PHILIPS

Ultrasound

Customer story

Simplifying liver assessment in internal medicine

Philips Affiniti ultrasound for elastography and contrast-enhanced ultrasound (CEUS)

Where

Sonography Institute, Uster, Switzerland

Who

Associate Professor Jan Tuma, MD, Principal

Challenge

How ultrasound can help in the assessment and treatment of patients with liver disease

Solution

Philips Affiniti offers advanced capabilities – including quick and easy elastography and contrast-enhanced ultrasound (CEUS) – for ongoing patient assessment and monitoring of disease progression

As treatments for liver disease advance, the role of internal medicine becomes even more important in staging and monitoring disease and its treatment.

Dr. Jan Tuma uses the capabilities of the Philips Affiniti ultrasound system, including elastography for diffuse liver disease and contrast-enhanced ultrasound (CEUS) for focal disease, to provide excellent care for his patients.

Quantification plays an **increasing role** in care

With regard to liver and other abdominal exams, Dr. Tuma says, “Ultrasound is very central to patient care. We have a lot of people with liver diseases and we need to see if it’s fibrosis or another chronic disease such as alcoholic cirrhosis. We see diffuse liver disease and a lot of focal liver diseases, and it’s extremely useful to use ultrasound to look for primary liver cancer or metastasis, as well as other focal diseases such as benign disease, focal nodular hyperplasia, or hepatic hemangiomas.

“We can provide quantification with ultrasound. There are new therapies to treat liver disease and we can use elastography to measure the state of the fibrosis as part of patient management.”

Advanced capabilities in an affordable system

Dr. Tuma finds that the combination of capability and affordability of Affiniti helps him deliver a high standard of care. He says, “Affiniti is very practical. It does not take much time to do an exam and I can perform liver assessments in a few minutes.” He views ultrasound as valuable in both diffuse and focal liver disease, helping to differentiate between benign and malignant disease. “We have studies that compare CEUS with CT and MRI. We don’t have the complications that can come with CT or MRI. CEUS really helps the assessment,” he says.

“Elastography on the Affiniti is very easy to use,” says Dr. Tuma. “It’s like manual palpation, looking for stiffness.” The speed and ease of performing an exam with the Affiniti system lets Dr. Tuma concentrate on his patients, rather than on the system.

ElastPQ for liver stiffness assessment

Philips ElastPQ elastography generates shear waves inside the liver by using acoustic force from a focused ultrasound beam. The system monitors shear wave propagation and measures its velocity, then displays it in an easy-to-interpret format. Obtaining liver stiffness measurements with Philips ElastPQ shear wave elastography is surprisingly easy and fast, even on difficult-to-image patients.

- Easily combine a routine ultrasound imaging exam of the liver anatomy with targeted tissue stiffness values
- Assess liver fibrosis in patients with clinically suspected disease even before abnormalities are detected with ultrasound imaging
- Evaluate and obtain a baseline stiffness value in patients with chronic liver disease
- Follow up patients under treatment to monitor progression, stabilization, or regression of liver disease
- Help avoid the need for liver biopsies when elastography results are consistent with other clinical findings

Enhancing the experience for all

Dr. Tuma views the Affiniti system as useful for a wide range of clinicians and a wide range of patient types, and enhances the patient experience. “I use ultrasound to help the patient understand his or her condition,” Dr. Tuma says. “I explain what’s on the screen. I have two monitors, one for the patient and one for me. I use arrows to clarify what they’re seeing so they know what is going on in the exam.”

Dr. Tuma believes it is important for internal medicine clinicians to understand the strengths of each imaging modality and how ultrasound fits in to patient care.

“I find that when I teach, initially medical students think only specialists should use ultrasound, but then they get hands-on experience with the machine and they see what it can do for them and for patients,” he says.

Clinical cases

Affiniti and simplifying patient assessment

“The images are marvelous. Not just in the overview, but also if you’re looking for **details**.”

Jan Tuma, MD

Case study 1 Focal nodular hyperplasia

A 28-year-old female asymptomatic medical student was scanned during routine participation in an ultrasound course and was incidentally found to have an isoechoic mass in segment IV of the liver.

Follow-up examinations with color Doppler ultrasound and contrast-enhanced ultrasound[1] (CEUS) allowed Dr. Tuma to confirm a conclusive diagnosis of focal nodular hyperplasia (FNH).

