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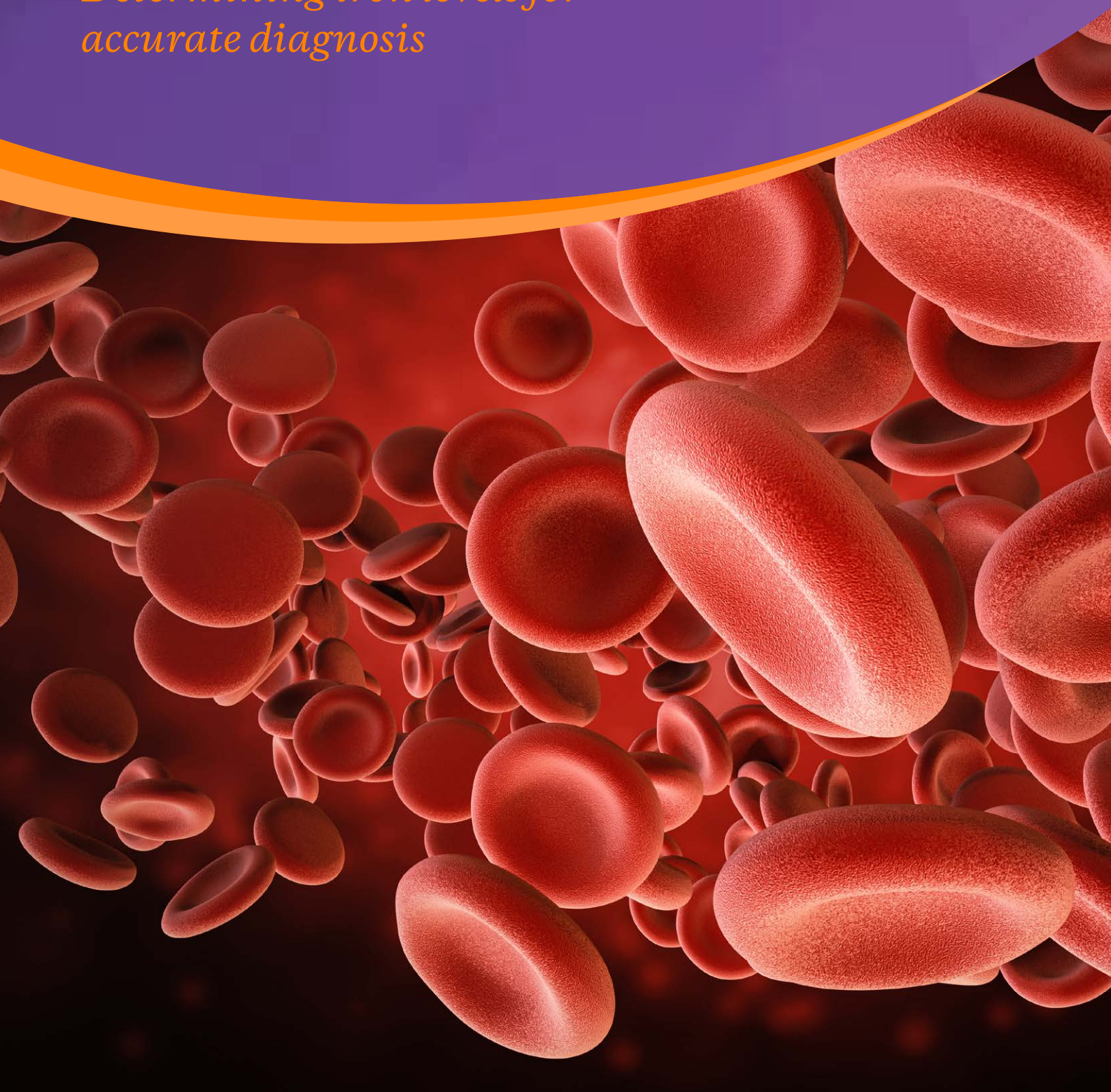
Iron Deficiency

Determining iron levels for accurate diagnosis



Iron Deficiency

Iron is an essential element that serves many important biological functions, acting as a co-factor for many enzymes and participating in electron transfer reactions. As part of haemoglobin in red cells and myoglobin in skeletal and cardiac muscle, iron is essential for the development of red cells which play a crucial role in delivering oxygen to the tissues of the body. Careful iron balance is important for good health – approximately 3-4g of iron is found in the average human body with over two thirds of total iron incorporated into haemoglobin in red cells. Usually 1-2mg of iron is absorbed daily through diet and most of the iron needed daily comes from macrophage mediated recycling of red cells.[1] Iron balance is controlled by the hepcidin hormone.

