1. Chapter 19
   Endocrine and Hematologic Emergencies

2. Introduction
   ● Endocrine system influences nearly every __________________________ organ, and bodily function.
   ● Endocrine disorders can have many signs and symptoms.
   ● Hematologic emergencies
     – Difficult to assess and treat
     – Your actions may save a life.

3. Endocrine System
   ● A complex message and __________________________ system.
   ● Glands secrete messenger hormones.
   ● __________________________ are chemical messengers.
   ● System maintains homeostasis
   ● Endocrine disorders are caused by an internal communication problem.

4. Anatomy and Physiology
   ● Glucose metabolism
     – The brain needs glucose and oxygen.
     – __________________________ is necessary for glucose to enter cells.
     – The pancreas produces glucagon and insulin.
       ● Stores and secretes insulin and glucagon in response the blood glucose level

5. Diabetes (1 of 2)
   ● Diabetes impairs the body’s ability to use glucose (sugar) for fuel.
   ● Complications include blindness, __________________________ disease, and kidney failure.
   ● Without treatment, blood glucose levels become too high.
     – In severe cases, may cause life-threatening illness, or coma and death

6. Diabetes (2 of 2)
● As an EMT, you need to know signs and symptoms of blood glucose that is:
  – High (____________________ )
  – Low (hypoglycemia)
● Central problem in diabetes is lack, or ineffective action, of ____________________________________.
● Hyperglycemia and hypoglycemia can occur with diabetes mellitus type 1 and type 2.
● All hypoglycemic patients require prompt treatment.

7 Defining Diabetes (1 of 2)
● Diabetes mellitus
  – Metabolic disorder in which the body cannot _______________________ glucose
  – Usually due to a lack of insulin.
● Glucose
  – One of the basic sugars in the body
  – Along with oxygen, it is a primary fuel for cellular metabolism

8 Defining Diabetes (2 of 2)
● Insulin
  – _______________________ produced by the pancreas
  – Enables glucose to enter the cells
  – Without insulin, cells starve
● Hormone
  – Chemical substance produced by a gland
  – Has special _______________________ effects on other body organs and tissues

9 Diabetes Mellitus Type 1 (1 of 5)
● _______________________ disorder where the immune system produces antibodies against the pancreatic beta cells
● Patient does not produce any insulin
● Insulin injected daily
● Onset usually in childhood through the fourth decade of life
  – Patient must obtain insulin from an external source

10 Diabetes Mellitus Type 1 (2 of 5)
● Many people with type 1 diabetes have an implanted insulin pump.
Many people with type 1 diabetes have an implanted insulin pump. – Continuously measures glucose levels and provides an ___________ infusion of insulin – Can malfunction and diabetic emergencies can develop – Always inquire about the presence of an insulin pump.

11 □ Diabetes Mellitus Type 1 (3 of 5)
   ● Most common metabolic disease of childhood
   ● New-onset patient symptoms:
     – _____________
     – Polydipsia
     – Polyphagia
     – Weight loss
     – Fatigue

12 □ Diabetes Mellitus Type 1 (4 of 5)
   ● Patient’s blood glucose level is above normal
     – Kidney’s filtration system becomes overwhelmed and glucose spills into the ______________ .
   ● Glucose is unavailable to cells.
     – Body turns to burning fat.
     – Produces acid waste (ketones)
     – Kidneys cannot maintain acid–base balance.
     – Kussmaul respirations result

13 □ Diabetes Mellitus Type 1 (5 of 5)
   ● If fat metabolism and ketone production continue, diabetic ketoacidosis (DKA) can develop.
   ● May present as generalized illness
   ● DKA can result in death.
     – Obtain patient’s history and presentation.
     – Obtain a glucose level.
       ● Generally higher than _______________ mg/dL

14 □ Diabetes Mellitus Type 2 (1 of 3)
   ● Caused by resistance to the effects of insulin at the cellular level
An association between obesity and increased resistance to the effects of insulin
Pancreas produces more insulin to make up for the increased levels of blood glucose and dysfunction of cellular insulin receptors.
Insulin can sometimes be improved by exercise and dietary modification.

