TEXAS LIVER TUMOR CENTER PATIENT GUIDE

University Health System
Texas Liver Tumor Center

In partnership with Texas Liver Institute and UT Health San Antonio

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Texas Liver Tumor Center (TLTC)

Table of Contents

1. Overview of Liver Tumors

Liver tumors are the primary area of focus of the multispecialty team of experts at Texas Liver Tumor Center. In a single location, we offer a comprehensive range of diagnostic services, as well as the latest advances in treatment options, including chemotherapy, radiation therapy, intra-arterial embolization, tumor ablation, surgical liver resection, and liver transplant consultations. We assess each patient – and each potential treatment option – to devise the best possible approach for any given situation.

Texas Liver Tumor Center is one of the nation's premier destinations for the evaluation and treatment of all types of liver tumors, including rare and complex conditions, such as pediatric liver tumors.

Some of the cancerous liver tumors our experts evaluate and treat:

- Hepatocellular carcinoma, also known as a hepatoma, is a type of primary liver cancer that originates in liver cells (hepatocytes).
- Cholangiocarcinoma is cancer of the bile ducts that are small tubes throughout the liver that drain bile to the intestine.
- Cystadenocarcinoma is a cancer that transforms from a benign cyst (cystadenoma) into a malignant tumor.
- Metastatic cancer is a secondary liver cancer; these tumors originate in other parts of the body, such as the colon or gallbladder, and spread to the liver.
- Hepatoblastoma is a malignant liver tumor that is unique to the pediatric population and primarily affects younger infants and children.

The experts at Texas Liver Tumor Center can also evaluate and provide treatments, as needed, for benign (noncancerous) liver tumors, such as:

- Hemangiomas – The most common type of noncancerous liver tumors; these are caused by an abnormal growth of blood vessels and usually produce no symptoms; rarely they may be large or cause discomfort and can be surgically removed.
- Focal nodular hyperplasias (FNHs) – The second most common type of noncancerous liver tumors, FNHs most often affect young women. Because they typically produce no symptoms, FNHs are usually detected in imaging tests performed for unrelated reasons. No treatment is required.
- Hepatic adenomas – Relatively rare, hepatic adenomas often develop in women of childbearing age and may be related to estrogen exposure. If a hepatic adenoma is diagnosed, discontinuation of oral contraceptives and monitoring is recommended.
- Polycystic liver disease – This rare condition causes fluid-filled sacs (cysts) to develop throughout the liver. Most liver cysts do not produce symptoms unless they are very large, in which case they may cause abdominal pain and bloating. If necessary, large liver cysts can be drained or surgically removed.

At Texas Liver Tumor Center, our goal is to diagnose and treat our patients as quickly as possible. To accomplish this, we've established a streamlined and accelerated patient evaluation process. In one day, our patients can meet with a wide range of specialists, receive all necessary diagnostic testing, and leave our state-of-the-art outpatient center with the knowledge and peace of mind that an individualized treatment plan is in place.

To learn more about the various types of liver tumors, or to schedule a personal consultation with our experts, contact Texas Liver Tumor Center today. We accept, but do not require, referrals.

2. Cancerous Liver Tumors

Cancerous liver tumors represent the clear majority of diagnoses treated at Texas Liver Tumor Center. We have a multidisciplinary team of physicians and surgeons who treat these unique and complex conditions, allowing us to provide our patients with world-class care. And, due to our wide-ranging expertise in treating cancerous liver tumors, we are equipped for all types of cancer. We provide initial diagnoses and treatment plans, as well as second-opinion evaluations.

Texas Liver Tumor Center treats a full spectrum of primary cancerous liver tumors, including:

- Hepatocellular carcinoma: This is the most common form of primary liver cancer, accounting for nearly 75 percent of all diagnoses.
- Cholangiocarcinoma (bile duct cancer): Accounts for 10 to 20 percent of all cancerous liver tumors, this malignancy develops in the small tubes that carry bile from the liver to the intestine.
- Cystadenocarcinoma: This relatively uncommon condition develops when a fluid filled cyst in the liver develops into a cancer.
- Angiosarcoma and hemangiosarcoma: These rare yet rapidly growing liver tumors develop in the cells that line the liver's blood vessels.
- Hepatoblastoma: Childhood cancer that is very responsive to chemotherapy and a cure is feasible with appropriate multidisciplinary treatment that may include surgery, chemotherapy and occasionally liver transplantation.

Our physicians also treat metastatic liver cancers that have spread to the liver from organs. For instance, we often treat gastrointestinal carcinoid tumors, which originate in the lining of the gastrointestinal tract, and frequently spread from the stomach or intestines to the liver. We also treat colorectal and gallbladder cancer metastases.

Because each of these conditions is unique, it's crucial for patients to consult with a team that has experience treating their specific diagnoses. For instance, minimally invasive surgery may be an option for patients who are diagnosed with cholangiocarcinoma, while patients who are diagnosed with cystadenocarcinoma may require a more traditional, open operation. Angiosarcomas are often diagnosed after they have spread outside of the liver, so systemic treatments such as chemotherapy are used more frequently than surgery for treating this condition. At Texas Liver Tumor Center, we are equipped to treat each unique type of liver malignancy with a high level of expertise.

Additionally, we understand the importance of prompt action when it comes to treating cancerous liver tumors. Every day can make a difference, which is why we use an accelerated patient evaluation process. In a single day, patients can undergo any necessary diagnostic imaging, consult with numerous experts under the same roof, and schedule appointments for their liver cancer treatments. Patients who wish to participate in our research initiatives and clinical trials can also be matched with any appropriate opportunities during this initial evaluation.

To learn more about cancerous liver tumors, or to schedule an appointment to consult with our team regarding your specific diagnosis, contact Texas Liver Tumor Center today.

2.1 Hepatocellular Carcinoma (HCC)

HCC is the most common form of primary liver cancer. It most often occurs in adults who have chronic liver disease from viral hepatitis B or C and in non-alcoholic fatty liver disease when significant scarring is present. Importantly it can be a complication of cirrhosis from any cause (alcohol, Wilson disease, or hemochromatosis (excess iron in the body)).