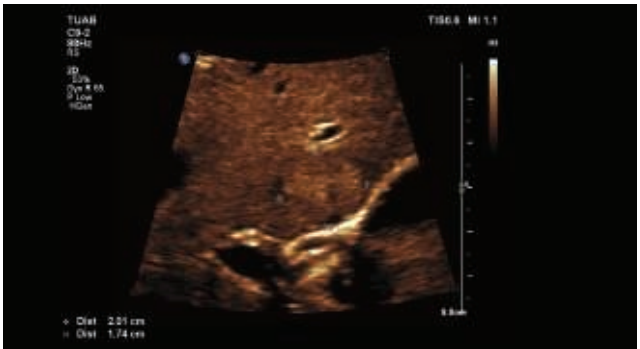

Figure 1 Isoechoic mass of 20x17 mm in segment IV of the liver.

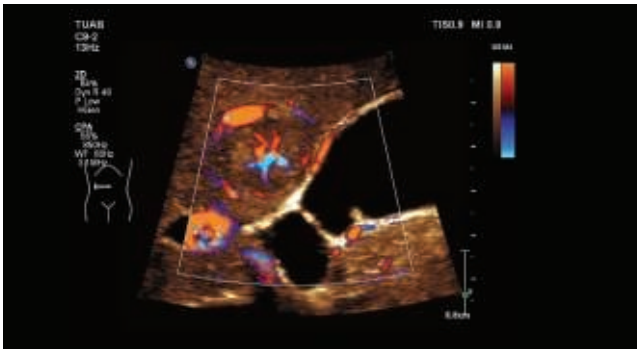

Figure 2 Color Doppler ultrasound shows strong perfusion from center of mass.

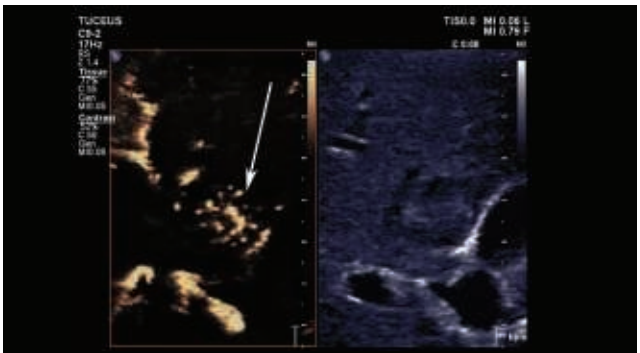

Figure 3 CEUS bolus injection quickly demonstrates perfusion of mass starting in the center (arrow).

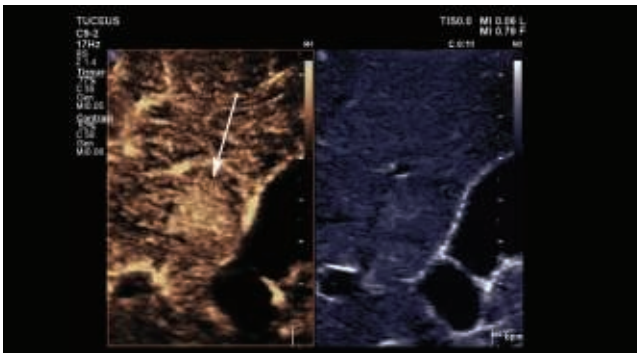

Figure 4 Perfusion of the liver is visible soon after.

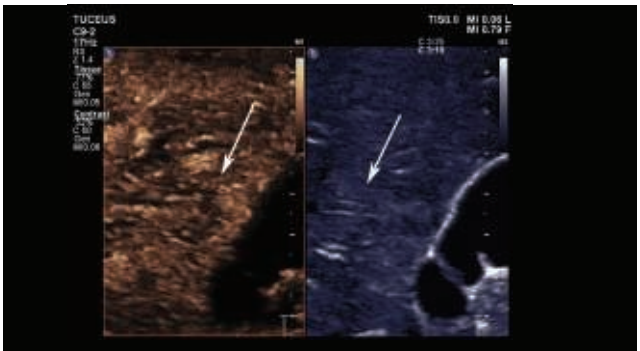

Figure 5 In the late phase after three minutes, perfusion of FNH and the liver is the same.

