Semester 4

CASES DISCUSSION ON DIABETES MELLITUS

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Learning Outcomes

By the end of the lecture, the students will be able to:

1. Correlate knowledge of insulin to clinical situations
2. Correlate knowledge of oral hypoglycemic drugs to clinical situations

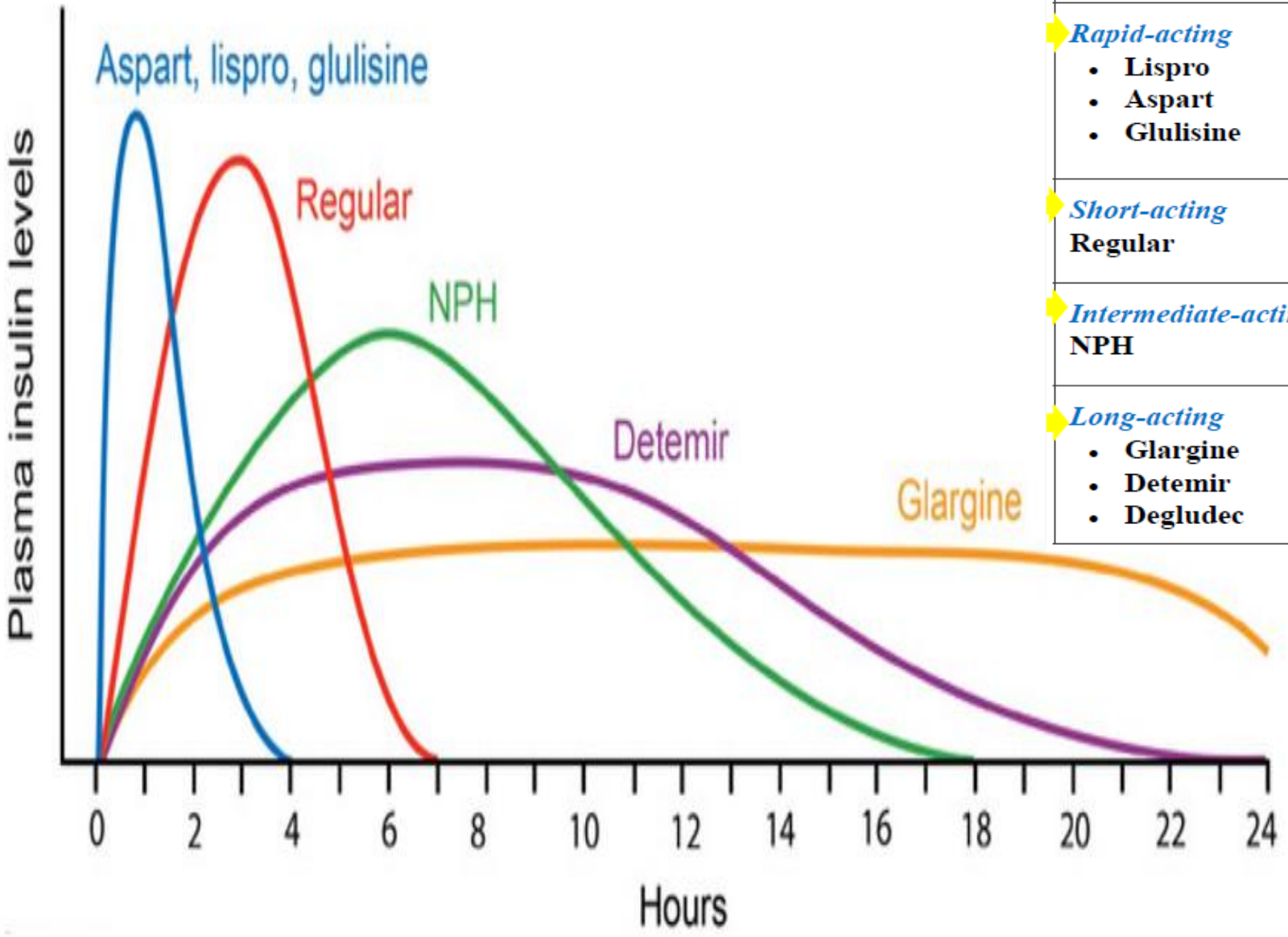
Diabetes mellitus

- A heterogeneous group of metabolic disorders **hyperglycemia** + disturbances in metabolism of CHO, fat, and protein.