Diabetes Mellitus Type 2 (2 of 3)
Oral medications used to treat type 2 diabetes
Some increase secretion of insulin and pose a high risk of hypoglycemic reaction.
Some stimulate for insulin.
Others decrease the effects of glucagon and decrease the release of glucose stored in the liver.
Injectable medications and insulin are also used for type 2 diabetes.

Diabetes Mellitus Type 2 (3 of 3)
Often diagnosed at a yearly medical examination from complaints related to high blood glucose levels, including:
Recurrent infection
Change in
Numbness in the feet

Severity of Diabetes
Severity of diabetic complications depends on patient’s blood glucose level and when diabetes began.
Obesity increases the risk of diabetes.
Diabetes complicates every other medical condition and injuries

Role of Glucose and Insulin
Glucose is the major source of for the body.
Constant supply of glucose needed for the brain.
Insulin acts as the key for glucose to enter cells.
Normal glucose (blood sugar) is to mg/dL.

Insulin
Classic Symptoms of Uncontrolled Diabetes (3 Ps)
- Polyuria: frequent, plentiful
- Polydipsia: frequent drinking to satisfy continuous thirst
- Polyphagia: excessive eating

Energy Sources
- The body uses glucose as a principal energy source
- When glucose is not available, the body turns to other sources
  - _________________ is most abundant.
  - Using fat for energy results in buildup of ketones and fatty acids in blood and tissue.

Symptomatic Hyperglycemia (1 of 4)
- Occurs when blood glucose levels are high
- Patient is in a state of altered mental status resulting from several combined problems.
  - In type 1 diabetes, leads to _________________ with dehydration from excessive urination
  - In type 2 diabetes, leads to a nonketotic hyperosmolar state of dehydration

Symptomatic Hyperglycemia (2 of 4)
- Hyperosmolar hyperglycemic nonketotic syndrome (HHNS)
  - When blood glucose levels are not controlled in diabetes mellitus type _________________

Symptomatic Hyperglycemia (3 of 4)
- HHNS key signs and symptoms
  - i. Hyperglycemia
  - ii. Altered mental status, drowsiness, lethargy
  - iii. Severe ________________________, thirst, dark urine
  - iv. Visual or sensory deficits
v. Partial paralysis or muscle weakness
vi. Seizures

Symptomatic Hyperglycemia (4 of 4)
- Higher glucose levels in the blood cause the excretion of glucose in the urine.
  - Patient increases fluid intake.
  - Patient cannot drink enough fluid to keep up with the exceedingly high glucose levels in the blood.
  - Urine becomes ______________________ and concentrated.
  - Patient may become unconscious or have seizure activity due to severe dehydration.

Symptomatic Hypoglycemia (1 of 3)
- Acute emergency where a patient’s blood glucose level ______________________ and must be corrected swiftly
  - Can occur in patients who inject insulin or use oral medications
  - When insulin levels remain high, glucose is rapidly taken out of the blood.
  - If glucose levels fall, there may be an insufficient amount to supply the brain.

Symptomatic Hypoglycemia (2 of 3)
- Mental status declines.
  - Patient may become aggressive or display unusual behavior.
  - Unconsciousness or permanent brain damage can quickly follow.
- Hypoglycemia develops much more ______________________ than hyperglycemia.
- Signs and symptoms of hypoglycemia
- Patient needs intravenous (IV) glucose or intramuscular (IM) or intranasal (IN) glucagon (beyond EMT competencies).
Symptomatic Hypoglycemia (3 of 3)
- Hypoglycemia is quickly reversed by giving the patient glucose.

Hyperglycemic Emergencies

Diabetic Ketoacidosis (DKA) (1 of 2)
- Decrease in insulin levels.
- Most common in type 1 diabetes
- ________________ cannot enter cells.
- Glucose accumulates in the blood.
- Body PH decreases
- Polyuria
- Polydipsia

Diabetic Ketoacidosis (DKA) (2 of 2)
- ________________ diuresis
- Dehydration
- Shock
- Cells metabolize fat, produce ketones as waste
- Retention of ________________ by kidneys which leads to cardiac arrhythmias

Hyperosmolar Hyperglycemic Nonketotic Syndrome (HHNS)
- More often caused by type 2 diabetes
- ________________, more gradual onset than DKA
- No sweet-smelling breath
- Other S/S same as DKA
- Excessive urination results in dehydration.