HCC is largely asymptomatic until it is very advanced. As the tumor progresses, there may be vague symptoms such as weight loss, fatigue, or nausea. Worsening liver function may occur when the tumor fills the liver and can present as jaundice, swelling or confusion. Late in the course, pain or rarely bleeding into the abdomen may occur. It is standard of care for patients with cirrhosis and high-risk chronic liver disease to undergo regular monitoring for the development of HCC in early stage.

As is the case with any type of liver tumor, outcomes are generally more favorable when HCC is diagnosed and treated in its earliest stages. Our team understands the emotional stress on a patient and their family can be great during a lengthy evaluation. To reduce the amount of time that elapses between diagnosis and treatment, Texas Liver Tumor Center has developed a one-day comprehensive patient evaluation process. Individuals who come to us with HCC are evaluated by a multispecialty team of experts, receive valuable education on their condition, and leave with a comprehensive treatment plan on the same day.

At Texas Liver Tumor Center, we provide a complete range of diagnostic tests and treatments under one roof. On the diagnostic side, we utilize the latest advances in MRI and CT imaging, magnetic resonance elastography, tissue and blood serum testing, and liver function testing. HCC is unique in that arteries feed it. This allows for a diagnosis with just particular imaging results and blood tests. Only the minority of patients require a liver biopsy.

For treatment, we offer a full scope of therapies, including:

- Chemotherapy
- Radiation therapy
- Intra-arterial embolization
- Tumor ablation
- Surgical liver resection
- Liver transplant consultations

Our clinical trials program is also designed to help patients maximize their treatment options to include novel therapies that are currently being studied by our research team. Our partner, UT Health Cancer Center, is a NCI-Designated Cancer Center. Because of this partnership, our patients can access the latest advances in HCC treatment at our facility.

Additionally, our team includes some of the most distinguished medical professionals in the United States, including medical oncologists, hepatologists, hepatobiliary surgeons, clinical researchers, and palliative care providers. At Texas Liver Tumor Center, we provide patients with HCC access to a full spectrum of care without having to make appointments with different providers.

For more information about HCC or the liver cancer treatments offered at Texas Liver Tumor Center, contact us today. We welcome patients from across the nation, with or without referrals.

2.2 Cholangiocarcinoma (Bile Duct Cancer)

Cholangiocarcinoma, or bile duct cancer, develops in the tubes that carry digestive fluids from the liver to the small intestine. This condition accounts for 10-20 percent of all liver cancer diagnoses.

There are three types of cholangiocarcinoma, each one differentiated by where in the bile duct the cancer develops. The classifications include:

- Intrahepatic cholangiocarcinoma – These cancers develop in the branches of the bile ducts inside the liver.
- Perihilar (hilar) cholangiocarcinoma – These cancers (also known as Klatskin tumors) develop in the area where the bile ducts leave the liver.
- Distal cholangiocarcinoma – These cancers develop in the portions of the bile ducts that are closest to the small intestine (outside of the liver itself).

Together, perihilar and distal cholangiocarcinomas are referred to as extrahepatic bile duct cancer, due to their development outside of the liver.

At Texas Liver Tumor Center, our oncologists treat patients with all forms and stages of bile duct cancer. Through a unique diagnostic and consultative process that takes place throughout the span of a single day, our team can provide patients with the one-on-one attention and comprehensive answers that they need and deserve.

At Texas Liver Tumor Center, patients can get multiple expert opinions from today's leading oncologists and hepatologists, without having to wait weeks in between appointments. In terms of diagnosis and treatment, we offer everything from liver and gallbladder function tests, imaging scans, and tumor marker lab assessments to internal and external beam radiation therapy, chemotherapy, liver surgery, and transplantation consultations. Novel cholangiocarcinoma therapies are also offered through our partnership with the UT Health Cancer Center – a National Cancer Institute-designated Cancer Center.

As cholangiocarcinoma treatment often includes a combination of methods, such as surgery, radiation therapy, and chemotherapy, Texas Liver Tumor Center team includes several medical professionals in each of these disciplines. Working together to evaluate each patient's case, this team provides world-class treatment recommendations for patients across the nation.

For more information about cholangiocarcinoma and our unique approach to diagnosis and treatment, contact Texas Liver Tumor Center.

2.3 Cystadenocarcinoma

Cystadenocarcinoma – This is a relatively uncommon condition in which case a cyst becomes cancerous. In comparison to simple cysts, these appear more complicated on imaging with septations and nodularity. There is a female predominance with an intrahepatic location in 90%+ of the cases. It is most commonly treated with surgical resection.

2.4 Secondary Liver Cancers

2.4.1 Neuroendocrine and Carcinoid Tumors of the Liver

Gastrointestinal carcinoid tumors are a form of neuroendocrine cancer that can develop in (or spread to) the liver. Although it's more common for these tumors to develop in the small intestine, pancreas, colon, stomach and later progress to the liver, it is also possible for these tumors to originate in the liver.

When treating neuroendocrine carcinoid tumors, it's important for oncologists to not only determine the cancer's site of origin, but also:

- How quickly the tumors are spreading (whether they are low-grade or high-grade)
- Whether they are functioning (hormone-producing) or non-functioning (non-hormone-producing)
- Whether the tumors are present in just one lobe of the liver or both
- How the patient has responded to previous treatments, if applicable
- The underlying liver health and function

At Texas Liver Tumor Center, our multidisciplinary team conducts a collaborative evaluation of each patient to ensure that every influencing factor is taken into consideration. During our unique, one-day patient evaluation process, imaging scans and diagnostic tests are performed in the morning, treatment discussions and consultations are scheduled throughout the afternoon, and by the end of the day, the patient has a fully developed plan in place for treating his or her gastrointestinal carcinoid tumors.

As for treatment, we offer today's most innovative therapies for neuroendocrine carcinoid tumors. From advanced surgical procedures to novel medicines that are currently only available through clinical trials, every potential treatment is accessible at Texas Liver Tumor Center. Because of our significant research presence, we're able to match our patients with the newest and most effective liver tumor therapies available. Our physicians represent some of the most esteemed names in medicine, ensuring that each patient who turns to Texas Liver Tumor Center receives care that is driven by world-class research and expertise.

To learn more about our approach to treating neuroendocrine carcinoid tumors of the liver, contact Texas Liver Tumor Center today.

