

Iron Overload: An AHP Guide

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1. Introduction

Iron overload cardiomyopathy (IOC) is caused by excessive iron accumulation in the myocardium, leading to progressive heart failure. It is commonly seen in patients with conditions like hereditary hemochromatosis, thalassemia, or chronic blood transfusions. The excess iron deposits in the heart tissue can cause direct myocardial damage, fibrosis, and eventually, dilated cardiomyopathy. However, with effective therapy it is a potentially reversible form of heart failure.

IOC can be challenging to differentiate from other forms of heart failure, as it can present with non-specific findings like myocardial dilation and reduced ejection fraction. However, CMR is a valuable tool in both diagnosing and assessing the extent of myocardial iron deposition and its effects on heart function. T2 * mapping is the gold-standard technique to evaluate myocardial iron load, while late gadolinium enhancement (LGE) and cine imaging, provide complementary insights into the myocardial function and fibrosis.

2. CMR Protocol

	Sequence/Technique	Notes
1	Anatomy (Localisers)	Scouts to plan cardiac views
2	LV and RV function – Cine SSP	Long and short axis to assess wall motion, LV/RV function and volume
3	T2* Mapping	Quantify myocardial iron load; typically, lower T2* values indicate higher iron concentrations
4	Late Gadolinium Enhancement	Assess myocardial fibrosis; may be present in advanced cases

3. Reporting Checklist

- LV: EDV, ESV, SV, EF, mass (indexed to BSA)
- RV: EDV, ESV, SV, EF(indexed to BSA)
- Regional wall motion abnormalities: May include global or regional hypokinesia, often due to severe myocardial iron deposition



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- T2 Mapping*: Quantification of iron load (shorter T2* times suggest higher iron burden)
- LGE: Fibrosis may be present in later stages; distribution is typically subendocardial or transmural

4. Key Diagnostic Criteria

- IOC: potentially reversible cause of heart failure under effective therapy
- Dilated phenotype: majority of patients, impaired systolic function
- Restrictive phenotype: non-dilated ventricles, preserved systolic function, diastolic dysfunction, enlarged atria
- Evidence of iron overload: degree of iron overload can indicate risk of developing heart failure
 - T2 * > 20ms: low
 - T2 * 10-20ms: intermediate
 - T2 * <10ms: high
- Can be seen in patients with hereditary haemochromatosis, thalassemia major and those undergoing repeated blood transfusions
- Fibrosis: Advanced iron overload may lead to myocardial fibrosis detectable via LGE imaging
- Focal signal loss in native T1 and T2 weighted images.
- Abnormally dark liver
- Isolated cardiac or liver involvement is possible
- Serial follow-up imaging of iron loading may be needed to guide chelation therapy

5. Tips & Tricks for Allied Health Professionals

- Ensure High-Quality T2 Imaging*: Iron overload can be subtle on non-contrast imaging, but T2* mapping is a highly sensitive tool to assess myocardial iron burden
- Assess t2 * values in septum – fewer artefacts and iron deposition is similar in all LV segments
- High correlation of T2 * values and native T1 values (T2 *↓, native T1↑)
- Assess for Myocardial Fibrosis: Advanced stages of iron overload often result in fibrosis, which may appear as subendocardial or transmural LGE. Ensure optimal TI selection for nulling of normal myocardium

Reference

Herzog, B. A., Greenwood, J. P., Plein, S., Garg, P., Haaf, P., & Onciul, S. (2017). Cardiovascular Magnetic Resonance Pocket Guide. Eur Soc Cardiol.