Most readers probably know that the liver is the biggest gland in the body and the focal point of many of our metabolic processes and our ability to cope with environmental toxins. It mitigates damage related to noxious exposure (for instance, combining too much alcohol with pain relievers for the ensuing hangover).

We may also know that chronic drug and alcohol abuse can take a serious toll on the liver and, consequently, on its ability to function and maintain health. What may be news to some, however, is that the fastest growing form of liver disease is related neither to toxic exposure (as with drugs and alcohol), nor to viral infection (as with hepatitis A, B, and C), but to the over-accumulation of triglycerides in hepatocytes—the working cells of the liver. In other words, increasing rates of liver inflammation and even cirrhosis may be related to a spectrum of often-silent conditions, beginning with nonalcoholic fatty liver disease (NAFLD). And because the liver is a keystone for fluid management in the body, it is important for massage therapists to be familiar with these conditions and the risks they involve.

ANATOMY REVIEW: A HEALTHY LIVER

The liver is an astonishing organ with a long list of important functions. A healthy adult liver weighs about 3 pounds. It occupies a large portion of the upper right quadrant of the abdomen, and it crosses over the midline to the left side. It lies just inferior to the diaphragm, deep to the xiphoid process, and superficial to the stomach.

The blood supply to the liver is unique, as it is supplied both by the hepatic arteries, which deliver oxygen-rich blood from the aorta, and by the portal vein, which delivers nutrient-rich, but oxygen-poor, blood from the organs of digestion and the spleen. Through the portal vein, the liver has first dibs on the sugars and proteins absorbed in the intestines, but it also has to process a huge amount of blood from both arterial and venous supply.

The liver is composed of four main lobes, and each of those has many lobules made of precisely organized hepatocytes—working liver cells. One function (among many) for hepatocytes is to manufacture bile. This chemical helps hold fats in suspension so that digestive enzymes can break them into smaller molecules for absorption. Bile is collected in a complicated set of channels that drain into the hepatic duct, then the cystic duct, and finally the common bile duct (which is shared by the liver, gallbladder, and pancreas) to be released into the small intestine. During active digestion, bile goes directly from the liver into the duodenum. But bile production is constant (at a rate of 500–1000 milliliters per day), so when the digestive system doesn't need it, bile backs up into the gallbladder for storage.

In addition to manufacturing bile, the liver has many other essential functions:
- It packages fatty acids in a form that can be transported for cells to use as fuel.
- It builds amino acids into vital plasma proteins used for blood clotting, immune system function, and other things.
Consuming too many calories in general, and fat calories in particular, can overwhelm the liver's ability to metabolize fats normally. (Of course, it doesn't help that the average American gets roughly 40 percent of his or her calories from fat.)

- It converts the ammonia left over from protein metabolism into urea that can be excreted.
- It converts glucose to glycogen for storage; this can be released to help stabilize blood glucose levels.
- It conserves iron from dead red blood cells for recycling.
- It filters out toxins from the substances we ingest (food, alcohol, drugs, etc.).
- It removes excessive hormones from the blood for excretion.
- It stores several vitamins, including A, D, E, K, and B12.

When liver function is impaired, any combination of these functions may be lost and many serious complications can arise.

**NONALCOHOLIC FATTY LIVER DISEASE**

Traditionally, we have associated liver disease with two main contributing factors: chronic wear and tear connected to drug or alcohol abuse, or long-term, low-grade inflammation related to viral infections. Now, with one-half of U.S. adults classified as overweight and one-fourth classified as clinically obese, another source of long-term liver stress is creating a new group of liver disease candidates—people with pathologic accumulation of triglycerides within their functioning liver cells, the hepatocytes.

Consuming too many calories in general, and fat calories in particular, can overwhelm the liver's ability to metabolize fats normally. (Of course, it doesn't help that the average American gets roughly 40 percent of his or her calories from fat.) A person's body mass index (BMI) appears to have a direct correlation with his or her risk of having nonalcoholic fatty liver disease (NAFLD). In addition, insulin resistance—the condition of cells becoming less sensitive to the action of this important hormone—changes the way the liver metabolizes nutrients. Insulin resistance is also tied closely to an elevated BMI. The overall consequence for the liver is that hepatocytes literally fill with triglycerides, and this interferes with the liver's ability to perform its vital functions.

The label of NAFLD is applied specifically to people who develop fatter liver disease while consuming less than 10 grams of alcohol within a single week. This is equivalent to one 12-ounce beer, or one 4-ounce glass of wine, or one 1-ounce shot of liquor. It is fair to suggest that a lot of overweight people with liver problems consume more alcohol than this each week, but do not meet the criteria for excessive consumption that would put them at risk for alcoholic liver disease. Consequently, the number of people developing silent but potentially progressive liver disease may be even higher than reported under this classification system.

**PRIMARY LIVER DISEASE: THE NAFLD SPECTRUM**

- **NAFLD:** Nonalcoholic fatty liver disease is closely associated with high-fat diets and being overweight. It is estimated that up to 20 percent of all U.S. adults and 5 percent of all U.S. children would test positively for this condition, even without symptoms. It is usually a silent condition, and may not be recognized unless liver function tests are performed for some other reason. An overtaxed liver does secrete some enzymes called transaminases into the bloodstream, but the liver is so good at compensating for lost function that signs and symptoms tend to be minimal, subtle, and only very slowly progressive. For this reason, NAFLD by itself is sometimes described as a benign condition.