2.4.2 Colorectal Liver Metastasis

A colorectal liver metastasis occurs when cancer that initially develops in the colon or rectum spreads to the liver. As cancerous cells reproduce, they often grow into nearby tissues and lymph nodes. The liver is one of the most frequent locations for colorectal cancer metastases. However, this condition is known as metastatic colorectal cancer, and it is treated differently than a primary liver cancer (a tumor that initially develops in the liver).

While treating cancer of any kind is a complex process, treating a colorectal liver metastasis requires an especially high level of expertise in a fully collaborative setting. That's because surgery may not always be an appropriate treatment method, and an individualized combination of other treatments is often necessary.

Cancer treatments that destroy cells throughout the entire body – which is necessary when treating a colorectal liver metastasis – are called systemic treatments. Chemotherapy is one such example and is very important in the setting of cancers that have spread outside of the original location to treat microscopic cancer cells before they get to another target area. These treatments contrast with targeted treatments such as radiation therapy, which only address a single, specific part of the body such as the liver or lung. At Texas Liver Tumor Center, our oncologists expertly combine systemic and targeted treatments to help manage metastatic colorectal cancers. As many advances have occurred in this field, we aim to bring state of the art knowledge and treatment directly to patients.

When treating a colorectal liver metastasis, our oncologists:

- Consider our broad spectrum of clinical trials to determine if any current studies are exploring new treatment options for colorectal liver metastases
- Conduct a multidisciplinary meeting to evaluate every possible treatment option in a collaborative, team-based environment
- Complete any advanced imaging scans or diagnostic tests that can provide additional information about where (and how far) a tumor has spread

What's most unique to our program is the fact that these steps are completed during a single patient visit. We understand that waiting weeks – and possibly even months – before starting treatment can give the cancer more time to spread, which is why we have taken a proactive approach in developing our same-day patient evaluation process. No physician referral is required.

To schedule an appointment at Texas Liver Tumor Center, contact us today. We welcome patients with new liver tumor diagnoses, as well as those who are seeking a second opinion on a colorectal liver metastasis.

2.4.3 Gallbladder Cancer

As the name suggests, gallbladder cancer is a malignancy that develops in the gallbladder – a small, pear-shaped organ that sits just beneath the liver. The gallbladder's function is to store the digestive fluids produced by the liver until they are ready to be distributed in the small intestine. Because of the organ's proximity to the liver, gallbladder cancer often spreads (metastasizes) to the liver.

Even when gallbladder cancer spreads to the liver, it is still considered gallbladder cancer because the cancerous cells are the same as those that made up the original gallbladder tumor. However, if a gallbladder tumor spreads to the liver, patients may wish to receive treatment from an oncologist who specializes in treating liver tumors. This is because the liver has several unique features – such as its ability to regenerate after surgery – that can influence treatment. Oncologists who specialize in treating liver tumors can consider these unique factors to provide patients with comprehensive, evidence-based treatment plans.

At Texas Liver Tumor Center, our team treats a full range of conditions, including metastatic gallbladder cancer. We offer today's most advanced therapies, including:

- Tumor resection surgery (surgery to remove one or more cancerous tumors)
- Liver surgery (surgery to remove part of the liver)
- Lymphadenectomy (surgery to remove the lymph nodes, through which cancer can spread to distant organs)
- Chemotherapy (medication-based treatment to destroy cancerous cells)

- Internal and external beam radiation therapy (particle-based treatments to target liver tumors)
- Other novel options, such as immunotherapy, which is accessible through our clinical trials portfolio

Through our one-day patient evaluation process, in which patients come to Texas Liver Tumor Center in the morning and leave at the end of the day with a carefully designed treatment plan in place, we can eliminate much of the uncertainty that accompanies a metastatic gallbladder cancer diagnosis. With several of the nation's most highly regarded liver tumor experts collaborating on each patient's case, Texas Liver Tumor Center is a premier destination for comprehensive care.

If you have been diagnosed with metastatic gallbladder cancer and would like to schedule an appointment at Texas Liver Tumor Center, contact us today.

2.4.4 Ovarian Cancer Metastasis

Ovarian cancer is often diagnosed in advanced stages. When the cancer involves the abdomen and peritoneum as well as segments of the liver a broad approach is needed. Extensive surgical treatment is considered to improve both quality of life and life expectancy. Additionally, systemic treatment with chemotherapy is offered through standard or study treatment protocols.

2.4.5 Lung Cancer Metastasis

Lung cancer commonly spreads to the liver. Previously, little could be done in these circumstances. Recent approval of targeted systemic therapy and immunotherapy has changed that paradigm. In cases where there are 1 or few liver lesions, targeted radiotherapy is showing promise. Members of Texas Liver Tumor Center carefully consider everyone and develop the most appropriate treatment plan.

2.5 Rare Liver Tumors: Angiosarcoma and Hemangiosarcoma

Sarcomas are cancers that originate from connective tissue cells. These cancers can contain bone, cartilage, fat, blood vessels, or hematopoietic tissues. In contrast, carcinomas are cancers that originate from epithelial cells – the cells that line the blood vessels and organs.

Angiosarcoma of the liver (includes hemangiosarcoma) is an uncommon malignant tumor that is often associated with distant vinyl chloride, arsenic, anabolic steroids, radiation, or thorium dioxide exposure. Typical symptoms include abdominal pain, fatigue, jaundice, ascites, and weight loss. Angiosarcoma is diagnosed in older individuals (age >60) and is more common in men. It is generally considered an aggressive cancer and treatment options depend on the extent of disease.

3 . Benign Liver Tumors (Non-cancerous)

3.1 Hemangioma

Hemangiomas, also referred to as cavernous hemangiomas, are vascular malformations found in the liver. It is the most common benign liver tumor. Hemangiomas are generally asymptomatic, but larger hemangiomas can cause abdominal pain and/or bleed. The diagnosis is generally made incidentally with imaging and occurs predominately more in women than men (3:1) with majority of cases found between the ages of 30-50. Management of hemangiomas depends on size and associated symptoms.

3.2 Hepatic Adenoma

Hepatocellular or hepatic adenoma is a benign (non-cancerous) liver tumor that is typically caused by a hormonal imbalance – specifically, excess estrogen. Most people who develop these tumors are young women who use oral contraceptives, although men who use anabolic steroids and individuals with type I, III, IV glycogen storage disease are also at risk.

