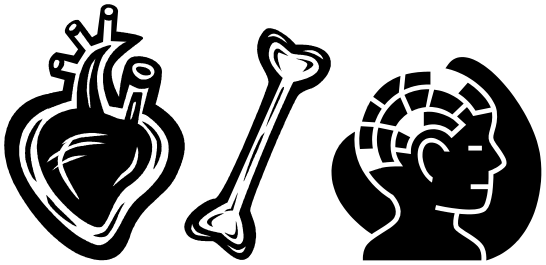
CHAPTER 5

MEDICAL PROBLEMS OF OBESITY

Being overweight can lead to serious health problems in both children and adults. More and more young people are developing "adult" diseases such as high blood pressure, type 2 diabetes, cardiovascular disease, and high blood cholesterol. Obesity can also lead to breathing problems during sleep, as well as joint injuries. For girls, obesity can result in hormone imbalances and fertility problems down the road.

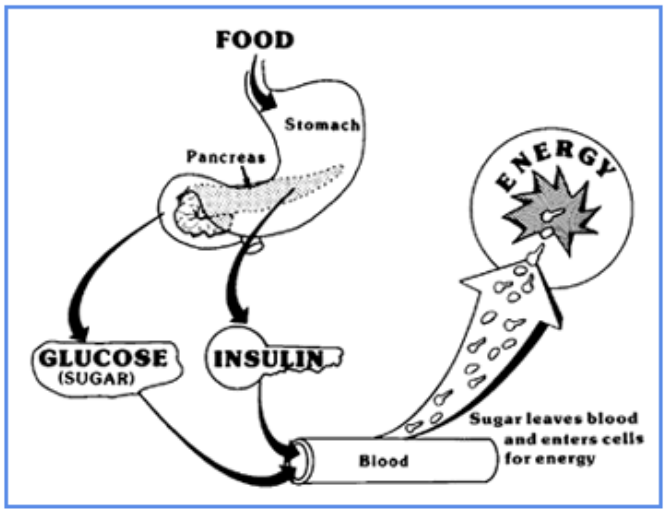


Type 2 diabetes

Diabetes is a disease that prevents your body from converting food into energy. During digestion, enzymes break down much of the food you eat into a simple form of sugar called glucose. Glucose is absorbed into the blood and carried to all parts of the body. Your cells use glucose to fuel the body's energy and growth needs. However, glucose can't enter the cells unless the hormone insulin is present. Normally, insulin is produced by the pancreas, a large gland located behind the stomach.

When you have type 2 diabetes, your pancreas continues to makes insulin—at least at first—but the hormone doesn't efficiently "unlock" the cells to let the glucose enter. This condition is known as *insulin resistance*. It can occur even before actual diabetes develops. The pancreas responds to insulin resistance by making extra insulin to keep blood

sugar in check. Eventually, the pancreas can't keep up with the demand. Excess glucose builds up in the blood. Meanwhile, your cells are starved for energy.



Untreated, diabetes leads to serious complications. Over time, the excess glucose in the blood damages the heart, blood vessels, kidneys, nerves and other organs. Uncontrolled diabetes can result in heart attack or stroke, vision problems, kidney failure, and loss of limbs.

What causes diabetes?

There are two kinds of diabetes that occur in children: type 1 and type 2. Type 1 diabetes is brought on by a defect in the immune system that causes the body to destroy the insulin-producing cells in the pancreas. Doctors used to think type 1diabetes was the only form of the disease children could get. However, children and teens are increasingly being diagnosed with type 2 diabetes. This development can be traced largely to lifestyle factors such as obesity and lack of physical activity.

What are the risk factors for type 2 diabetes?

The following factors can lead to developing type 2 diabetes:

- **Obesity**

- **Family history of diabetes**
- **Ethnic background (African-American, Hispanic, American Indian, Asian, or Pacific Islanders all have a higher risk than caucasians)**
- **Lack of physical activity**
- **Puberty**

What are the symptoms of type 2 diabetes?

Children and teens often don't show the typical symptoms of type 2 diabetes--thirst, increased urination, and weight loss. Instead, high blood sugar is usually uncovered during a routine check up.

