

An Introduction to the Liver

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The liver is the largest organ in the body. It is reddish-brown, weighs about three pounds (in the adult male) and is about the size of a football. It is located behind the ribcage on the upper right side of the abdomen. The liver is special in that it can regrow its own tissue. As much as three-quarters of the liver can be removed, and the organ can grow back in about a month. Because of this regrowth, livers for transplants can be taken from living donors.

The liver has four lobes or sections. Each lobe is made up of lobules, which contain the working liver cells. The liver has blood coming into it from many places. It gets oxygen-rich blood from the heart through the main artery leading into the liver (hepatic artery). Another source is oxygen-poor blood containing nutrients, poisons, and other things that come from the intestines (portal vein). The liver filters this blood, then sends it on to the heart through the hepatic vein.

Functions of the Liver

The liver's job is to run over 500 bodily functions. It plays a role in the processing of food, sugar and fat. It also plays a key role in the body's defense system—the immune system. It processes almost everything a person eats, breathes, or takes in through the skin. About 90% of the body's nutrients pass through the liver from the small and large intestines. The liver changes food into energy, stores this energy, and makes blood proteins. The liver also removes bacteria and poisons from the blood. A baby's liver also makes blood cells in the womb.

Digestion

The liver plays an important role in the breakdown of food in the body. Liver cells make bile, a greenish-yellow fluid that helps in the breakdown of fats and in bringing nutrients into the body. Waste made by the liver in the breakdown of food is carried in the bile and removed from the body. Someone with a liver that is not working well may have less bile. They may not process wastes as well as a person with a healthy liver. When this happens, the body may have trouble processing food. Liver cells also change heme (a portion of hemoglobin that is released when red blood cells are broken down) into bilirubin. When the liver is damaged, bilirubin may build up in the blood causing yellowing of the skin and whites of the eyes (jaundice).

Metabolism (Processing)

The liver helps provide the body with energy. It controls the production, storage, and release of sugar, fats, and cholesterol. When food is eaten, the liver changes glucose (blood sugar) into glycogen. The glycogen is then stored in the liver as an energy source for later use. During the night while you sleep, the liver changes glycogen back

into glucose when energy is needed at night. This process is called gluconeogenesis. The liver controls the storage of fats by changing amino acids (the building blocks of protein) into fatty acids. Some fatty acids, such as triglycerides are changed by the liver into ketones. Ketones are fuel for muscles. Ketones are used when the body does not have enough sugar. The liver also makes, processes and removes cholesterol from the body. Cholesterol is an important part of cell structures and certain hormones.

Storage

The liver stores several nutrients, including vitamins A, D, B9 (folate), and B12. In fact taking too much of vitamin A and D can harm the liver. The liver also stores iron and is important in changing iron into heme. Heme is the oxygen-carrying portion of the red blood cells.

Making Proteins

The liver builds many important proteins, including enzymes, hormones, clotting factors, and immune factors. Liver enzymes called ALT and AST (aminotransferases or transaminases) break down amino acids from digested food. They then use these parts to build new proteins needed by the body. These enzymes can build up to high levels in the blood when the liver is damaged. This is why ALT and AST are measured in tests to find out if there is damage in the liver. Several of the proteins made by the liver are needed for blood to do its job. The blood's job is to move vitamins, minerals, hormones, fats and special proteins, like albumin (a protein that helps maintain proper blood volume). The liver also makes clotting factors to help the blood clot after an injury. Low levels of clotting factors can cause bleeding and easy bruising. Other proteins made by the liver include alkaline phosphatase, gamma-glutamyl transferase (GGT), and insulin growth factor.

Filters and Detoxifies

The liver plays an important role in removing harmful substances and toxins that enter the body. These include alcohol, drugs, harmful chemicals, pesticides, and heavy metals. The liver can become overworked when high levels of these things buildup in the body. These substances are first brought to the liver by the portal vein. The liver then processes these substances and removes them in the bile. The liver also processes and removes harmful substances that the body produces naturally. These include ammonia and extra hormones (especially sex hormones, such as estrogen). Many drugs and certain herbal remedies can hurt the liver if taken in high doses or over long periods of time. These even include common over-the-counter drugs, like Tylenol® (acetaminophen). However, if Tylenol is taken

in the right doses as prescribed by your medical provider it is safe. For this reason, people should be very cautious about taking more than one drug at a time and mixing them with alcohol. *Never mix Tylenol and alcohol.* If the liver is harmed, it may not be able to break down and remove drugs very well. This could cause the drug levels to become too high and cause side effects that may hurt the body.

Liver Damage

Chronic hepatitis C infection, drinking too much alcohol, and other factors can lead to serious liver damage. Since the liver performs so many important jobs, harming the liver can hurt almost all of the body's systems. This includes the intestines, heart and other organs important in making hormones and keeping the body from getting infections and cancer. A normal liver can develop light scarring, called fibrosis, fatty liver, called steatosis, and, the more damaged the liver becomes, the liver can develop heavy scarring, called cirrhosis. If the liver becomes too heavily damaged, it is no longer able to do the many jobs that are needed to keep the body healthy.

There are different levels of damage that can occur to the liver. In the first level, the liver is only scarred but can still function pretty normally (compensated cirrhosis). In the next level, the liver is so damaged that it is unable to function properly (decompensated cirrhosis). Within these definitions there are many different levels of liver damage so check with your medical provider.

Scar tissue may block the normal flow of blood through the liver. This causes the blood to back up. This can then cause high blood pressure in the veins and arteries entering and leaving the liver (portal hypertension), and stretched and weakened blood vessels in the throat and stomach (varices). People with severely damaged livers may also have:

- fluid build up in the abdomen (ascites)
- swelling, especially in the legs and ankles (edema)
- kidney damage (renal failure)

If the liver is unable to remove poisons and other harmful substances like ammonia, these chemicals may build up in the blood. This can lead to trouble with thoughts and thinking, a change in personality, confusion and even coma (encephalopathy). People with long-term liver damage sometimes end up with cancer of the liver, but this usually happens only after the liver develops cirrhosis.

Keeping the Liver Healthy

There are many things you can do to help keep the liver healthy.

Healthy Liver Tips:

- Eat a healthy, well-balanced diet that follows the new Food Guide Pyramid. This diet is low in fat, sugar and salt, high in whole-grain products, and has enough protein. Protein is in most meats, chicken, turkey, cheeses, nuts and beans. Visit www.mypyramid.gov for more information on nutrition.
- Don't drink alcohol, or at the very least, limit how much you drink.
- Don't use recreational drugs.
- Take your prescriptions as instructed by your doctor or nurse.
- Be careful when mixing over the counter drugs, prescription drugs, herbal supplements, street drugs and/or alcohol.
- Stay away from poisonous liquids and fumes including solvents, paint thinners, and bug killers. If you have to use such chemicals, cover your skin, wear gloves and a mask and keep the windows open to allow air in.
- Do not eat raw or undercooked shellfish, which may have diseases that can be harmful to the liver.
- Ask your doctor to give you both the hepatitis A and the hepatitis B vaccinations if you have not been previously infected.

**Visit the HCV Advocate Web Site:
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