Typically, hepatocellular adenoma involves a single, well-defined tumor. When multiple tumors develop, the condition is known as hepatic adenomatosis.

Hepatocellular adenoma does not always cause symptoms, although tumors can sometimes cause the following complications:

- Abdominal pain
- A palpable mass in the stomach
- Hypotension (low blood pressure)
- An accelerated heart rate
- Abnormal sweating

In some cases, hepatocellular adenomas can become malignant (cancerous) hepatocellular carcinomas. There can also be a complication of rupture and hemorrhage leading to internal bleeding. While these are relatively uncommon, hepatic adenomas require ongoing surveillance for growth. It is recommended to intervene with surgery or localized ablative therapy if they become > 5 cm to prevent these complications.

At Texas Liver Tumor Center, we offer a comprehensive range of treatments for benign and cancerous liver tumors, including hepatic adenomas. We are one of the only facilities in the nation to offer a one-day patient evaluation process, in which we conduct all necessary diagnostic testing and treatment consultations in a single appointment. Our patients have unique opportunities to meet with some of the nation's top hepatologists, oncologists, and liver tumor surgeons under one roof, and leave within just a few hours with a multispecialty treatment plan in place.

To learn more about hepatocellular adenoma and the outstanding treatment options available at Texas Liver Tumor Center, contact us today.

3.3 Focal Nodular Hyperplasia

Focal nodular hyperplasia (FNH) is a benign tissue reaction to a congenital arterial malformation. In other words, FNH refers to an area of denser liver cell growth in response to increased blood/nutrient supply from a larger than usual artery. It is the increased density of liver cell growth that appears to be mass like on imaging.

It is the second most common benign hepatic tumor after hemangioma. Other names for this entity include solitary hyperplastic nodule, hepatic hamartoma, focal cirrhosis, and hepatic pseudotumor. FNH is generally asymptomatic, discovered incidentally with imaging and often found as a single lesion <5 cm in size. Diagnosis can be made with CT or MRI imaging, but sometimes biopsy is needed. FNH occurs predominantly more in women than men (8 or 9:1 ratio) and is seen between the ages of 20-50. There is no role for stopping oral contraceptive pills as these lesions are not hormone sensitive. Management is dependent on size and symptoms of the FNH. Given that FNH are often asymptomatic and small, the treatment is usually conservative.

3.4 Liver Cysts

Most liver cysts are benign and found incidentally with imaging. There are a few liver cysts that are potentially malignant and are covered in other sections.

Simple cysts are benign cysts that contain clear fluid and do not communicate with the bile ducts within the liver. Most simple cysts do not cause symptoms unless they are large. Management of symptomatic simple cysts can include surgery or manipulation of the cyst by specialists called interventional radiologists. Otherwise, management of simple cysts is conservative and may involve serial monitoring with imaging.

Polycystic liver disease is an uncommon hereditary entity where multiple liver cysts are present. In most cases, polycystic liver disease is associated with autosomal dominant polycystic liver disease (ADPKD). Management of polycystic liver disease depends on the extent of disease and associated symptoms.

3.5 Nodular Regenerative Hyperplasia

Nodular regenerative hyperplasia (NRH) refers to the benign transformation of liver tissue to contain small nodules (often very small <3 mm size) in response to blood flow changes in the venous system of the liver.

This is an uncommon entity and can be seen on imaging as diffuse nodularity in the liver. Diagnosis is made by liver biopsy as characteristic features of NRH are microscopic. Given that signs and symptoms of NRH can mimic those of cirrhosis (ascites, thrombocytopenia, splenomegaly, hepatic encephalopathy, or varices), biopsy is also used to exclude cirrhosis.

NRH may be associated with or due to rheumatologic disorders, hematologic disorders, congenital disorders, or medications. Thus, management of NRH includes treating the underlying disorder/association and other related symptoms.

4. Pediatric Liver Tumors

Liver tumors can affect children and adolescents. These tumors could be benign (hemangiomas, FNH) or malignant (HCC, cholangiocarcinoma).

There are a few conditions that have been associated with the development of certain liver tumors in the pediatric age group including the following:

1. Glycogen storage disorders → adenomas
2. Tyrosinemia and progressive familiar intrahepatic cholestasis → HCC
3. Familial adenomatous polyposis → hepatoblastoma

Hepatoblastoma is a malignant liver tumor that is unique to the pediatric population and primarily affects younger infants and children. Hepatoblastoma can involve large sections of the liver and may metastasize to other organs including the lungs. Fortunately, hepatoblastoma is very responsive to chemotherapy and a cure is feasible with appropriate multidisciplinary treatment that may include surgery, chemotherapy and occasionally liver transplantation.

For more information on **hemangiomas** and **focal nodular hyperplasia (FNH),** please see section on benign liver tumors. For more information on **hepatocellular carcinoma (HCC**) and **cholangiocarcinoma**, please see section on cancerous liver tumors.

5. Causes of Liver Disease

5.1 Nonalcoholic Fatty Liver Disease

Nonalcoholic fatty liver disease (NAFLD) is one of the most common types of liver disease in both adults and adolescents, and is also one of the leading causes of hepatocellular carcinoma (HCC) (a form of primary liver cancer). NAFLD is a condition in which excess fat accumulates in the liver. While a healthy liver contains a small amount of fat (up to 5% percent), a higher concentration can lead to complications, including liver inflammation, liver cell injury, and eventually the development of liver cirrhosis. Fatty liver disease also can be linked to other serious health concerns such as cardiovascular disease.

Excess fat can build up in the liver if the body creates too much fat or cannot break it down quickly enough. The main risk factors for NAFLD include obesity, type 2 diabetes and hyperlipidemia (excess fat in the blood). It can also be genetic, or inherited from a parent. When NAFLD is detected and treated early, it is possible to significantly reduce the risk of long-term complications.

Nonalcoholic steatohepatitis (NASH) is the most severe form of NAFLD and occurs when the excess fat in the liver is accompanied by liver inflammation and scarring over time. In more severe cases this condition can lead to end stage liver disease or HCC. At Texas Liver Tumor Center, we provide comprehensive treatments for both cancerous and non-cancerous liver tumors, including HCC that develops because of fatty liver disease. During a single appointment, patients can consult with our team of experienced hepatologists, oncologists, alcoholism counselors, and other liver disease specialists, complete any necessary diagnostic testing on the same day, and leave with an individualized treatment plan.