However, your doctor may want to do a check for diabetes if you are overweight and have any of the following symptoms. These conditions are signs that your body isn't using insulin well:

- **Patches of thick, dark skin around the neck or under the arms called *acanthosis nigricans***
- **Polycystic ovary**

True or False: Common Myths about Diabetes

Eating too much sugar causes diabetes. FALSE
There is absolutely no link between eating sugar and getting diabetes. But, that said, obesity is a major risk factor for type 2 diabetes and insulin resistance. And, overindulging in sweet and fatty foods often leads to overweight…

People with diabetes can never eat any sugar. FALSE
People with diabetes can eat natural and refined sugars as long as they keep their total carbohydrate intake within the limits set out by their meal plan. It's important to remember that foods with large amounts of added sugar often provide few nutrients for the number of calories they contain.

People with type 2 diabetes don't need insulin. FALSE
Sometimes diet, exercise, and medication fail to keep blood glucose levels in acceptable ranges. In these cases, insulin injections are necessary to keep blood glucose on target.

Kids only get type 1 diabetes. FALSE
Type 2 diabetes was once considered an "adults only" disease. But, the rising rate of obesity among children and teens has opened the door to type 2 diabetes in this age group.

Type 2 diabetes is not as serious as type 1. FALSE
Uncontrolled, both type 1 and type 2 diabetes can lead to serious complications. These include high blood pressure, heart disease, nerve damage, limb loss, kidney failure, and blindness.

Having diabetes means a strict "diabetic diet". FALSE
There is no such thing as a "diabetic diet." People with diabetes need to eat a balanced diet that includes that includes a variety of nutritious food. But, as long as you pay attention the effects of food on your blood sugar, there is room for your old favorites—in moderation, of course.

syndrome (PCOS)

- **High blood pressure**
- **Abnormal cholesterol levels**

How is type 2 diabetes treated?

Just as with adults, the treatment goal for children and teens is to keep blood sugar levels as close to normal as possible. This will greatly lower the risk of complications down the road. A management plan for type 2 diabetes usually includes one or more of the following steps:

- **Meal planning.** A dietitian or diabetes educator will develop an eating plan to manage diabetes. This type of plan outlines what types of foods to eat when to keep blood sugar in control. It can also help with weight loss.
- **Regular physical activity.** A child or teen with type 2 diabetes needs regular physical activity. Exercise helps lowers blood glucose because it ups the body's use of energy. It also helps with weight control.
- **Blood glucose monitoring.** Regular blood sugar checks are an important part of diabetes care. The readings let you know if your blood sugar is in a healthy range. A doctor or nurse will show you how to use a blood glucose meter and tell you when you should check your blood.
- **Oral medicines.** If blood sugar can't be managed with diet and exercise alone, oral medicines ("diabetes pills") may be added. These drugs help your body use the insulin it makes more effectively.

- **Insulin.** Insulin may be added to your treatment plan when blood sugar can't be controlled with diet, exercise, and oral medications alone. Insulin must be injected under the skin.

High Blood Cholesterol

Lipids are fat particles in the blood. Cholesterol is a type of lipid. In adults, the level of blood lipids has been directly linked to the build up of fatty deposits—called plaques—on the walls of the arteries. This can lead to heart disease. Several studies have pointed out that these fatty deposits begin forming in the arteries during childhood. The deposits build up slowly over time. As a result, the consequences—heart disease and stroke—are not usually seen until later in adulthood. It appears, though, that high blood cholesterol levels in childhood speed up the accumulation of deposits in the arteries. This makes heart disease more likely as an adult.

Preventing Fatty Buildup in Arteries

Children and teens can prevent fatty deposits in the arteries from progressing into heart disease by taking the following steps:

- Avoid obesity or lose weight if you're overweight.
- Get 30 to 60 minutes of moderate exercise on most days of the week.
- Don't start smoking or quit if you already smoke.
- Get checked for high blood pressure and diabetes and treat those conditions as necessary.

What are the different types of blood lipids?

