Please Review the Guidelines for Iron Imaging at 1.5T before proceeding. This document only presents those features that are different at 3.0 Tesla.

**Cardiac Imaging**

Cardiac protocols developed at 1.5 Tesla can be successfully used at 3.0 Tesla without modification. However, the following points are important

1. Volume specific shim (localized just on the heart) will reduce spurious decreases in cardiac T2\* value.
2. Susceptibility effects from porta-caths and lung-heart interface have longer spatial range. It is critical to exclude these regions from ROI during analysis.
3. Signal decay is two-fold greater at 3.0 Tesla, thus signal truncation when signal intensity approaches the noise floor are crucial.

**Liver imaging by standard multiple echo gradient echo**

The multiple echo-gradient echo sequence described in the protocols at 1.5T can be used to estimate liver iron concentrations in patients with low and moderate iron burdens. The dynamic range can be extended approximately 20% by collecting one TE per breath-hold using logarithmically spaced echo times. Table 1 summarizes the approximate relationship between minimum echo time and maximum detectable LIC at 3.0 Tesla.

Echo times will vary depending on the imaging parameters but the following principles should be obeyed.

#1) Shortest possible first echo at all times. To accomplish this, keep the voxel resolution in the frequency direction low (64-128). Receiver bandwidth should be as high as possible and maximum gradient strength and slew rates should be utilized (in compliance with local regulations). The target is for a minimum echo time near 1 ms. It is also critical to read every echo, not every other echo, during readout. On Philips and Siemens, this is done by disabling the “flyback” option and on General Electric this is controlled by CV18 on the user CV page.

#2) Interecho spacing should also be as short as possible. The number of echoes can be then be adjusted such that the final echo is between 7 and 14 ms. If the liver is lightly iron loaded, and one cannot collect more than 8 echoes, it is advisable to adjust the interecho spacing such that the final extends to around 14 ms.

*It is critical to understand that the echo spacing determines the dynamic range of liver iron than can be measured. Table 1 demonstrates the approximate maximum LIC that can be estimated for a given minimum echo time and echo spacing. Patients with LIC values greater than this threshold will have livers that appear exceedingly darker on the first echo time. Any patient with a liver-skeletal muscle signal ratio < 0.5 on the first echo time should be considered at risk for LIC underestimation.*

|  |  |
| --- | --- |
| 1st Echo Time | Maximum LIC |
| 0.6 | 32 |
| 0.7 | 27 |
| 0.8 | 24 |
| 0.9 | 21 |
| 1.0 | 19 |
| 1.1 | 17 |
| 1.2 | 16 |
| 1.3 | 14 |
| 1.4 | 13 |
| 1.5 | 12 |
| 1.6 | 11.5 |
| 1.8 | 10 |
| 2.0 | 9.5 |

**Liver R2\* by Ultrashort TE techniques**

Our group and Claudia Hillenbrand’s group independently validated Ultrashort TE as a viable approach for liver iron quantification over the entire dynamic range. UTE sequences are available as Works-In-Progress on Philips and Siemens products. As such, they can only currently be used under IRB approved research studies. The techniques have some key differences across the three vendors and phantom validation is essential to confirm that the sequences are configured correctly. I also recommend that the references provided in the UTE folder be reviewed carefully.

An exam card for the Philips UTE sequence is provided in the Pulse Sequence folder. Investigators interested in the Siemens solution should contact Dr. Claudia Hillenbrand directly (Claudia.Hillenbrand@STJUDE.ORG). General Electric supported a UTE WIP sequence in the past. Interested investigators should work through their GE Research Support representative. **References**

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2. Fernandes JL, Fioravante LAB, Verissimo MP, Loggetto SR. A free software for the calculation of T2\* values for iron overload assessment. *Acta Radiol*. 2017;58(6):698-701.

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4. Wood JC, Enriquez C, Ghugre N, et al. MRI R2 and R2\* mapping accurately estimates hepatic iron concentration in transfusion-dependent thalassemia and sickle cell disease patients. *Blood*. 2005;106(4):1460-1465.

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7. Meloni A, Rienhoff HY, Jr., Jones A, Pepe A, Lombardi M, Wood JC. The use of appropriate calibration curves corrects for systematic differences in liver R2\* values measured using different software packages. *Br J Haematol*. 2013;161(6):888-891.