To learn more about nonalcoholic fatty liver disease, its role in the development of HCC, and the treatment options that we offer, contact Texas Liver Tumor Center, or Texas Liver Institute (www.txliver.com).

5.2 Alcoholic Liver Disease

Heavy alcohol consumption can lead to progressive liver disease. Initially fat builds up in the liver and causes inflammation (alcoholic steatohepatitis). This chronic inflammation can progress to cirrhosis and liver cancer. Once alcoholic liver disease develops, continued alcohol use typically leads to complications of liver disease. One severe manifestation of alcoholic liver disease is acute alcoholic hepatitis, which is a dangerous condition with a high risk of death. This is typically associated with jaundice and often requires specific treatment in addition to stopping all alcohol.

It is estimated that up to 20 percent of patients with alcoholic fatty liver will progress to alcoholic cirrhosis. Factors associated with an increased risk of progression to cirrhosis include ongoing alcohol use, daily drinking rather than periodic binge drinking, obesity, female sex and superimposed liver disease such as hepatitis C. On the other hand, drinking with meals appears to decrease the risk of progression. Coffee consumption may have a beneficial effect.

Alcoholic liver disease is suspected when there is a history of heavy alcohol use, elevated liver enzymes, suggestion of fatty liver on imaging tests, or is found on a liver biopsy.

Key to the management of alcoholic liver disease is discontinuing all alcohol. Abstinence may allow for reversal of the liver damage induced by alcohol, if the liver disease has not progressed to cirrhosis. In the setting of cirrhosis, alcohol abstinence decreases the risk of liver failure, the development of clinical complications of cirrhosis and improves survival. Liver transplantation can be an option for those patients with end-stage liver disease from alcoholic liver disease who meet the 6-month sobriety criteria and are committed to alcohol abstinence.

5.3 Viral Hepatitis

Hepatitis means inflammation of the liver and can be caused by 3 different viruses: hepatitis A, B and C. Hepatitis A is a short-term infection and does not lead to cancer. Hepatitis B and hepatitis C can become long-term infections that can lead to scarring of the liver, called cirrhosis, and liver cancer.

There are vaccines to prevent hepatitis A and hepatitis B but no vaccine for hepatitis C. However, there are several new therapies against hepatitis C that can remove all hepatitis C virus from a person's body and cure them of the infection. However, if the person has been infected for a long period of time, there may already be significant liver scarring and even liver cancer.

To learn more about viral hepatitis, its role in the development of HCC, and the treatment options that we offer, contact Texas Liver Tumor Center or directly contact Texas Liver Institute, which offers state of the art therapy for viral hepatitis (www.txliver.com).

5.4 Genetic Liver Diseases

5.4.1 Hereditary Hemochromatosis

Hereditary hemochromatosis (HH) is caused by a genetic defect and leads to increased iron absorption in the small intestine. The clinical complications of HH are related to large amounts of iron deposition in the liver, heart, pancreas, and pituitary.

Most patients are identified by abnormal iron values on routine blood work. The symptoms associated with HH are typically nonspecific such as fatigue. More organ-specific symptoms are joint pain, symptoms related to complications of chronic liver disease, diabetes and congestive heart

failure. The diagnosis is usually made through laboratory test results; however, a liver biopsy may sometimes be necessary.

The treatment of HH is phlebotomy (removing blood and therefore iron from the body). With adequate treatment, in general patients feel better, with less fatigue. In addition, in patients that have not developed cirrhosis, the associated liver injury can regress, the enlargement of the liver as well as the liver test elevation improve. The heart function may also improve.

The most common causes of death in HH are related to the complications of cirrhosis and liver cancer. Patients who are treated early should not develop these complications; therefore, early diagnosis is important. Once a patient is identified to have HH, all first-degree relatives should be offered screening with genetic testing.

5.4.2 Wilson Disease

Wilson disease is a rare genetic condition which leads to copper overload in the liver. The impaired copper removal from the bile ducts in the liver leads to accumulation of copper in several organs, most notably the liver, brain, and cornea. Over time, the liver is progressively damaged leading to cirrhosis. A small percent of patients develop acute liver failure, where the liver rapidly fails and those patients almost always require liver transplantation, which cures this disease.

Wilson disease typically affects young individuals. The symptoms of Wilson disease include rapid liver failure, sudden or chronic elevation of liver enzymes (indicating liver inflammation), cirrhosis, and fatty liver. Since the excess copper can also accumulate in the brain, patients with Wilson disease can have neurologic and psychiatric symptoms.

A liver biopsy is almost always needed to establish the diagnosis and determine the amount of liver damage. The mainstay of treatment has been copper-chelating (binding) therapies. Untreated, Wilson disease is universally fatal. Copper accumulation in the liver eventually leads to the development of cirrhosis with its associated complications. Patients with neurologic Wilson disease may progress until the patient becomes severely disabled. Genetic testing is used to identify the specific genetic mutation to screen siblings.

The prognosis for patients who receive and are adherent to treatment for Wilson disease is excellent, even in some who already have advanced liver disease. Among patients requiring liver transplantation, survival following transplantation is excellent and cures the disease.

5.4.3 Alpha-1 Antitrypsin Deficiency

Alpha-1 antitrypsin (AAT) deficiency is a genetic disorder affecting the lungs, liver, and rarely, skin. In the lungs, AAT deficiency causes early onset emphysema. The liver disease due to AAT deficiency is caused by an accumulation of abnormal AAT protein, which leads to progressive liver injury.

Adults with liver involvement may have no symptoms until they develop advanced cirrhosis. The diagnosis is suggested by a low AAT level whereby further genetic testing can confirm the diagnosis. A liver biopsy can help confirm the diagnosis. Management focuses on supportive measures to prevent or reduce the complications of chronic liver disease. For adults with end-stage liver disease due to AAT deficiency, liver transplantation results in excellent five-year survival rates.