Most lipids travel in the blood in chemical bundles of fat and protein called lipoproteins. The more fat a particle has, the lower its density. That means low density lipoproteins contain more cholesterol and high density particles have more protein. The types of lipids found in the blood are:

- **LDL (low-density lipoprotein).** Commonly called "bad" cholesterol, LDL leads to the build up of plaque in the arteries. LDL constitutes 60 to 70% of the total cholesterol in the blood. A high LDL level increases your risk of heart disease. A low-fat diet and regular exercise can reduce LDL.
- **VLDL (very-low-density lipoprotein).** Another "bad" cholesterol, these particles are made up mostly of fat. VLDL accounts for 10 to 15% of total cholesterol.
- **HDL (high-density lipoprotein).** This is the "good" cholesterol. HDL makes up 20 to 30% of total cholesterol. It helps prevent the build up of fatty deposits in the arteries by removing cholesterol from the blood. A low level of HDL (below 40mg/dl) is a risk factor for heart disease, while a high level (above 60mg/dl) is considered a "negative risk factor" because it protects against heart disease. Weight loss, quitting smoking, and getting regular exercise are factors that can help raise HDL levels. Eating trans fatty acids (found in margarine and other hydrogenated oils) is thought to decrease HDL levels.
- **Triglycerides.** This is another type of fat that travels in the bloodstream. Most body fat is stored in the form of triglycerides. The link between triglycerides and heart disease is still being researched. However, high triglycerides may be linked to unhealthy levels of other blood lipids.

How are blood lipids measured?

A simple blood test is all that's needed to measure your blood lipids. Your doctor may ask you to not eat for 8 to 12 hours before having the blood test. Your total

cholesterol number is the sum of all the types of blood lipids. This reading provides a "snapshot" of your heart disease risk. But looking only at your total cholesterol reading can be misleading. For example, a low HDL can offset a high LDL making the total look normal, even though both the HDL and LDL are at unhealthy levels. Before a doctor begins any sort of treatment, he or she would want to see a complete break down of all the blood lipids.

The following are guidelines set out by the National Heart Lung and Blood Institute for cholesterol levels in children and teens:

Cholesterol levels in Children and Adolescents 2–19 years old		
Category	**Total Cholesterol (mg/dL)**	**LDL Cholesterol (mg/dL)**
Acceptable	less than 170	less than 110
Borderline	170–199	110–129
High	200 or greater	130 or greater

In addition, HDL levels should be greater than or equal to 35 mg/dL and triglycerides should be less than or equal to 150 mg/dL for children and teens.

What are the risk factors for high blood cholesterol?

The following factors can lead to problems in blood lipid levels:

- **Sedentary lifestyle**
- **High fat diet**
- **Obesity**
- **Family history**

High Blood Pressure

When you have high blood pressure (also called hypertension), your heart has to pump with extra force to move blood around your body. Children, even very young babies, can have high blood pressure. High blood pressure is a major risk factor for heart disease and stroke in adulthood. Detecting and treating high blood pressure early is important for both children and adults. The American Heart Association recommends that all children over age 3 get their blood pressure checked.

High blood pressure hurts the arteries and the smaller vessels, arterioles, that connect to the tiny capillaries. The constant force of the blood against the artery walls eventually damages the delicate linings. As a result, the arteries become scarred and hardened. This makes it more difficult for blood to pass, and adds to the workload of the already stressed heart. Injury to the artery lining also promotes the build up of fatty deposits in the vessels. These deposits can rupture, leading to blood clots that can cause heart attack and other organ damage.

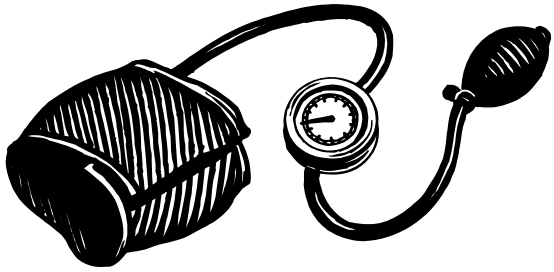
The extra work that high blood pressure causes for your heart makes the heart muscle weaken and enlarge over time. At first, a slightly enlarged heart may still work well enough to hide the damage that is taking place. But, as the heart muscle continues to weaken, it isn’t able to pump hard enough to get oxygen and nutrients to the organs and tissues.