Hyperglycemic Crisis (Diabetic Coma) (1 of 3)
A state of unconsciousness resulting from:
- ________________
- Hyperglycemia
- Dehydration
- Excess blood glucose
Excess blood glucose
Hyperglycemic Crisis
(Diabetic Coma) (2 of 3)
Can occur in diabetic patients:
● Not under medical treatment
● Who have taken insufficient insulin
● Who have markedly _______________
● Under stress due to infection, illness, overexertion, fatigue, or alcohol

Hyperglycemic Crisis
(Diabetic Coma) (3 of 3)
● If untreated, can result in _______________
● Treatment may take hours in a well-controlled hospital setting.
● Suspect for all unconscious patients of unknown etiology

Diabetic Coma

S/S of DKA
● Air hunger (Kussmaul Respirations)
● Dehydration
● Sweet, _______________ breath odor
● Rapid, weak pulse
● Normal or slightly low blood pressure
● Varying degrees of unresponsiveness
● Gradual onset--over several hours or days
● Skin is normal

Management of DKA
● High flow oxygen
● Obtain blood glucose level if authorized
● Transport

Hypoglycemic Emergencies

Insulin Shock
(Hypoglycemic Crisis)

Insulin Shock
(Hypoglycemic Crisis)
● Three causes of Insulin Shock
  – insulin _____________________
–taking insulin but not eating adequately
–over exercising
● Decreased blood sugar
● Brain is deprived of sugar

42 S/S of Insulin Shock
1 ● Normal or rapid breathing
   ● Pale, __________________________ skin
   ● Sweating
   ● Dizziness, headache
   ● Rapid pulse
   ● Normal or slightly elevated B/P

2 ● Aggressive or confused behavior
   ● Hunger
   ● Fainting, seizure, or coma
   ● Weakness on one side of the body
   ● __________________________ Speech

43 Care for Insulin Shock
● Oxygen
● Obtain sugar level if authorized
● Give sugar if __________________________ (Instant Glucose)
● Contact ALS backup if unconscious or severe altered LOC
● Rapid Transport
   – True emergency

44 Diabetic Conditions

45 Diabetes and Alcohol Abuse
● Patients may appear __________________________.
● Suspect hypoglycemia with any altered mental status.
● Be alert to the similarity in symptoms of acute alcohol intoxication and diabetic emergencies.
● Diabetics may drink alcohol and become intoxicated

46 Emergency Medical Care (1 of 2)
Ask a patient with known diabetes:
Do you take insulin or any pills to lower blood sugar?
Have you taken your usual dose of ________________ (or pills) today?
Have you eaten normally today?
Have you had any illness, unusual amount of activity, or stress today?

Emergency Medical Care (2 of 2)

Perform initial assessment.
Obtain baseline vital signs and SAMPLE history.
Check for emergency medical identification symbol.
Always do a full, careful assessment.
Ask patient or family about last meal or insulin dose.
_____________________ administer anything by mouth to an unconscious patient.

DKA vs. Insulin Shock

Pt eaten but has not taken insulin?
- DKA
Pt taken insulin and has exercised profusely?
- Insulin shock
Pt accidentally took two doses of insulin?
- Insulin shock
Pt has been sick and vomiting lately and has been taking insulin?
- Insulin Shock

DKA vs. Insulin Shock

Pt has taken insulin and has been eating normally?
- ?????
Pt has not been eating and has not taken insulin?
- ?????
When in doubt, GIVE SUGAR!!

Administering Glucose (1 of 4)

Names:
– Glucose
– Insta-Glucose
Dose equals ________________ grams (one tube)
Glucose should not be given to a diabetic patient with a decreased level of consciousness.

51 Administering Glucose (2 of 4)
- DO NOT give glucose to a patient with the inability to ______________________ or unconscious.
- Give between cheek and gums

52 Administering Glucose (3 of 4)
- Make sure the tube is intact and has not ______________________.
- Squeeze a generous amount onto a bite stick.