6. Our Team

6.1 Hepatobiliary and Transplant Surgery

Dr. Gregory Abrahamian specializes in adult and pediatric kidney and liver transplant surgery. Dr. Abrahamian received his medical degree from the UT Health San Antonio. He completed his residency and transplant fellowship at Wilford Hall Medical Center in San Antonio, Texas, and Massachusetts General Hospital. He specializes in adult and pediatric kidney and liver transplant surgery and has served with the United States Air Force overseas.

Dr. Francisco Cigarroa is a nationally renowned transplant surgeon. He received his bachelor's degree in biology from Yale University and his medical degree from The University of Texas Southwestern Medical Center at Dallas. He completed fellowships in pediatric surgery and transplant surgery at Johns Hopkins Hospital. He has been a UT Health faculty member since 1995 and was part of the surgical team that performed the first split liver donor transplant between two recipients in Texas. In 2003, President George W. Bush appointed Dr. Cigarroa to serve on the President's Committee on the National Medal of Science. In 2009, Dr. Cigarroa became the first Hispanic to be named Chancellor of The University of Texas System. After five years, he returned full-time to his passion for transplant and hepatobiliary surgery. He is fluent in Spanish and English.

Dr. Danielle Fritze is an assistant professor in the Division of Organ Transplantation in the Department of Surgery at UT Health San Antonio. Dr. Fritze completed her medical degree and subsequent surgical training at the University of Michigan. Following general surgery residency, she pursued additional fellowship training in transplantation and hepatobiliary surgery. Dr. Fritze specializes in liver and kidney transplantation as well as surgery of the liver, bile duct, and pancreas. She has a special interest in pediatric transplantation.

Dr. Glenn Halff is Director of the Division of Organ Transplantation in the Department of Surgery at UT Health San Antonio. He received his medical degree at the University of Texas Medical School in Houston, Texas. He completed his residency and internship at New York University in New York City, New York and his transplant fellowship at the University of Pittsburgh. In 1992, he started the liver transplant program at University of Texas Health Science Center at San Antonio. He performs adult and pediatric liver and kidney transplants. He along with Dr. Francisco Cigarroa performed the first split liver transplant in South Texas. He also performs adult-to-adult living liver transplants and specializes in all liver, biliary and pancreas surgeries.

Dr. Colleen Jay joined the University Hospital System as a liver, kidney, and pancreas transplant surgeon, and she is an assistant professor in the Division of Transplantation at the UT Health San Antonio. Dr. Jay earned her medical degree from Indiana University School of Medicine in 2005. She completed a residency in general surgery at Northwestern McGaw Medical Center in Chicago. During her time there, she also obtained a Master's of Science degree in Clinical Investigation from Northwestern University. In 2014, Dr. Jay completed a fellowship in liver, kidney, and pancreas transplantation at the Mayo Clinic, and she is board-certified by the American Board of Surgery.

Dr. Tarunjeet Klair is an assistant professor in the Division of Organ Transplantation in the Department of Surgery at UT Health San Antonio. Dr. Klair completed his medical degree from Manipal University in India and his general surgery training at the Albert Einstein College of Medicine/Montefiore Medical Center in New York. He received fellowship training in abdominal

organ transplantation and hepatobiliary surgery at the Columbia University Medical Center/New York Presbyterian Hospital. At Columbia, Dr. Klair was trained by some of the pioneers in transplantation – Drs. Jean Emond and Lloyd Ratner. Dr. Klair performs liver and kidney transplant surgery for adults and children. His special interests are in living donor liver transplantation and treatment of liver cancer.

6.2 Hepatology

Dr. Naim Alkhouri is the Director of the Metabolic Health Center at the Texas Liver Institute. Prior to joining TLI and UT Health San Antonio, he was Assistant Professor of Medicine at the Cleveland Clinic Digestive Disease Institute and Director of the Metabolic Liver Disease Clinic. Dr. Alkhouri completed his medical degree at the University of Damascus in Syria before completing his internal medicine and pediatric post-graduate training and residency at Albert Einstein Medical Center in Philadelphia. Dr. Alkhouri completed his pediatric gastroenterology, hepatology and nutrition fellowship at Cleveland Clinic and finally an Adult Transplant Hepatology fellowship at the Digestive Disease and Surgery Institute, Cleveland Clinic. Among many research awards, Dr. Alkhouri received the American College of Gastroenterology Junior Faculty Development Award. Dr. Alkhouri is fluent in Arabic and English.

Dr. Juan Guerrero received his medical degree from the Medical College of Wisconsin and completed his residency in internal medicine at UT Health. He went on to complete a fellowship in hepatology specializing in transplant at UT Health. Dr. Guerrero is a transplant hepatologist but also proficient in the endoscopic diagnosis and therapy of patients with advanced liver disease. He is certified by the American Board of Internal Medicine in gastroenterology and hepatology.

Dr. Carmen Landaverde is an Assistant Clinical Professor of Medicine at UT Health San Antonio where she attends on the wards and teaches the house staff. Prior to joining The Texas Liver Institute-Austin, Dr. Landaverde completed her Gastroenterology and Hepatology Fellowship at the University of California at Los Angeles (UCLA) and her Transplant Hepatology Fellowship at Baylor University Medical Center at Dallas, Texas. She has authored and co-authored review articles on the management of fluid retention and cirrhosis, NAFLD and nutrition, outcomes in liver re-transplantation and treatment of hepatitis C. She is certified by the American Board of Internal Medicine, Gastroenterology and Hepatology, and Transplant Hepatology. Dr. Landaverde is fluent in Spanish and English.

Dr. Eric Lawitz is a VP, Scientific and Research Development at Texas Liver Institute and a Clinical Professor of Medicine at UT Health San Antonio. Dr. Lawitz received a B.S. from University of Illinois Chicago and M.D. from Rush Medical College. Dr. Lawitz received his postgraduate training in Gastroenterology/Hepatology at Brooke Army Medical Center and is board certified in Gastroenterology/Hepatology. Dr. Lawitz has over 300 publications to include publications in the *New England Journal of Medicine, Gastroenterology, Lancet, Hepatology, and Journal of Hepatology*. In addition, Dr. Lawitz serves on the editorial board of *Lancet, Gastroenterology, American Journal of Gastroenterology, Gastroenterology & Clinical Gastroenterology, Hepatology, Journal of Hepatology, and Therapeutic Advances in Gastroenterology.*

Dr. Nicole Loo is the Director of Hepatobiliary Cancer at the Texas Liver Institute. Prior to joining TLI, she trained at world renowned institutions for liver and liver transplantation including internal medicine residency at Mayo Clinic in Rochester, Minnesota followed by gastroenterology fellowship at Yale in New Haven, Connecticut and, finally, liver transplantation fellowship at Mayo Clinic in Rochester, Minnesota. Her research interests include hepatitis B, portal hypertension, and liver cancer. She has previously served on the American Gastroenterology Association's (AGA) Education

& Training Committee and the Trainee Committee and has contributed as an author to the AGA's DDSEP 8 study test questions bank. She is an Assistant Professor at the UT Health San Antonio. She is fluent in Chinese and English.