Case study 2 Previously undiscovered hemangioma

A patient presented with an incidental finding in the left hepatic lobe. Because the tumor was so firmly anchored to the outermost part of the lobe, it had not been seen in prior studies. B-mode ultrasound did not reveal the nature of the mass.

CEUS was used to investigate and further characterize the mass. Upon bolus injection of contrast media, the mass was gradually perfused from the periphery to the center. The perfused areas showed nodular forms, with circulation at the centers partly deficient or not present. CEUS confirmed an extremely large hemangioma with thrombosed areas in the center region.

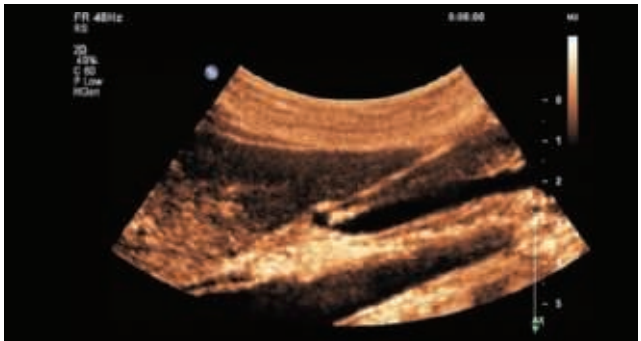

Figure 6 Longitudinal view with normal left liver lobe.

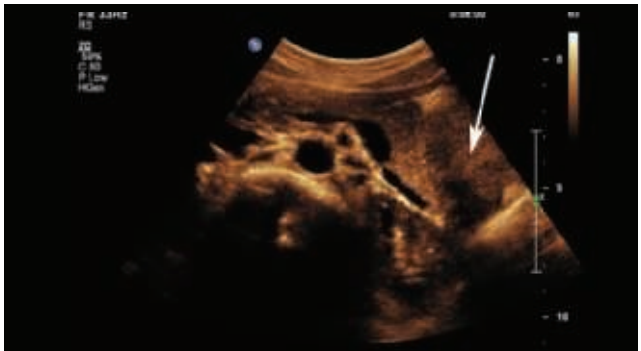

Figure 7 Transverse view with normal aorta, kidney pancreatic tail, and air in stomach. Soft pressure removes the air, revealing the suspicious mass.

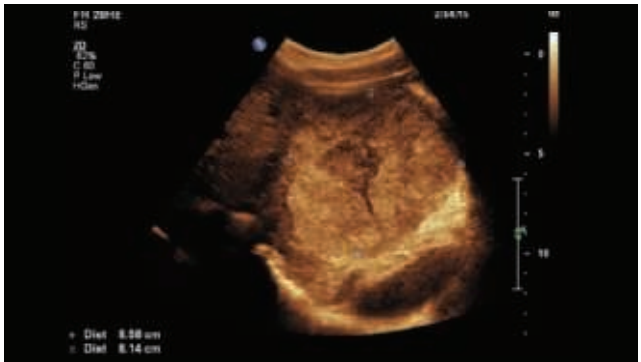

Figure 8 Mass in more cranial transverse view measures 8.6 x 8.1 cm.

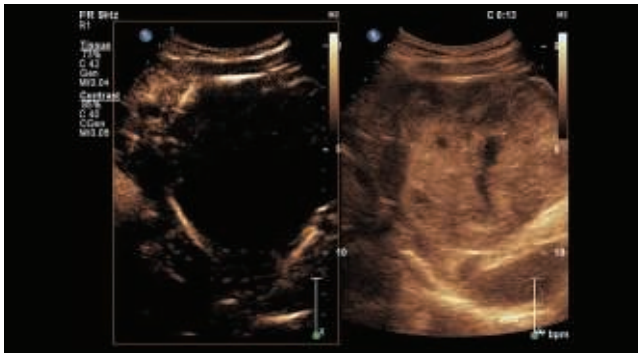

Figure 9 CEUS, 13 sec after IV bolus of contrast agent, shows perfusion beginning in liver (left) but perfusion begins only at margin of mass.