- Some percentage of people with NAFLD progress to a more serious form of liver disease called nonalcoholic steatohepatitis, or...
NASH. Experts suggest that NASH affects up to 3 percent of the adult population. The main difference between NAFLD and NASH is the presence of inflammation. Chronic low-grade inflammation in the liver can lead to the accumulation of scar tissue that essentially scrambles the delicate and highly organized hepatocytes. The reasons some people progress from NAFLD to NASH while others do not are not clearly understood.

- The end-stage of NASH is cirrhosis—the condition of having masses of scar tissue in the liver that disrupts so much hepatocyte function that serious symptoms and complications develop. Nonalcoholic fatty liver disease has only been studied as a condition separate from other liver diseases since 1980, and we know that it is very slowly progressive, so the actual percentage of people diagnosed with NAFLD who progress all the way to NASH and then cirrhosis is not yet known. Some studies suggest that the progression rate from NASH to cirrhosis may be about the same as seen with hepatitis C. This would indicate that diagnosis rates for nonalcoholic cirrhosis will rise significantly within the next 10–20 years.

SECONDARY LIVER DISEASE

NAFLD and NASH are discussed currently as primary liver diseases; that is, they occur without a specific underlying infection or toxic exposure. This distinguishes them from secondary liver disease—conditions that develop as complications of an underlying disorder. Some of these include:

- Alcoholic liver disease. This is associated with excessive alcohol consumption (typically more than four 10-gram units each day). It is usually seen in younger patients than with NASH, and the onset of symptoms is usually severe and acute.
- Hepatitis B, C. These viral infections are associated with a relatively high risk of long-term liver damage, cirrhosis, liver failure, and liver cancer. They are directly tied to chronic inflammation and scar tissue that develops in response to a pathogenic invasion.
- Wilson’s disease. This genetic disorder involves the accumulation of copper in the liver and other tissues. This interferes with liver function and can lead to cirrhosis.
- Drug-induced liver disease. Several prescription and nonprescription drugs can contribute to liver degeneration. Some of the most common ones include prednisone (a steroidal anti-inflammatory), tamoxifen (taken to reduce the risk of breast cancer recurrence), methotrexate (a type of chemotherapy), and NSAIDs (nonsteroidal anti-inflammatory drugs).

SYMPTOMS OF LIVER DISEASE

Early symptoms of NAFLD (where there are any) include fatigue, unintended weight loss, and vague pain in the upper right quadrant of the abdomen. Elevated levels of transaminases may alert doctors to liver stress. More identifiable markers are signs that indicate insulin resistance, including abdominal obesity, hypertension, elevated blood glucose, and elevated cholesterols. Some people develop patches of darkened skin at the axilla or neck. This is called acanthosis nigricans, and it is an indicator of blood glucose dysregulation.

Ultimately, the diagnostic criteria for NAFLD include the signs of insulin resistance along with long-term elevated liver enzymes, an ultrasound that shows a fatty liver, and the exclusion of other possible causes. If NAFLD progresses to NASH, inflammatory chemicals may damage hepatocytes and scar tissue may begin to invest healthy liver tissue. However, the liver is remarkably good at compensatory function, so these dangerous steps may not be associated with specific symptoms.

If NASH finally complicates to cirrhosis, this tends to look different from the cirrhosis seen with secondary liver disease as discussed earlier. Cirrhosis related to NAFLD and NASH tends to have a very slow onset that occurs late in life; it is rarely seen in people under 60 years old, and it is usually seen along with type 2 diabetes. The liver damage seen with this type of cirrhosis tends to lead to the appearance of spider veins in the skin, blotchy red patches on the palms, a loss of body hair, and feminizing characteristics for men and masculinizing characteristics for women. Very late-stage cirrhosis
may also involve ascites—the accumulation of fluid in the peritoneal cavity because the liver is too congested to process all the blood that is delivered through the hepatic and portal vessels.

**TREATMENT OPTIONS FOR NAFLD**

Although NAFLD and the accompanying risk of NASH is an increasingly common problem with our aging and overweight population, the best ways to treat or reverse it have not been investigated thoroughly. If it is caught early (and because it is silent—it typically isn’t), the liver changes may be reversed with healthy changes in diet and exercise—both of which can stabilize blood glucose and reduce triglycerides. Aggressive treatment with diabetes management drugs and cholesterol lowering medications are frequently recommended, but their efficacy in reversing the NAFLD or preventing progression to NASH is not fully established.

**MASSAGE FOR NAFLD**

If a massage therapist has clients who are significantly overweight, the chances are excellent that many of them would test positive for low-grade liver damage. If any signs of more extreme liver problems are present, and especially if a client needs to curtail his or her activity levels because of illness, rigorous bodywork that focuses on fluid movement may be outside the capacity of that client to adapt. Here, as in many cases, the practitioner must assess what normal daily activities a client can do easily and keep the adaptive demands of the massage within those parameters.

The good news is that the act of receiving massage, even gentle non-circulatory based modalities, tends to inspire clients to take better care of themselves. In massage, we offer a self-indulgent treat that is also a health-promoting health-care intervention, and it increases our clients’ sense of value and self-worth. Because NAFLD is best controlled through positive changes in diet and exercise, any intervention that advances the idea that good self-care is a worthwhile investment of time, energy, and sacrifice can have benefits that far outlast the immediate relaxation that we associate with a brilliant massage.

Ruth Werner is a writer and NCBTMB-approved provider of continuing education. She wrote A Massage Therapist’s Guide to Pathology (Lippincott Williams & Wilkins, 2009), now in its fourth edition, which is used in massage schools worldwide. Her book Disease Handbook for Massage Therapists is also now available from Lippincott Williams & Wilkins. Werner can be reached at www.ruthwerner.com or wernerworkshops@ruthwerner.com.