Dr. Fred Poordad is Professor of Medicine at the UT Health San Antonio, Vice President of Academic and Clinical Affairs at The Texas Liver Institute and Chief of Hepatology and the University Transplant Center. Dr. Poordad received his bachelor and medical doctorate at the University of Alberta in Edmonton and completed a residency in internal medicine at St. Thomas Medical Center and Northeastern Ohio Universities College of Medicine. Dr. Poordad also completed fellowships in gastroenterology at the University of South Carolina and in hepatology/liver transplantation at the Johns Hopkins University School of Medicine. Dr. Poordad sits on multiple committees for national societies and has over 300 publications including numerous book chapters, abstracts, educational monographs and publishes in such journals as *Gastroenterology, Hepatology, Liver Transplantation, the New England Journal of Medicine, Journal of Hepatology, American Journal of Transplantation,* and *International Journal of Artificial Organs*.

Dr. Fabian Rodas is the Director of Transplant Services at Texas Liver Institute and is an Assistant Clinical Professor of Medicine at UT Health San Antonio. Prior to joining the Texas Liver Institute and UT Health, he completed his Hepatology Fellowship at Carolinas Healthcare System in Charlotte, North Carolina. Dr. Rodas also has international experience caring for patients in hospital systems in other countries and is fluent in Spanish and English. He has a special interest in liver transplant outcomes as well as the study of portal hypertension and decompensated liver disease. While at the Carolinas Healthcare System, his research included studying the natural history of non-alcoholic steatohepatitis (NASH) and primary sclerosing cholangitis (PSC). Dr. Rodas is certified by the American Board of Internal Medicine and is fluent in Spanish.

Dr. Vincent Speeg completed graduate school (BA, MA, PhD) at Rice University studying comparative biochemistry and physiology. He received his medical degree from the University of Texas Southwestern Medical School in Dallas and completed a medicine residency in Nashville, Tennessee at the Vanderbilt University Affiliated Hospitals. He was a Research Associate in the US Public Health Service at the National Cancer Institute in Bethesda, MD for two years before going back to Vanderbilt to complete GI fellowship. He transitioned from primarily bench research to clinical care during the last 10 years. He has been a transplant hepatologist and medical director of transplantation at University Transplant Center since the beginning of the program.

Dr. Jennifer Wells is from Fort Worth and attended Baylor University where she graduated with a BA in Biology. She went to Texas Tech University Health Sciences Center for her Medical Degree. She completed her Internal Medicine residency, Gastroenterology fellowship as well as her Transplant Hepatology fellowship at the University of Wisconsin Hospital and Clinics in Madison, WI. Dr. Wells joined the faculty at Baylor University Medical Center's transplant program in Dallas where she practiced for 6 years. In 2015, Dr. Wells joined Texas Liver Institute and UT Health in Austin. She is an Assistant Professor at the UT Health San Antonio.

6.3 Interventional Radiology

Dr. Garza-Berlanga completed his Medical School and Radiology Residency training in Monterrey, Mexico. Then, he completed a two year fellowship in Vascular and Interventional Radiology at RUSH University Medical Center in Chicago, Illinois. Dr. Garza-Berlanga joined UT Health faculty in 2011 He performs a wide range of minimally invasive procedures to treat cancer and arterial, venous and liver

diseases. His main interest is the treatment of tumors through percutaneous ablation and catheter based techniques.

Dr. Ghazwan Kroma received his medical degree from Damascus University in Syria in 1994. He completed his residency in Diagnostic Radiology in 1997 at Damascus University. Dr. Kroma worked as a diagnostic radiologist in Syria and Saudi Arabia from 1997 to 2004. He then completed a Neuroradiology fellowship at Louisiana State University in 2005; followed by two years of Interventional Radiology fellowships at Louisiana State University and the UT Health San Antonio. He joined UT Health faculty in 2007. Dr. Kroma is certified by the American Board of Radiology for diagnostic radiology followed by a Certificate of Advanced Qualification in vascular interventional radiology (CAQ).

Dr. Jorge Lopera completed his Medical School and Radiology Residency training in Medellin, Colombia. He completed two years of Interventional Radiology fellowship training at Louisiana State University in New Orleans. He is certified by the American Board of Radiology in Diagnostic Radiology and in Interventional Radiology. Dr. Lopera is a Fellow of the Society of Interventional Radiology. His main interests are the treatment of liver tumors, peripheral vascular interventions, treatment of arterio-venous malformations (AVMs) and dialysis related interventions.

Dr. Rajeev Suri received his medical degree from The Christian Medical College in India. He has completed residencies in diagnostic radiology at Cedars Sinai Medical Center in Los Angeles and at the Postgraduate Institute of Medical Education and Research in India. He completed a Cardiovascular and Abdominal Interventional Radiology Fellowship at the University of California Los Angeles. Dr. Suri is Board Certified by the American College of Radiology. His clinical interests include carotid artery stent placement, chemoembolization, infrainguinal arterial interventions, radiofrequency ablations, uterine fibroid embolizations, and transjugular intrahepatic portosystemic shunts.

Dr. John A. Walker, Jr., completed his medical training with the UT School of Medicine at San Antonio. Following medical school, he completed a two-year research fellowship with the US Army Institute for Surgical Research working in regenerative medicine and imaging. He then obtained a research doctorate in imaging with the UT School of Biomedical Sciences while simultaneously training in the UT School of Medicine at San Antonio Diagnostic Radiology residency. Through his efforts, he completed the prestigious ABR Holman Radiology Research Pathway. He then completed a fellowship in the UT School of Medicine at San Antonio Vascular and Interventional Radiology Program. Upon completion of his training, Dr. Walker joined the UT faculty in 2016.