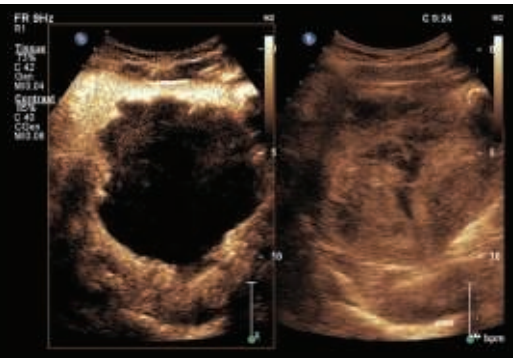

Figure 10 CEUS, 24 sec after IV bolus of contrast agent, shows perfusion of mass starting in the periphery of the nodular forms.

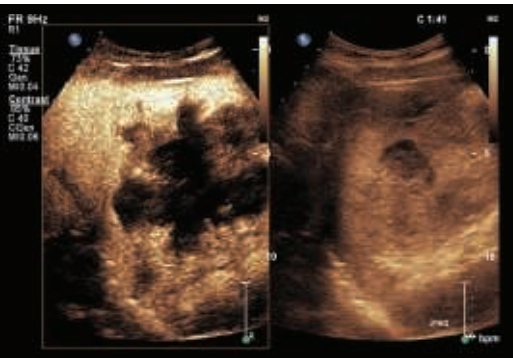

Figure 11 CEUS, 101 sec after IV bolus of contrast agent, demonstrates that mass perfusion progresses slowly from the periphery to the center.

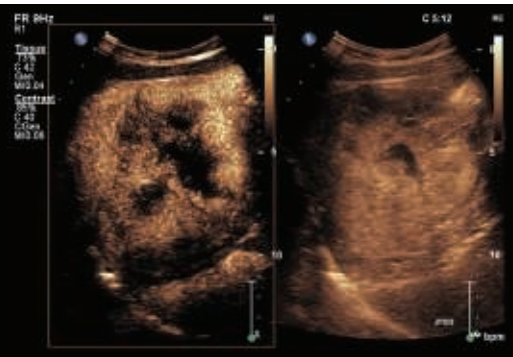

Figure 12 At 312 sec after IV bolus of contrast agent, CEUS shows that some areas are still not perfused, indicating that these are thrombosed parts of an extremely large hemangioma.

Case study 3 Hepatocellular carcinoma

A 56-year-old female patient with a previous history of drug addiction and hepatitis C infection and current use of alcohol was seen for ongoing monitoring of the liver. Therapy with interferon and peginterferon ribavirin had been unsuccessfully attempted in 1996 and 2003. The patient's hepatitis C infection was of genotype 1a, which often proves resistant to these medications.

In 2011, the patient was examined with CEUS and B-mode ultrasound. The patient's α-fetoprotein was in the normal range and no typical hepatocellular carcinoma was detected. However, very small hemangiomas were suspected in a CT examination, which suggested the need for regularly established six-month control studies.

The patient's periodic work-related stays in Africa from 2012 through 2015, complicated by continued alcohol use, made consistent follow-up care challenging. Control studies performed in 2012, 2013, and 2014 showed that liver values were worsening, demonstrating thrombocytopenia as well as higher levels of transaminases. While these studies showed clear cirrhotic changes, they were not suggestive of any tumors such as hemangiomas or hepatocellular carcinomas.

In 2016, the patient returned from Africa and underwent a control study that demonstrated cirrhosis with a higher degree of stiffness measured by point shear wave elastography (pSWE).[2-4] Portal perfusion was normal.

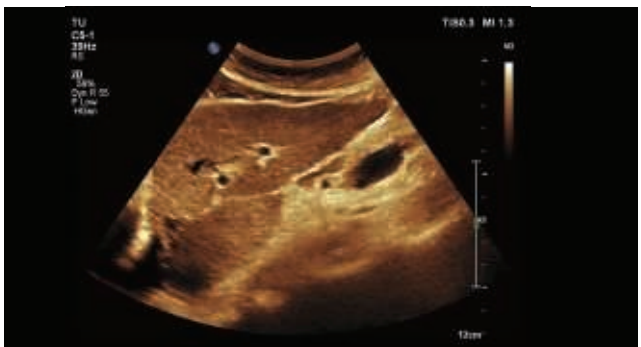

Figure 13 Longitudinal image of left liver lobe shows an inadequate large segment I, diffuse coarsened echo pattern, and bumpy liver contour typical of cirrhosis.

