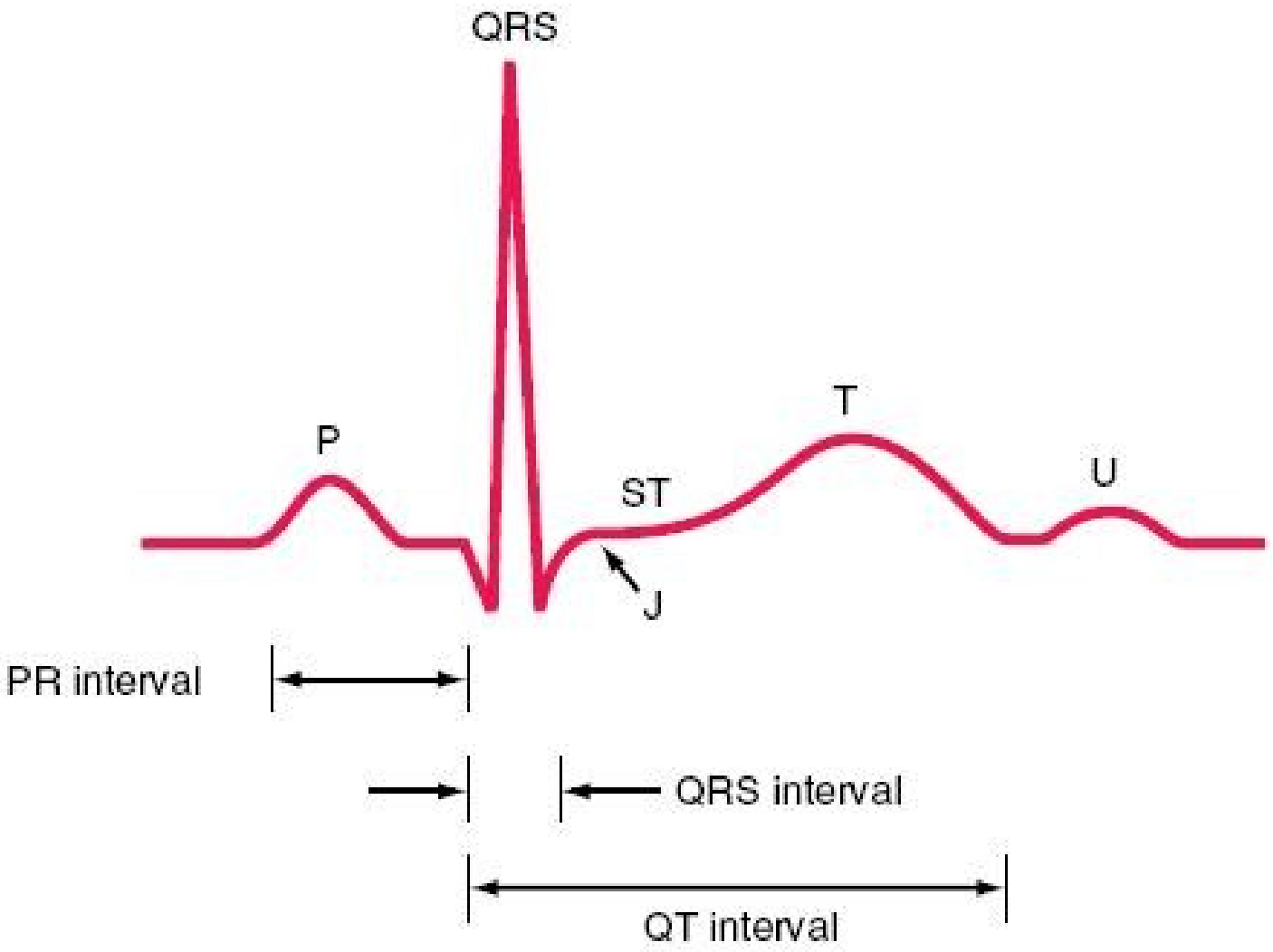
In 25% of Cases

- Immediate Mortality (Sudden Cardiac Death)