53 Administering Glucose (4 of 4)
- Open the patient’s mouth.
- Place the bite stick on the mucous membranes between the cheek and the ______________________ with the gel side next to the cheek.
- Repeat if needed

54 Complications of Diabetes
- Heart disease
- ______________________ disturbances
- Renal failure
- Stroke
- Ulcers
- Infections of the feet and toes
- Seizures
- Altered mental status

55 Seizures
- Consider ______________________ as the cause.
- Use appropriate BLS measures for airway management.
- Obtain blood glucose level if authorized
- Call for ALS backup for IV administration of glucose
- Provide prompt transport.

56 Geriatric Needs
- Patient may have undiagnosed diabetes.
Certain symptoms suggest poorly controlled or uncontrolled diabetes.

- Nonhealing wounds
- Blindness
- Renal failure

Obtain a _________________ history.

Check blood glucose level if authorized.

**Blood Glucose Monitors**

- Test strips
- Normal range 80-120 mg/dL

There are numerous different glucometers. You must become familiar with the one used on your service.

**Hematologic Emergencies**

- Hematology is the study and prevention of blood-related diseases.
- Blood is “the fluid of life.”
  - Understanding it helps understand disorders.

**Blood**

- Made up of cells and _________________.
- Red blood cells contain hemoglobin, which carries oxygen to the tissues.
- White blood cells respond to infection and collect dead cells for their correct disposal.
- Platelets assist in clot formation.
- Plasma transports blood cells.

**Sickle Cell Disease (1 of 2)**

- Inherited disorder, affects _________________ blood cells
- Predominant in African, Caribbean, and South American ancestry
- People with sickle cell disease have misshapen RBCs that lead to dysfunction in _________________ binding and unintentional clot formation.
  - Clots may result in a blockage known as vaso-occlusive crisis.

**Sickle Cell Disease (2 of 2)**

- May cause hypoxia; swelling or rupture of blood vessels or
May cause hypoxia; swelling or rupture of blood vessels or pain and organ damage, and death
● Sickle cell disease (cont’d)
  – Sickled cells have a short life span
  – Results in more cellular waste products and contributing to sludging of the blood

62 Complications of Sickle Cell Disease (1 of 2)
1 ● Cerebral vascular attack
● Gallstones
● Jaundice
● Avascular necrosis
● Splenic dysfunction
● __________________________ tolerance
2 ● Leg ulcers
● Retinopathy
● Chronic pain
● Pulmonary hypertension
● Chronic renal failure
● Anemia
●

63 Complications of Sickle Cell Disease (1 of 2)
● Sickle cell disease (cont’d)
  – Many of these complications are very __________________________ and potentially life threatening.

●

64 Clotting Disorders
● Thrombophilia
● Hemophilia
●

65 Thrombophilia
● Tendency to develop blood __________________________
● Blood-thinning medications used to treat
● Not common in pediatric patients
● Risk factors:
– Recent surgery, impaired mobility, congestive heart failure, cancer, respiratory failure, infectious diseases, over 40 years of age, being overweight/obesity, smoking, oral contraceptive use

66 Hemophilia (1 of 2)

● Rare: Only about 20,000 Americans have the disorder.
● Congenital; impaired ability to____________________ blood clots
● Predominant in males (1 per 5,000–10,000)
● Hemophilia A most common
● Patients typically have intravenous factor VIII replacement infusions (which help the blood clot) close at hand.

67 Hemophilia (1 of 2)

Signs and symptoms:
● Spontaneous, acute, chronic bleeding
●____________________ bleeding (major cause of death)
● During assessment, seriously consider injury/illness that can cause bleeding.

68 Deep Vein Thrombosis

● Clotting disorders—deep vein thrombosis (DVT)
   – Common medical problem in sedentary patients and in patients who have had recent injury or____________________
   – Methods designed to prevent blood clot formation, include:
     ● Blood-thinning medications
     ● Compression stockings
     ● Mechanical devices

69 Deep Vein Thrombosis

● Clotting disorders—DVT (cont’d)
   – Risk factors
   – Treatment
     ●____________________ therapy
     ● Oral medications typically administered for at least 3 months after diagnosis of a DVT
   – A clot from the DVT can travel from the patient’s lower extremity to the lung, causing a pulmonary embolus.
Emergency Medical Care for Hematologic Disorders

- Mainly supportive and symptomatic
- Patients with inadequate breathing or altered mental status:
  - Administer high-flow $O_2$ at 12 to 15 L/min.
  - Place in a position of ______________________.
  - Transport rapidly to hospital.