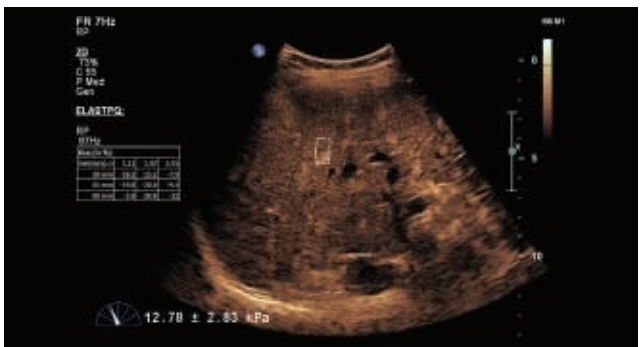

Figure 14 Liver stiffness, measured by shear wave elastography (pSWE) was 12.7 kPa. Stiffness greater than 10 kPa is typical of cirrhosis.

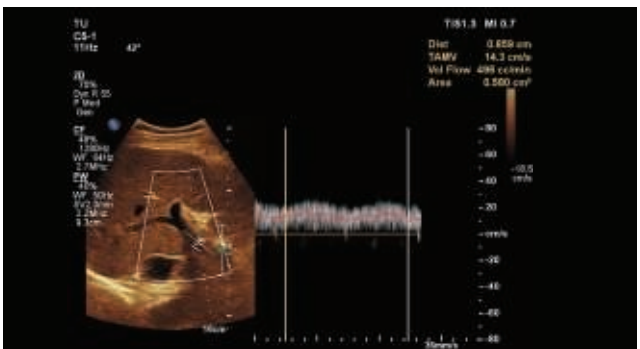

Figure 15 Portal venous perfusion shows TAMV (time average mean velocity) of 14.3 cm/sec (normal > 12 cm/sec) and vol flow (flow volume in 1 min) of 496 ml/min (normal > 500 ml/min).

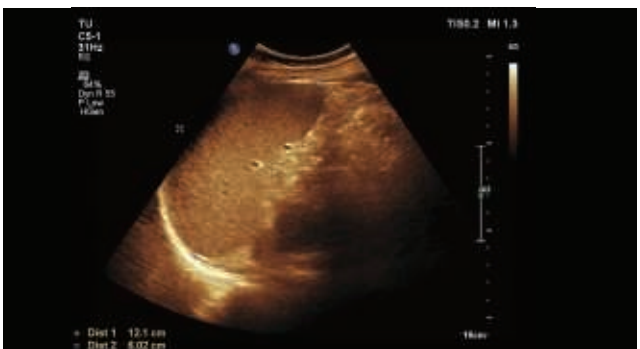

Figure 16 Spleen in intercostal cut is enlarged at 12.1 x 6.0 cm; volume is 464 ml (436 ml/m^2 BSA).

Other parameters were typical of advanced cirrhosis: thrombocytopenia (platelet count of 44,000/mm^3), leukocytopenia (leukocyte count of 3,600 cells/mm^3), and anemia (hemoglobin 99g/l). Spleen volume was enlarged to 419 ml/1.73 m^2 BSA (normal is < 200 ml). In addition to typical cirrhotic changes, ultrasound showed a new hyperechoic mass. CEUS demonstrated very rapid perfusion of this mass, with irregular vessels. The perfusion persisted for a length of time, which was interpreted to mean the mass was most likely a hepatocellular carcinoma.

A follow-up liver-specific magnetic resonance imaging examination demonstrated the same result. In this case, no biopsy was necessary to confirm diagnosis and the patient underwent surgery. The tumor, which was a hepatocellular carcinoma, was completely removed. Subsequently, therapy with ledipasvir/sofosbuvir and ribavirin was initiated, and the patient was viral-free after only a few weeks.

