Our Metrics

Understanding T2*

Perspectum Diagnostics provides a comprehensive assessment of liver health based on a range of MRI-derived biomarkers, using our flagship product Liver*MultiScan*™.

What is T2*?

T2* is a time constant (measured in milliseconds) describing the decay of an MRI signal. This decay is influenced by spatial variation (inhomogeneities) in the magnetic field of the MRI scanner. T2* is field strength dependant.

What does T2* measure?

In the liver, iron deposits (typically in the form of ferritin and hemosiderin) cause such inhomogeneities and have a measurable effect on T2*.

Tissues with high iron typically have very short T2*, while tissues with very low iron have longer values. The relationship between T2* and liver iron concentration (mg Fe/g dry weight tissue) has been well validated[1].

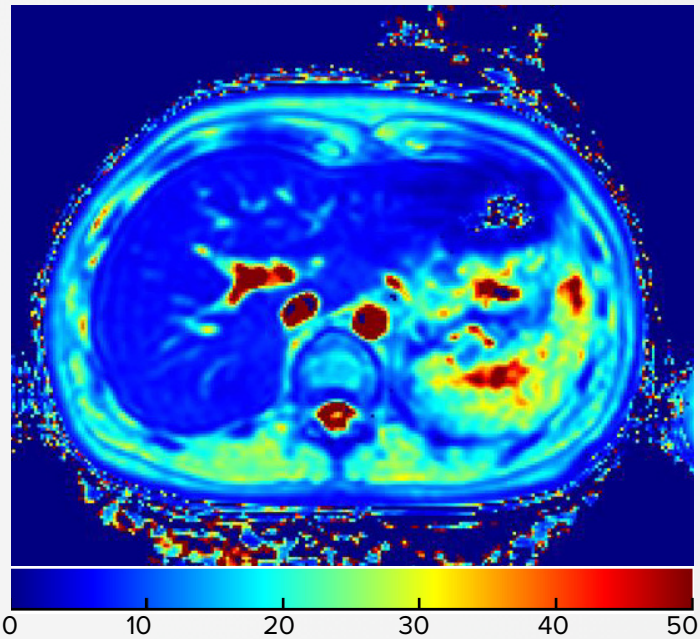

Figure 1. Quantitative T2* map produced using Liver*MultiScan*. This image is from a study with BioBank data acquired with a 1.5T Siemens scanner. T2* = 6.5ms. (2.6mg Fe/g)

Using a parametric map, T2* can be measured (Figure 1), and can be used as a biomarker in the assessment of hepatic iron overload, or hemosiderosis.

Why is T2* useful?

A principal function of the liver is the regulation of iron homeostasis, and any imbalances in iron load can cause damage and dysfunction throughout the body. Measuring iron load is important in assessing liver health.

For patients and doctors, having a reliable measure of iron load can be important in effectively managing liver disease, and using T2* to measure liver iron can help identify patients who need treatment. Our collaborative work with the UK Biobank project (Figure 2) has estimated that almost 5% of the UK population have iron overload (over >1.8mg/g liver iron[2]) and 30% of those with Fatty Liver Disease are believed to have iron overload[2].

The presence of iron can also affect T1 and the measurement of T1, so accurate T2* assessment is also important to the accurate quantification of corrected T1 (our measure of inflammation and fibrosis).