How is high blood pressure classified?

A blood pressure reading is expressed as two numbers, one over the other. The top number is called the *systolic pressure*. This is a measurement of pressure against the artery walls when your heart beats. The bottom number is the *diastolic pressure*. This is the pressure in the arteries when the heart relaxes between heart beats. Both numbers are important.

Blood Pressure Classification in Adults (18 and Older)		
Category	***Systolic (mm Hg)***	***Diastolic (mm Hg)***
Normal	Lower than 120	Lower than 80
Prehypertension	120 - 139	80 - 89
Hypertension:		
Stage 1	140-159	90-99
Stage 2	160 or higher	100 or higher

Blood pressure classification for children is more complicated than it is for adults. A child's blood pressure normally rises with age. For this reason, a child's age, sex, and height have to be taken into account when determining normal blood pressure. High blood pressure is diagnosed when a child's pressures are at the high end of the range expected for healthy children of the same age, sex, and height.



Blood Pressure Classification in Children and Adolescents	
Category	***Systolic/Diastolic Blood Pressure (percentile compared to children of the same age, sex, and height)***
Normal	Less than 90th percentile
Prehypertension	90th to less than 95th *OR* 120/80 mm Hg
Hypertension:	
Stage 1	95th to 99th percentile plus 5 mm Hg
Stage 2	99th percentile plus 5 mm Hg

The 95 th Percentile of Blood Pressures (mm Hg) in Children and Teens*

	Girls	Girls	Boys	Boys
Age in years	**50 th percentile for height**	**75 th percentile for height**	**50 th percentile for height**	**75 th percentile for height**
1	104/58	105/59	102/57	104/58
6	111/73	112/73	114/74	115/75
12	123/80	124/81	123/81	125/82
17	129/84	130/85	136/87	138/88

***Adapted from "Update on the 1987 Task Force Report on High Blood Pressure in Children and Adolescents: a working group report from the National High Blood Pressure Education Program"**

What are the risk factors for high blood pressure?

In some cases, high blood pressure is the result of another disease and will disappear when the underlying problem is treated. In most cases, however, experts don't know exactly what causes high blood pressure or what to do to prevent it. Research has shown that several factors contribute to a person's risk of developing this condition. These include:

Long Term Risks of High Blood Pressure

- Heart attack
- Stroke
- Kidney failure
- Eye damage
- Congestive heart failure

- **Family history.** People whose parents have high blood pressure are more prone to the condition.
- **Race.** African Americans are more likely to have high blood pressure than are Caucasians.
- **Male sex.** Men have a greater risk of high blood pressure than women until age 55 when both sexes have similar levels of risk. At age 75, women are more likely to have the condition.
- **Increasing age.** Blood pressure increases with age. Older people are more likely to have high blood pressure than younger people.
- **Salt (sodium) sensitivity.** For some people, eating foods high in sodium raises blood pressure. Sodium is one of the main components of table salt and is frequently found in very high levels in snack foods and drinks.
- **Obesity.** Children who are obese are three time more likely to have high blood pressure.

In addition, several other factors may also play a part in high blood pressure, including sedentary lifestyle, heavy

alcohol intake, diabetes, pregnancy, and certain over-the-counter medications.

How is high blood pressure treated?

We treat high blood pressure with changes in diet and lifestyle as well as with medications.