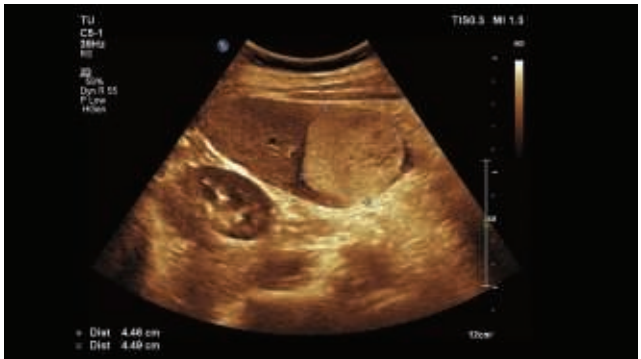

Figure 17 New hyperechoic mass of 4.5 cm found in segment IV.

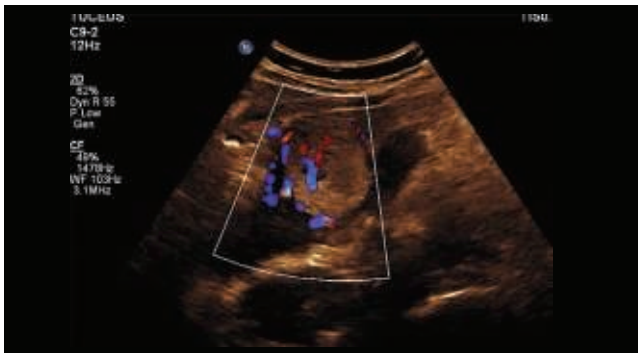

Figure 18 Color Doppler ultrasound shows the new mass with many vessels.

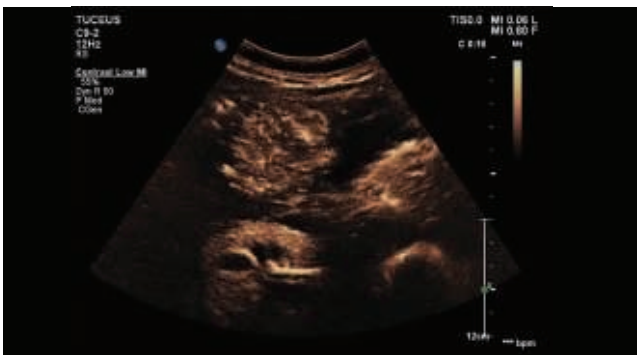

Figure 19 CEUS 16 sec after contrast bolus shows very early perfusion of mass, simultaneous with kidney cortex. Vessels in mass are very irregular.

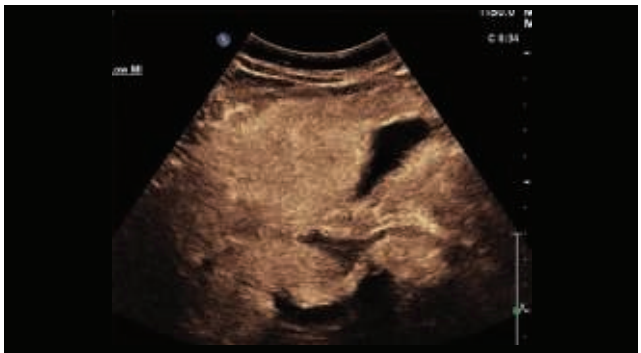

Figure 20 CEUS 34 sec after contrast bolus demonstrates enhanced perfusion of mass as compared to liver.

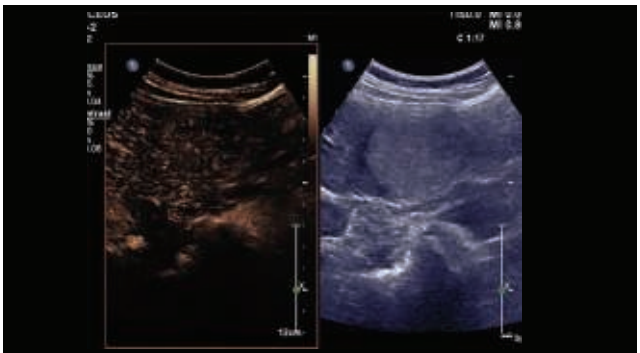

Figure 21 CEUS 77 sec after contrast bolus shows weak perfusion of mass comparable to the liver, which is highly suggestive of diagnosis of cirrhosis and hepatocellular carcinoma.

Case study 4 Assessing efficacy of therapy in hepatitis C

A 55-year-old male with a previous history of drug addiction and infection with the hepatitis C virus, genotype 1a, had unsuccessfully undergone therapy with interferon and peginterferon ribavirin in 2011.