6.4 Hematology/Oncology

Dr. Laura Tenner is a faculty member in the division of hematology/oncology. She completed her medical oncology fellowship at Indiana University School of Medicine, during which time she also completed a fellowship in clinical ethics at the Charles Warren Fairbanks Center for Medical Ethics. Dr. Tenner is board certified in both internal medicine and medical oncology with a focus in gastrointestinal cancers. She serves nationally on the American Society of Clinical Oncology (ASCO) Board of Ethics as well as the ASCO Cancer Prevention Committee. Her research includes using principles of ethics to help inform health services research and health policy.

Dr. Sukeshi Patel Arora is a native of San Antonio, graduated from University of Texas Southwestern Medical School in Dallas, Texas, and completed her Internal Medicine Residency and Medical Hematology and Oncology Fellowship at the UT Health San Antonio. She has been Assistant Professor of Medicine in the Division of Hematology/Oncology, UT Health Cancer Center, since 2014. As the leader for gastrointestinal malignancies, her clinical and research interests are gastrointestinal malignancies, GI geriatric oncology, and high-risk gastrointestinal cancer syndromes, such as Lynch syndrome.

6.5 Pathology

Dr. Francis Sharkey is a tenured Professor of Pathology and the Director of Autopsy Pathology at the University of Texas Medical School and UT Health San Antonio. He obtained his BS from Fairfield University in 1965, and followed with a BMS from Dartmouth Medical School in 1967. He completed his MD at Cornell University Medical College and continued with postgraduate training in anatomic pathology at the same institution, followed by a fellowship at Memorial Sloan-Kettering Cancer Center. He served in the US Army Medical Corps from 1971 to 1973 and held a faculty position at Hershey Medical Center-Pennsylvania State University, 1977-1987. UT Health San Antonio became his home in 1987. His major clinical interests include hepatopathology and laboratory quality management. He serves on the editorial board of Human Pathology, and with the College of American Pathologists' Laboratory Accreditation Program, serving as State and Regional Commissioner, Education Commissioner, Co-Chair of the Commission on Laboratory Accreditation, Chair of the Complaints and Investigations Committee, and editor of the Laboratory Accreditation Manual.

6.6 Clinical Coordinator

Katherine Crow, PA is a board certified physician assistant and the clinical coordinator for Texas Liver Tumor Center. She graduated from Baylor University in 1991 with a BS in Education and again in 1993 with a Master's degree in biology specializing in genetics. She was an adjunct professor of biology for 9 years at colleges in Ohio, Maryland, and Texas. Ms. Crow completed her Physician Assistant Studies degree at Louisiana State University Medical Center in 2009. Her experience includes interventional radiology specializing in interventional oncology and hepatobiliary interventions, as well as a surgical physician assistant in hepatobiliary surgery and solid organ transplant. She was the liver and pancreas tumor board coordinator at Louisiana State University Hospital and at the McDonald Regional Transplant Center both in Shreveport, Louisiana and continues in this role at Texas Liver Tumor Center.

6.7 Nutrition

Corrie Clark, RDN, LD is a Registered Dietitian Nutritionist for Texas Liver Tumor Center and University Transplant Center. She received her BS in Family and Consumer Sciences-Food and Nutrition from Texas State University in 1999, and completed her dietetic internship at the University of Houston in 2000. In 2009, Corrie earned her Certificate of Culinary Arts from The Culinary Institute of America at Greystone in Napa Valley, California. She practiced Clinical Dietetics in various healthcare and community settings for almost 20 years and managed a California Certified farmers' market for St. Helena Hospital Napa Valley. During her time in the Napa Valley, Corrie was Chef de Cuisine and Registered Dietitian for a well-known Lifestyle Medicine clinic. Additionally, Corrie is an Adjunct Nutrition Instructor and consultant for The Culinary Institute of America at San Antonio.

Barbra Swanson ND, RDN, LDN is one of the registered and licensed dieticians at Texas Liver Tumor Center. She is also a naturopathic doctor with three additional master's degrees in nutrition, natural health and holistic nutrition. She has 10 years of experience working with oncology patients at the UT Health Cancer Center and three and a half years at the Cancer Care Centers of South Texas. She currently serves as a transplant dietitian at UT Health San Antonio and University Health System. Barbara has been in practice for 24 years and has experience in geriatrics, bariatrics, internal medicine and wellness.

6.8 Nurse Coordinators

Valerie Girard obtained her RN in 2005 and worked in the University Hospital operating room with multiple surgical services including transplant services until 2009. At that time, she began working in liver transplant. Ms. Girard transitioned into hepatobiliary and transplant surgery in January 2010 as nurse coordinator. She has written departmental policies and protocols for hepatobiliary surgery patients and was integral in building the current processes and documentation for the multidisciplinary pancreas and liver tumor boards. Ms. Girard remains an active participant in continuing education for operating room techniques, instruments and equipment. She is a member of International AORN (Association of Perioperative Registered Nurses), TCORN (Texas Council of Operating Registered Nurses), ANA (American Nurses Association), and TNA (Texas Nurses Association).

Lori Saathoff obtained her BSN in 1995 and began her career in the medical/cardiac ICU at University Hospital where she continued for four years. She then transitioned to the Transplant /Hepatobiliary surgery program in 1999. Ms. Saathoff was a liver transplant and hepatobiliary coordinator for 15 years until moving into hepatobiliary surgery exclusively. She continues in the role of hepatobiliary surgical coordinator today. Ms. Saathoff has presented papers at NATCO on hepatocellular carcinoma and hepatitis C patients. She continues to present continuing and introductory education twice yearly at the Transplant Nursing Course.

6.9 TLTC Director

Irma V Infante, MSN, RN is the director of Texas Liver Tumor Center. She received her Bachelors of Nursing in 1995 and her Master of Nursing in 2012 from the University of Texas Health Science Center School of Nursing. Irma has over 20 years of nursing experience including 10 years of management. Her experience includes 5 years as a bedside nurse, 7 years as a liver transplant coordinator, and 9 years with the department of neurosurgery overseeing their clinical operations. Irma is also the director of Advanced Endoscopy Program for University Hospital.

7. Contact Us

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Texas Liver Tumor Center

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