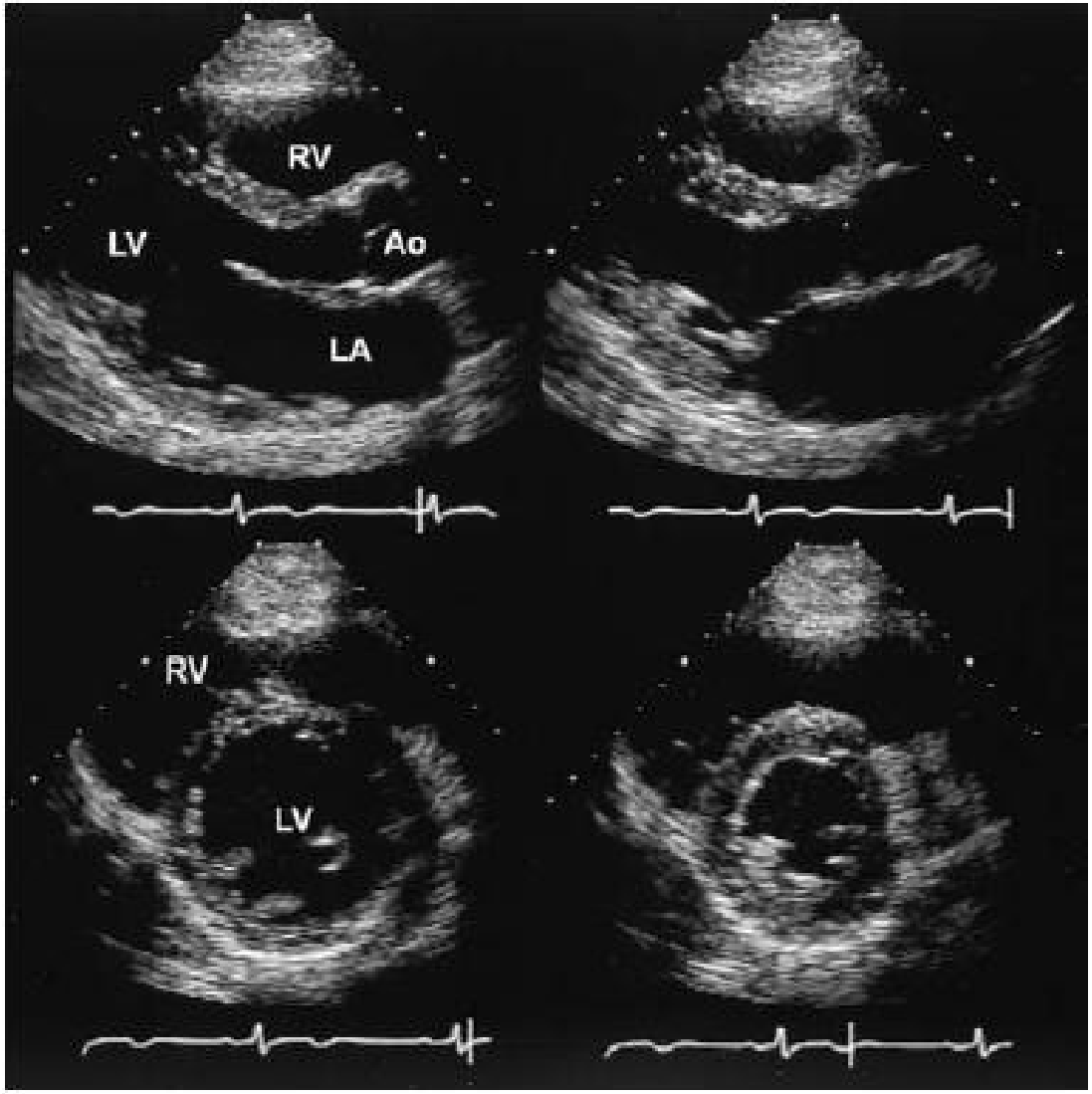
In 80–90% of Cases 1 or > major

- Cardiac Arrhythmias
- Congestive heart Failure
- Cardiogenic Shock
- Mural Thrombosis / Thromboembolism
- Rupture of free wall septum / Papillary Muscles
- Cardiac Aneurysm
- Pericarditis
- Post Infarction Syndrome

ECG



ECHO



Prophylaxis - Prevention of Coronary Artery Disease

Prophylaxis of Coronary artery disease

Management of Risk Factor

- ✓ **Modifiable**
- ✓ **Non modifiable**

Modifiable Risk Factors

By life style

- ✓ Smoking
- ✓ Obesity
- ✓ Physical inactivity

By pharmacotherapy & life style

- ✓ Lipid disorder
- ✓ Hypertension
- ✓ Insulin resistance

Non modifiable Risk Factors

- Age
- Male gender
- Genetic predisposition

Prevention of CAD

- ✓ **Primary**
- ✓ **Secondary**

With non-modifiable risk factors, intense management of Modifiable risk factors are necessary.

Risk assessment

Position or Status of the Patient with respect to

Risk factors.

Absolute risk = Parameter of Risk Assessment.

= Probability of developing CAD over a time period (10 Years).

Risk assessment

A male smoker aged 52yrs.having a total cholesterol 220mg/dl, HDL 45mg/dl, BP 160/90, Blood Sugar 130mg/dl.

Total Framingham Risk Point = 11

His absolute 10 Years Risk = 25%

Risk Category for MI (Fatal & Nonfatal) =

high

Smoking

Nothing less than complete cessation.

Obesity

Body mass index : Kg/M^2

> 30 -- Obesity

25 - 29.9 -- Overweight

< 25 -- Acceptable

Abdominal / Intra abdominal Fat depot

Lipid disorder, Hypertension & Diabetes

Risk Factor management

Hypertension - A Major Risk factor

Antihypertensives

Diabetes Mellitus & Insulin Resistance

Antidiabetics & Lipid lowering Drugs

Risk Factor management

Life style modification

- ✓ Diet
  - **Quantitative**
  - **Qualitative- Saturated Fat, Cholesterol, Na**
- ✓ Exercise
- ✓ Smoking
- ✓ Alcohol
- ✓ Obesity
- ✓ Stress & anxiety

Patient & Public education

Role of the Government


Thank you