In June, 2016, liver stiffness was assessed by pSWE (point shear wave elastography) and found to be 10.44 kPa. In October it measured 10.51 kPa. Therapy with ledipasvir/sofosbuvir and ribavirin was initiated, and the patient soon tested negative for the hepatitis C virus. Follow-up measurement of pSWE in April, 2017, showed a decrease in stiffness to 6.62 kPa.

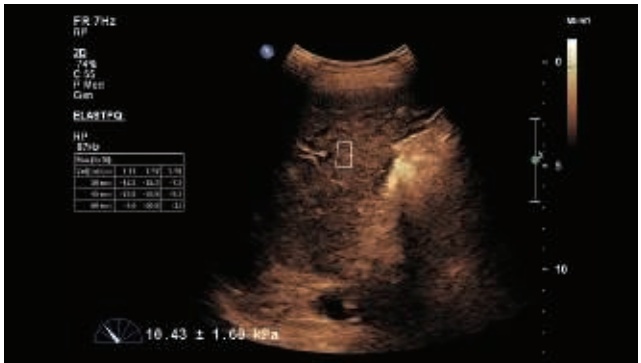

Figure 22 Liver stiffness measured October 21, 2016. Average of multiple measurements: 10.51 kPa.

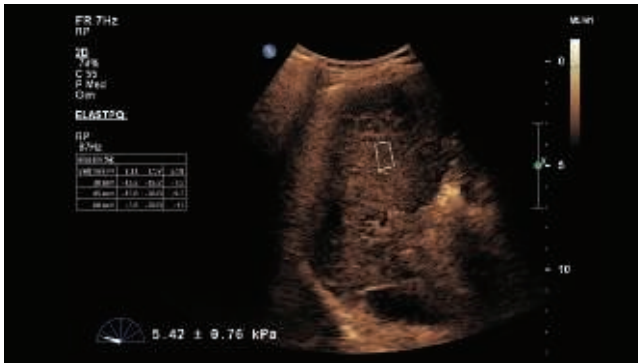

Figure 23 Liver stiffness measured April 4, 2017. Average of multiple measurements: 6.62 kPa.

New therapies, **informed treatment**

Ultrasound is integral to Dr. Tuma's internal medicine practice. He performs between 15 and 20 ultrasound exams each day and sees the value of ultrasound in providing quantitative assessments.

"There are new therapies and we need to know the extent of the disease and then monitor treatment. For example, in addition to evaluating portal flow and the spleen through ultrasound, we use elastography to measure the state of fibrosis. In hepatitis C, every six months we look for complications such as hepatocellular carcinoma (HCC)."

He has found that use of the Affiniti system has reduced his need to biopsy in hepatitis C for some patients.

"Affiniti is **excellent** with CEUS."

Jan Tuma, MD

About Dr. Tuma

Associate Professor Jan Tuma, MD, is Principal of the Sonography Institute, Uster, Switzerland. His background is in nephrology with a focus on renal tumors. Ultrasound is central to his internal medicine practice, and he also teaches ultrasound. He has been an Honorary Fellow of EFSUM (European Federation of Societies for Ultrasound in Medicine & Biology) since 2015.

References

1. Claudon M, Dietrich CF, Choi BI, et al. Guidelines and Good Clinical Practice Recommendations for Contrast Enhanced Ultrasound (CEUS) in the liver – update 2012: A WFUMB-EFSUMB initiative in cooperation with AFSUMB, AIUM, ASUM, FLAUS and ICUS. Ultrasound Med Biol 2013;39:187-210.

2. Bamber J, Cosgrove D, Dietrich CF, et al. EFSUMB guidelines and recommendations on the clinical use of ultrasound elastography. Part 1: Basic principles and technology. Ultraschall Med 2013;34:169-84.

3. Cosgrove D, Piscaglia F, Bamber J, et al. EFSUMB guidelines and recommendations on the clinical use of ultrasound elastography. Part 2: Clinical applications. Ultraschall Med 2013;34:238-53.

4. Ferraioli G, Filice C, Castera L, et al. WFUMB guidelines and recommendations for clinical use of ultrasound elastography: Part 3: liver. Ultrasound Med Biol 2015;41:1161-79.

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