- **Diet and lifestyle changes.** This is the first step in treatment. Changes that help lower blood pressure include:
    - **Limiting sodium in your diet**
    - **Eating plenty of fruits and vegetables**
    - **Following a diet that is high in calcium, magnesium, and protein and low in fat and cholesterol**
    - **Limiting alcohol intake**
    - **Losing weight**
    - **Increasing physical activity**
    - **Quitting smoking**

- **Medication.** If diet and lifestyle changes don't bring blood pressure down to a healthy level, your doctor may add one or more medications to your treatment. These drugs act in different ways in the body. Also, different people often respond to them differently. For that

reason, you may have to try several medications before hitting on the right combination. The types of high blood pressure medicines are:

- **Diuretics.** Rid the body of excess fluid and salt. They are sometimes called "water pills."
- **Beta blockers.** Ease the heart's workload by the lowering heart rate and reducing the volume of blood the heart pumps out.
- **Vasodilators.** Relax the muscles in the blood vessel walls.
- ACE inhibitors. Interfere with the body's production of angiotensin II, a chemical that the arteries to tighten.
- **ARBs.** Block the effects of angiotensin II.
- **Calcium channel blockers.** Decrease the force of the heart's pumping and relax the blood vessels.

Polycystic Ovary Syndrome (PCOS)

Polycystic ovary syndrome is a hormone imbalance. As a result, a woman's eggs don't develop normally in the ovaries. This causes irregular menstrual periods and other symptoms. For many women with PCOS, fluid-filled cysts form in the ovaries instead of eggs.

PCOS often first appears in the teen years around the start of menstruation. It is the most common type of female hormonal disorder, affecting between 5% and 10% of all women. PCOS can be mild or severe. Researchers think that heredity may play a part in the tendency to develop PCOS. The condition also seems to be linked to a higher than normal chance of developing diabetes.

What are the symptoms of PCOS?

No two women will have exactly the same symptoms with PCOS. However, the following traits are commonly seen with the condition:

- **Irregular menstrual periods.** Periods may come every several months or may not come at all.
- **Excess hair growth (hirsutism).** Extra hair on the face in the sideburn area, chin, and upper lip. Hair may also grow on the chest, nipples, lower abdomen, and thighs.
- **Hair loss.** Male-pattern baldness.
- **Acne.**
- **Polycystic ovaries.**
- **Obesity.**
- **Infertility.**

What causes PCOS?

PCOS occurs when your ovaries make excessively high levels of male hormones called androgens. (Testosterone is a form of androgen.) Androgen overproduction is caused by other hormone imbalances in the body. One such situation is a too high level of LH (luteinizing hormone), which is produced by the pituitary gland in the brain. Your ovaries can also be stimulated into producing extra testosterone when insulin in your blood is at a high level. Some women's ovaries may be more susceptible to the effect of insulin than others; therefore they may be more prone to PCOS.

Obesity is another factor in PCOS. Although not all women who have PCOS are overweight, excess body fat can lead to high levels of blood insulin. This can spur overproduction of male hormones in women who are predisposed to the condition.

Long term Risks of PCOS

Not all women with PCOS will develop the following conditions. However, the disorder puts you at higher risk for these problems.

- Fertility problems
- Endometrial cancer
- Diabetes
- Abnormal cholesterol levels
- Cardiovascular disease

How is PCOS diagnosed?

The common symptoms of PCOS—hair growth, acne, irregular menstruation, and obesity—may appear unrelated at first. Women are often not diagnosed until symptoms are advanced. PCOS is also frequently discovered when a woman experiences problems becoming pregnant.

When diagnosing PCOS, your doctor will try to rule out other conditions that may cause similar symptoms. Diagnosis will include a complete physical exam and medical history. Your doctor may also call for one or more of the following tests:

- **Ultrasound.** Checks if the ovaries are enlarged and contain cysts.
- **Blood tests.** Determine if there are high levels of androgens, LH, and other hormones.
- **Ovarian testing.** Monitors ovaries' response to specific hormones and medications.

How is PCOS treated?

PCOS can be treated but the condition never goes away. There are two avenues of treatment. Standard therapies

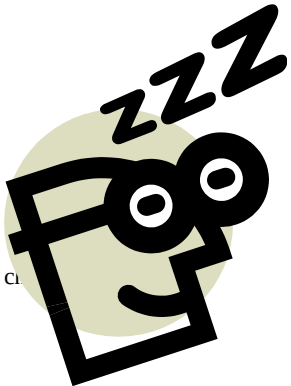
address the symptoms but don't correct the underlying problem. Newer treatments attempt to get at the root cause of PCOS by lowering the body's production of insulin.