❖ **Criteria for Diagnosis of Diabetes :**

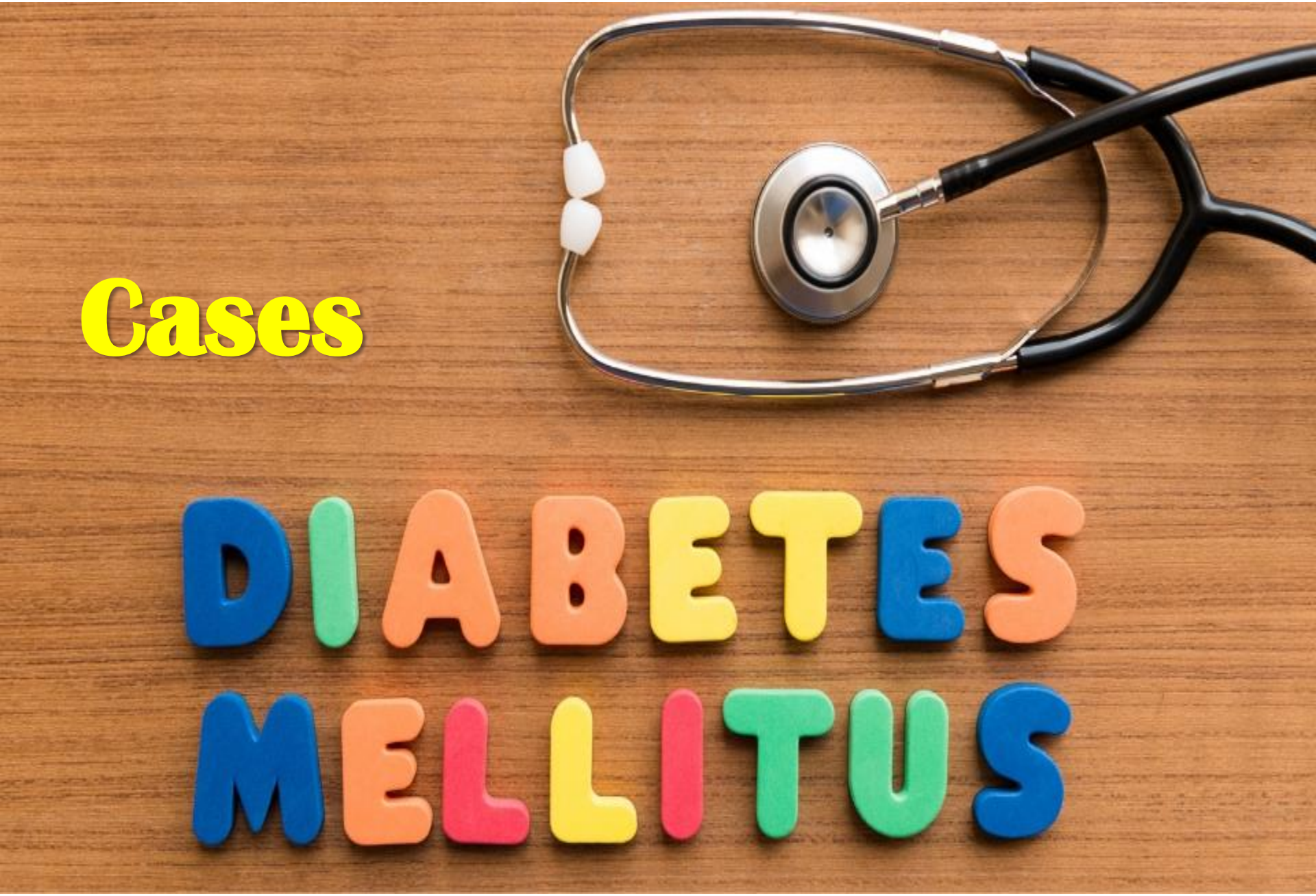
- Symptoms of diabetes: Polyuria, polydipsia, polyphagia +
- Fasting plasma glucose ≥ (126 mg/dL) or
- Random blood glucose concentration ≥ (200 mg/dL) or
- Two-hour post-prandial plasma glucose ≥ (200 mg/dL) .
- HbA1c ≥ 6.5%.

Pharmacokinetic profiles of common insulin preparations



Insulin Type		*Onset*
Rapid-acting • Lispro • Aspart • Glulisine	For control of postprandial hyperglycemia	10-15 min
Short-acting Regular		30 min
Intermediate-acting NPH	To maintain baseline glucose levels	1 h
Long-acting • Glargine • Detemir • Degludec		2 h

Cases



Case 1

10-year-old girl is diagnosed with type 1 diabetes. She will start on insulin therapy.

