

# MRI signal changes in the liver following multiple transfusions

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## Introduction

Diffuse signal changes in the liver on magnetic resonance imaging (MRI) often represent a depositional process with a decreased signal when iron or copper is deposited or an increased signal with fatty deposition.<sup>1</sup> Such findings are often incidental when imaging is done to identify a cause for other symptoms or to assess for complications of primary pathology.

## Case report

A 68-year-old man presented to our hospital with myelodysplasia, a pre-leukaemic haematological disorder characterised by bone marrow malfunction, which leads to cytopenia of one or more cell lines. Due to his recurrent anaemia, he had been transfused with 20 units of blood over a 4-month period. He was referred to Radiology for MRI of his liver to rule out malignant lesions. At the time of the scan, he had a ferritin level of 951 ng/ml (normal 20 - 100 ng/ml).

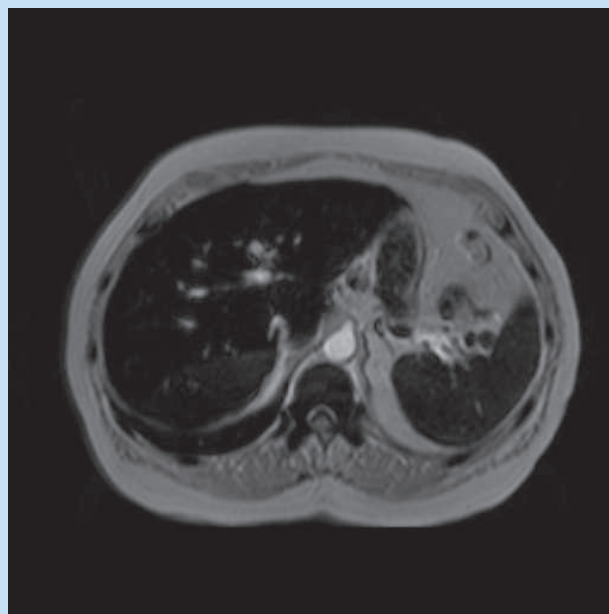


Fig. 1b. Axial T2W image demonstrating T2 shortening in the liver and spleen.

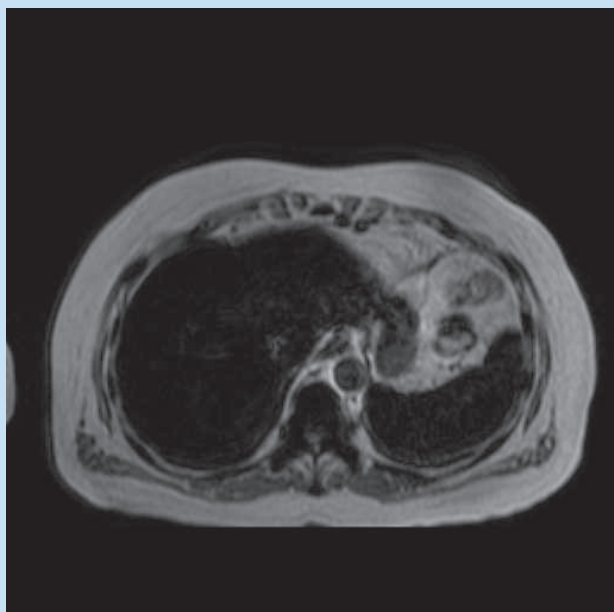


Fig. 1a. Axial T1W images demonstrating decreased signal in the liver and spleen.



Fig. 2. Unenhanced CT scan of the liver showing a hyperdense liver with an HU of 103 (normal value 54 - 60<sup>1</sup>), with normal density of the spleen.

## Discussion

In patients who receive multiple blood transfusions, the excess iron is initially deposited in the reticuloendothelial system of the liver, spleen and bone marrow as well as in the heart and endocrine system.<sup>2</sup> This may eventually lead to complications such as transfusion haemosiderosis of the liver, cardiac failure, diabetes and inadequate hypothalamic-pituitary adrenal reserve. The iron that accumulates in the liver is paramagnetic and interacts with adjacent hydrogen nuclei to cause susceptibility-induced relaxation owing to shortened proton relaxation times.<sup>3</sup> This leads to decreased signal intensity of the liver on T1W, T2W and STIR images<sup>4</sup> (as shown in Figs 1a and 1b). The increase in the 1/T2 relaxation rate of the liver is linearly related to the amount of blood transfused up to a level of 60 units, after which no significant increase is seen.<sup>5</sup> The T2 relaxation rate of the spleen also changes after blood transfusion but is not related to the number of blood transfusions.<sup>4</sup> Bone marrow may show hypo-intensity secondary to iron deposition after transfusion. No relationship has been demonstrated between bone marrow T2 relaxation rates and serum ferritin levels, or between liver and spleen 1/T2 relaxation.<sup>6</sup> Iron deposition may be seen as increased density in the liver and spleen on CT, but is less readily quantifiable (Fig. 2).

## Conclusion

Multiple transfusions result in iron deposits in the reticuloendothelial system, heart and endocrine system. Awareness of the signal changes when incidentally identifying this will avoid misdiagnoses. In addition, T2W MRI can be used as a prognostic tool to quantitatively determine true iron levels in the liver.

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