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| **About the Measure** | |
| **Domain:** | Sickle Cell Disease Curative Therapies |
| **Measure:** | Myocardia Iron Estimation Using T2\* MRI |
| **Definition:** | Red blood cell (RBC) transfusions lead to iron accumulation in the liver, heart, and endocrine organs. Sickle cell disease (SCD) patients are vulnerable to iron overload, which can lead to iron-related morbidity and mortality. Myocardial iron estimation via magnetic resonance imaging (MRI) is a non-invasive technique to measure levels of iron and predict the risk of developing iron-related cardiac complications. |

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| **About the Protocol** | |
| **Description of Protocol:** | This protocol provides guidance for analyzing T2\* iron estimation images generated by myocardial magnetic resonance imaging (MRI). |
| **Protocol:** | **T2\* Imaging Methods**  A complete discussion of T2\* Imaging methods can be found in Baksi (2014).  The “T2” indicator, which represents the amount of iron in the heart, is quantified as the smaller the T2\* then the greater the iron deposition. The reciprocal of T2\* is R2\*, with R2\* = 1/T2\*. Heart iron concentration is directly proportional to R2\*. By using gated, short-axis images taken from breath-hold, multi-echo sequences, iron concentration may be viewed in the heart. Using appropriate software to visualize the images, a T2\* relaxation curve can be viewed and a T2\* value generated to render a pathological diagnosis.   The presence of iron in the heart disrupts the magnetic field, therefore shortening relaxation time and decreasing value of heart T2\* compared with normal tissue. Reference ranges for T2\* iron loading have identified that:  High risk – T2\* value below 10 milliseconds  Intermediate risk – 10 to 20 milliseconds  Low risk – 20+ milliseconds |
| **Participant** | Patients at risk for heart failure due to iron overload from transfusion |
| **Source:** | Baksi, A. J., & Pennell, D. J. (2014). T2\* imaging of the heart: Methods, applications, and outcomes. *Topics in Magnetic Resonance Imaging, 23*(1), 13–20. |
| **Language of Source:** | English |
| **Personnel and Training Required:** | A trained magnetic resonance imaging (MRI) technician is required to administer the MRI. |
| **Equipment Needs:** | A magnetic resonance imaging (MRI) machine with a field strength of 1.5 Tesla |
| **Protocol Type:** | Complex instrumentation-based assessment |
| **General References:** | American College of Radiology, North American Society for Cardiovascular Imaging, & Society for Pediatric Radiology. (2016). *ACR–NASCI–SPR Practice Parameter for the Performance and Interpretation of Cardiac Magnetic Resonance Imaging (MRI)* (Resolution 5).  Anderson, L. J. (2011). Assessment of iron overload with T2\* magnetic resonance imaging. *Progress in Cardiovascular Diseases, 54*(3):287–294.  Anderson L. J., Holden, S., Davies, B., Prescott, E., Charrier, C. C., Bunce, N. H., Firmin, D. N., Wonke, B., Porter, J., Walker, J. M., & Pennell, D. J. (2001). Cardiovascular T2‐star (T2\*) magnetic resonance for the early diagnosis of myocardial iron overload. *European Heart Journal,* *22,* 2171–2179.  Kirk, P., Roughton, M., Porter, J. B., Walker, J. M., Tanner, M. A., Patel, J., Wu, D., Taylor, J., Westwood, M. A., Anderson, L. J., & Pennell, D. J.(2009).Cardiac T2\* magnetic resonance for prediction of cardiac complications in thalassemia major. *Circulation, 120*(20),1961–1968.  Westwood, M., Anderson, L. J., Firmin, D. N., Gatehouse, P. D., Charrier, C. C. , Wonke, B., & Pennell, D. J. (2003). A single breath-hold multiecho T2\* cardiovascular magnetic resonance technique for diagnosis of myocardial iron overload. *Journal of Magnetic Resonance Imaging, 18*(1):33–39. |