1. Which insulin regimen is better to be given to the patient to achieve good control of diabetes?

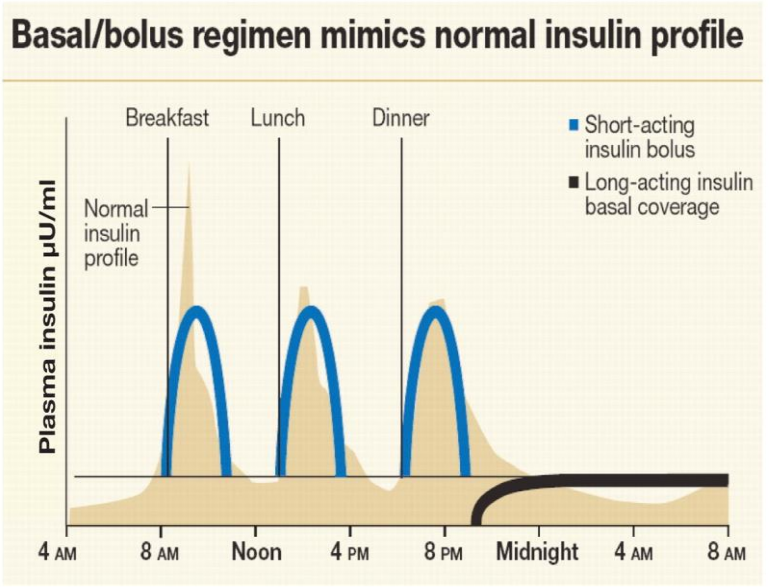
By establishing (basal – bolus regimen).

a basal level of insulin with

a small amount of insulin glargine

supplemented by small amounts

of insulin lispro at mealtimes.



2- What are the goals of therapy?

- Glycemic control
- HBA1C …. <7.0%
- Fasting plasma glucose …. (70-130 mg/dL)
- postprandial plasma glucose …. (<180 mg/dL)

Case scenario 2

12-year-old boy, having type 1 diabetes and is treated by insulin. His blood sugar levels were monitored regularly to estimate his insulin requirements.

He was found to have prebreakfast hyperglycemia, but his 3 a.m. blood glucose levels were normal. How can you control this early morning hyperglycemia?

- prebreakfast hyperglycemia develops due to waning of overnight basal insulin levels and provided that it is not accompanied by nocturnal hypoglycemia.
- It can be treated by increasing the dose of bedtime basal insulin.
- If patient was on NPH >> switch to glargine due to its longer duration of action.

Diabetic ketoacidosis (DKA)

- Three elements are required for the diagnosis:

❖uncontrolled hyperglycemia (blood glucose 250 mg/dL)

❖increased ketone concentrations.

❖metabolic acidosis (pH % 7.3)

- It occurs more often in patients with type 1 diabetes.
- Patients often present with nausea and vomiting, abdominal pain, polyuria, polydipsia, fatigue, and weight loss, decreased mental status , 25% present with coma.
- Signs of volume depletion, such as hypotension, tachycardia, and dry mucous membranes
- "fruity" breath resulting from acetone production.

causes of DKA

- The main factor leading to DKA is --->>>
- insulin deficiency which leads to reduced glucose uptake into skeletal muscle.
- Catabolism of fat stores increases serum concentrations of free fatty acids, which are then oxidized to ketone bodies in the liver; this also consumes bicarbonate, resulting in metabolic acidosis.

What are the basic principles of DKA management?

Key measures for treating DKA include:

1. Volume repletion
2. Correction of electrolyte abnormalities
3. Insulin therapy to correct hyperglycemia and ketonemia
4. Identification and treatment of the precipitating events e.g.. Infection.

DKA management

- Fluid Resuscitation:
  - Start intravenous (IV) 0.9% saline solution initially to correct hypovolemia.
  - Adjust the fluid rate based on the patient's response, vital signs, and urine output.
- Electrolyte Replacement:
- Monitor serum electrolytes closely, especially **potassium** levels. Add potassium to the IV fluids once the serum potassium level is below 5.5 mEq/L.
- Insulin Therapy:
  - Initiate a continuous **IV infusion of regular insulin** at a rate of 0.1 unit/kg/hr.
  - Monitor blood glucose levels hourly and adjust the insulin infusion rate to achieve a gradual decrease in blood glucose levels.
  - Once blood glucose reaches **200-250 mg/dL**, add **5% dextrose** to the IV fluids to prevent hypoglycemia.