Standard therapies:

- **Birth control pills.** Contain hormones that help regulate periods. Regular menstruation can help reduce the risk of endometrial cancer down the road.
- **Anti-androgens.** Block the effects of male hormones. These medicines can reduce acne and limit the growth of unwanted hair.
- **Fertility treatments.** Various techniques that help women to become pregnant.

Newer treatments:

- **Insulin-lowering medications.** Pioglitazone (Actos), rosiglitazone (Avantia) and metformin (Glucophage). These drugs are currently used to treat diabetes. They help lower reduce insulin resistance and lower insulin levels in the body. Research suggests that these medicines may help restore regular periods and cut down on the health risks associated with PCOS. They may also help reduce symptoms connected with too much male hormone. These drugs are not currently approved for treatment of PCOS, but trials are underway to test their effectiveness.



Obstructive Sleep Apnea (OSA)

When you have obstructive sleep apnea, your airways become blocked while you are sleeping. As a result, breathing stops and

air flow to the lungs is cut off for several seconds at a time. This is followed by a sudden attempt to breath. Often, a person with OSA will shift to a lighter sleep or wake up during these episodes. Periods of blocked breathing followed by waking can occur up to 60 times a night.

OSA is a serious, even life-threatening condition. Untreated it can lead to learning and behavior problems. It may also result in delayed growth and development, high blood pressure, and heart problems.

What causes OSA?

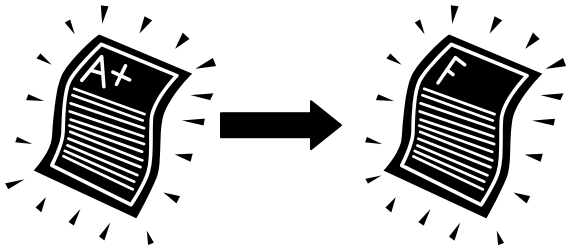
The muscles in your airways relax while you sleep. As a result, the tissues in the nose and throat fold closer together. Normally, there is still enough space for air to flow in and out of the lungs. But, if there are blockages in the airways, air flow can be cut off completely during sleep. A common cause of blocked airways is overly large tonsils. Obesity can also contribute to OSA because fat tissue can build up around your neck and throat. In addition, excess belly fat can push upward against your diaphragm—especially when you're lying down—and prevent air from flowing freely in and out of the lungs. The effects of OSA—daytime sleepiness and fatigue—make it even harder for an overweight child to be physically active and further contribute to obesity.

What are the symptoms of OSA?

Symptoms can vary from person to person. Some common indicators are:

- **Loud snoring**

- **Bedwetting**
- **Periods of not breathing during sleep**
- **Restless sleep**
- **Nightmares or other sleep disturbances**
- **Repeated waking to restore breathing**
- **Strange sleeping positions**
- **Excessive daytime sleepiness**
- **Mouth breathing**
- **Hyperactivity during the day**
- **Irritability**
- **Poor school performance**



How is OSA diagnosed?

Parents who notice their child snoring loudly or breathing noisily during sleep should talk to the child's doctor. The next step is often an evaluation by an ear, nose, and throat (ENT) specialist. This generally includes:

- Medical history and exam
- Review of behavioral or developmental problems
- Examination of the airways to check for blockages
- Sleep study to monitor brain, heart and muscle activity, chest wall movement, and air flow while the child is sleeping

The sleep study will record periods when airflow is fully or partially cut off and blood oxygen levels drop. If these episodes occur one or more times per hour, OSA is considered a problem.

What are the treatments for OSA?

Treatment for OSA depends on the cause of the problem. The most common cause of OSA is enlarged tonsils and adenoids. In this case, surgery to remove these glands usually solves the problem. When OSA is caused by obesity, weight loss is the first step. In addition, a special mask that blows air into the nose to keep the airway open during sleep may be needed. This is known as a continuous positive airway pressure (CPAP) machine.

In extreme cases, an operation is done to insert a tube in the neck. The tube is fitted with a valve that is closed during the day so the person can speak, but opened at night to allow air to flow directly into the windpipe and bypass the blockage.