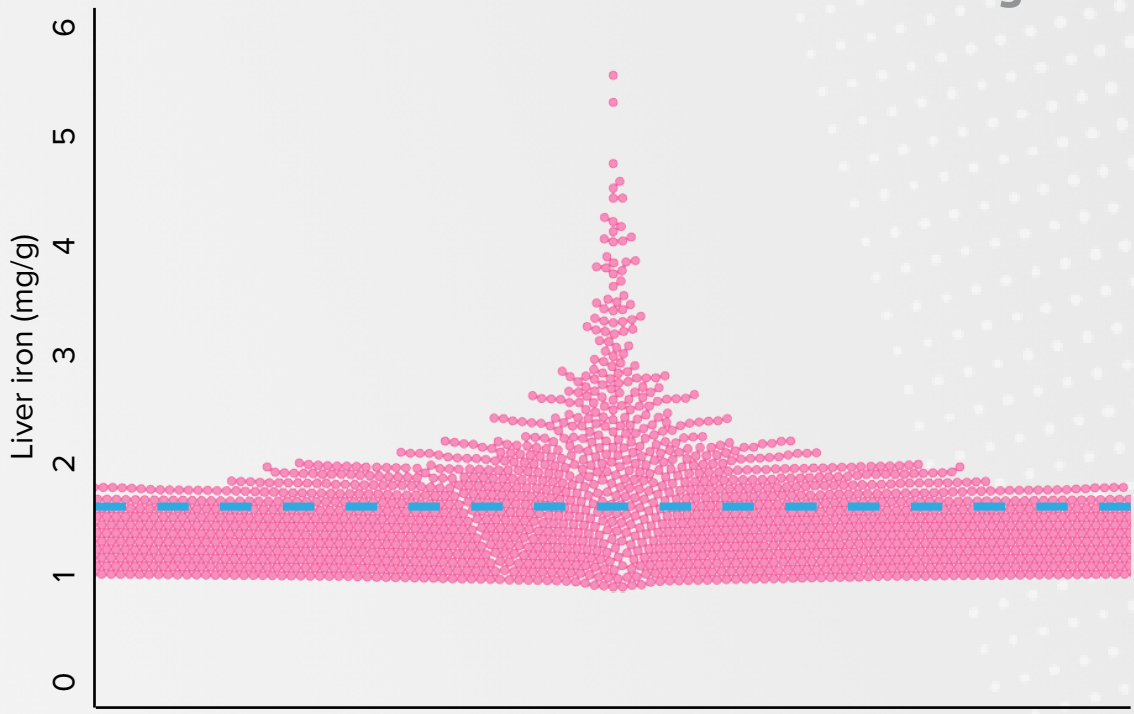

Figure 2. The distribution of hepatic iron load in the BioBank data. Those above the dotted blue line are considered to have iron overload (>1.8mg/g). This data was collected using a 1.5T Siemens scanner.

Perspectum's Method: T2* IDEAL

Liver*MultiScan*'s T2* maps are calculated based on the IDEAL algorithm.

Although T2 (which is related to T2*) and the related R2 can be used in the estimation of hepatic iron content, the gradient-echo T2* (and the related R2*) technique employed by Liver*MultiScan* is more widely used due to its speed and ease of use[3,1].

With IDEAL, arbitrarily spaced echoes can be used, allowing for optimization of acquisition times as well as signal-to-noise ratio[4,5].

Rapid T2* imaging: Liver*MultiScan*'s T2* maps are calculated from the same multi-echo spoiled gradient-echo images that are acquired to measure PDFF. These data can be collected in one short breath-hold (<10 seconds). This reduces the time that the patient needs to be in the scanner, which in turn maximizes scanner utility.

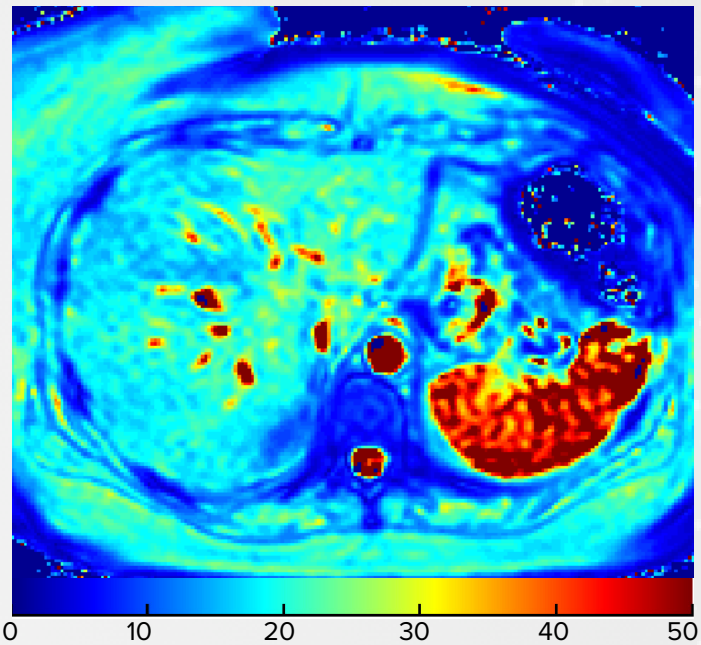

Figure 3. Quantitative T2* map produced using Liver*MultiScan*. This image is from a study with BioBank data acquired with a 1.5T Siemens MRI. T2* = 19.4ms.

References

1) Wood, et al., (2005). MRI R2 and R2* mapping accurately estimates hepatic iron concentration in transfusion-dependent thalassemia and sickle cell disease patients. Blood, 106(4): 1460–1465.
2) McKay, A.G., Wilman, H.R., Dennis, A., Kelly, M.D., Thomas, L.E., Bell, J.D., Neubauer, S., Banerjee, R. (2017). UK Biobank Study of Liver Iron Overload Shows Variable Penetrance of Different Genotypes. AASLD, Washington DC, 20. 24 October 2017
3) Meloni, et al., (2011). Single region of interest versus multislice T2* MRI approach for the quantification of hepatic iron overload. J Magn Reson Imaging, 33(2):348-55.
4) Reeder, et al., (2007). Water-fat separation with IDEAL gradient-echo imaging. J Magn Reson Imaging, 25(3):644-52.
5) Kijowski, et al., (2009). Cartilage imaging at 3.0T with gradient refocused acquisition in the steady-state (GRASS) and IDEAL fat-water separation. J Magn Reson Imaging, 28(1):167-74.

info@perspectum-diagnostics.com | perspectum-diagnostics.com | US: (+1) 857 321 8675 | UK: (+44) 1865 655325