- Acidosis Correction:
  - Monitor the patient's response to treatment by assessing arterial blood gas (ABG) values, including pH and **bicarbonate** levels.
  - Correct the underlying acidosis by providing adequate **fluid resuscitation and insulin therapy**.
- Monitoring and Supportive Care:
  - Continuously monitor **vital signs**, including blood pressure, heart rate, respiratory rate, and oxygen saturation.
  - Measure **urine output** hourly to assess response to fluid resuscitation.
  - Administer supplemental **oxygen** if respiratory distress is present.
  - Consider admission to the intensive care unit (**ICU**) for close monitoring and management in severe cases

Case scenario 3

John, 32 years old, with a history of type 1 diabetes mellitus, presents to the emergency room with complaints of severe abdominal pain, excessive thirst, frequent urination, and a fruity odor of his breath. He appears tachypneic, and severely dehydrated.

Vital signs are as follows: blood pressure 100/70 mmHg, heart rate 120 beats per minute, respiratory rate 30 breaths per minute. His blood glucose level is 400 mg/dL. Physical examination reveals dry mucous membranes, and a rapid pulse.

You suspect **Diabetic Ketoacidosis (DKA)**

1- What laboratory test should be done?

- Arterial blood gas (ABG): pH 7.2, bicarbonate (HCO_3^-)
- Serum electrolytes: Sodium (Na^+) Potassium (K^+)
- Urinalysis: Positive for ketones and glucose

2- How this case should be managed?

Case scenario 4

- A 42-year-old woman, was diagnosed with type 2 diabetes mellitus based on the history, physical examination, and lab results
- She was given dietary and lifestyle modification advice and was started on metformin 500 mg to be taken once a day with breakfast.

1. Which of the following actions most likely mediated the antidiabetic effect of the drug in the patient's disease?

A. Decreased breakdown of glycogen

B. Increased intestinal glucose absorption

C. Increased insulin secretion from pancreas

D. Increased glucose excretion in urine

E. Decreased glucose output from the liver

Answer is **E.** Decreased glucose output from the liver

2. She was instructed to take metformin with food. What is the primary reason for this instruction?

- About 20 to 30% of patients on metformin experience its **gastrointestinal adverse effects**, such as abdominal discomfort, anorexia, nausea, vomiting, and diarrhea. These adverse effects are dose-related and transient. These adverse effects can be minimized by
- taking the drug with or right after meals.
- Starting metformin with the lowest doses is also helpful in minimizing the risk of gastrointestinal adverse effects

3. Within 3 years her blood glucose levels required the metformin dose to be increased to 1,000 mg twice a day, but her HbA1C was remaining around 8.6%. Her physician decided to add another drug.

Which drug class do you recommend?

One option that is commonly followed is to add

- GLP-1 Agonists,
- (DPP-4) Inhibitors
- SGLTI.

Case scenario 5

- A 54-year-old patient attends the GP with dry cough, shortness of breath and **ankle swelling** over the past few days . He has a past medical history of type II diabetes.
- He was started on a new antidiabetic medication 10 days ago. Physical examination showed **peripheral edema, mild jugular venous distension.**

1. Which of the following drugs is most likely to have caused his new symptoms?

A. Acarbose
B. Pioglitazone
C. Metformine
D. Dapagliflozin
E. Glyburide

Answer is Pioglitazone

2. Sitagliptin was given to the patient after discontinuation of the previous medication. Which of the following molecular actions most likely mediated the therapeutic effect of this drug?

A. Inhibition of dipeptidyl peptidase-4

B. Inhibition of α-glycosidase

C. Activation of AMP-activated protein kinase

D. Activation of glucagon-like peptide (GLP)-1 receptors

E. Blockade of ATP-sensitive K+ channels

Answer is **A.** Inhibition of dipeptidyl peptidase-4

Case scenario 6

- A 62-year-old male became unconscious at his work and was taken to the nearest emergency department. Laboratory results indicated a blood glucose of 55 mg/dL. His wife told the doctor that her husband started a new antidiabetic medication 3 weeks ago that he takes once a day with breakfast.
- which of the following drugs cause this hypoglycemia?

A. Metformine.

B. Pioglitazone.

C. Sitagliptin.

D. Acarbose.

E. Glipizide.

Answer is **E.** Glipizide.

Case scenario 7

- A 36 years old female patient has a past medical history of Type 2 diabetes mellitus. Her blood glucose was controlled by gliclazide. Now, she becomes pregnant.
- what is the modification should be done for her diabetic condition?

It is recommended that oral hypoglycemic agents be avoided during pregnancy.

➢She should be switched to insulin therapy.


Thank
you!