Reduction in the body stores of iron leads to the development of iron deficiency – a common deficiency affecting an increasing number of Australians. Iron deficiency is often chronic and may be asymptomatic and as a result may go undiagnosed until there is a marked anaemia present. Symptoms of iron deficiency include lethargy and difficulty in concentration and may be associated with increased risk of infections, developmental delay in young children and poor pregnancy outcomes in pregnant patients.[2]

Incidence of Iron Deficiency

It is estimated that 1.1 million Australians are iron deficient.[3] In the 2014 ABS Census, over 20% of randomly selected Australian adults had iron deficiency, usually undiagnosed. Diving deeper into the statistics, 34% of Australian women of child-bearing age have iron deficiency, and 70% of pregnant women in their third trimester were affected.

Other high-risk groups of developing iron deficiency anaemia include indigenous and refugee populations, as well as children, especially in the toddler age group.[4]

Appropriate management of iron deficiency can lead to a dramatic improvement in energy levels, quality of life and general health and wellbeing.[5]

Incidence of Iron Deficiency in Australia from 2014 ABS Census

Detecting Iron Deficiency – the benefit of iron studies

A complete assessment of iron studies is recommended as an important first step in the investigation of patients presenting with symptoms suggesting iron deficiency. Testing for iron deficiency is somewhat controversial. A serum ferritin test is adequate if the patient is otherwise well, it is known to be an acute phase reactant and may however, be an inaccurate measure of iron stores in both acute and chronic inflammation, fatty liver, raised BMI or in the setting of OCP use.[2] Additional laboratory markers available with ordering iron studies may be helpful in the assessment of patients for iron deficiency; a low transferrin saturation (<20%) supports the diagnosis of iron deficiency in patients with concomitant inflammation or systemic illnesses (even in the presence of a normal serum ferritin). Below is a table to assist in the interpretation of iron studies:

	Iron	Transferrin saturation	Ferritin	Soluble transferrin receptor
Iron deficiency	Decreased	Decreased	Decreased	Increased
Iron deficiency + acute phase response	Decreased	Normal or decreased	"Normal" <100ug/L	Increased
Acute phase response	Decreased	Decreased	Increased	Normal
Iron overload	Increased	Increased	Increased	Decreased

Assessment for iron deficiency in the setting of concomitant inflammation

Iron deficiency is prevalent among patients with a number of inflammatory conditions such as inflammatory bowel disease (IBD), chronic heart failure (CHF), and chronic kidney disease (CKD). An assessment of inflammatory markers can be helpful if there is concern the patient has inflammation present. Assessment of CRP / ESR can be helpful in this scenario. More sophisticated tests like soluble transferrin saturation can be helpful but are non-Medicare rebatable items and the patient may be asked to pay out-of-pocket fees.

Treatment of Iron Deficiency and follow up testing

Careful follow up of iron deficient patients during and after iron replacement, to confirm an adequate response, is important. The frequency of repeat assessment will depend on the type of supplementation; oral supplements should be assessed after a period of 3 months to determine adequate response, however reassessment after a week or two following intravenous iron therapy would be helpful in determine a response in patients with iron deficiency anaemia. Serial assessment of iron studies can be helpful as a diagnostic tool to explore or exclude occult sources of blood loss. Any patients with recurrent unexplained iron deficiency will require a thorough assessment to explore occult sources of blood loss including GI blood loss.
Oral iron therapy is typically associated with a high incidence of gastrointestinal side effects such as nausea and constipation. This may occur in up to 40% of patients treated with therapeutic iron supplementation. If an iron preparation is not causing any side effects, it is often because there is very little iron. Iron in supplements is measured as equivalent to elemental iron. Recommended supplements to treat iron deficiency and improve iron stores contain 75 – 100mg per day of elemental iron. Some medications proposing to provide iron supplements contain as little 5mg per day of elemental iron and therefore, will be an inadequate supplement.

Clinical Labs' current reference ranges for assessment of iron studies.

Bio-Marker	Interpretation	Clinical Labs Ref Range
Serum Iron	A Serum Iron test measures how much iron is in the serum of the blood. Serum is the liquid component in blood; this is the substance that is left when clotting factors and red blood cells have been removed.	10.0 – 30.0
Transferrin	Transferrin is a protein transporter in the blood that moves iron throughout the body. This biomarker can indicate whether there are issues with transportation of iron or whether there is too much or too little iron in the blood. Transferrin levels may also be reduced with inflammation.	2.10 – 3.80
Saturation	This is a percentage measurement of how much iron is bound to the blood protein transferrin. Saturations of less than 20% may indicate iron deficiency, whereas saturations of over 45% may suggest overload. It can be useful in the diagnosis of Haemochromatosis.	15 – 45%
Ferritin	Ferritin levels reflect the amount of stored iron in the liver. Decreased levels are associated with low levels of dietary/supplemental iron, menorrhagia or occult bleeding. Elevated levels reflect iron overload which may be due to excess dietary/supplementary levels or haemochromatosis. Elevated levels can also be associated with inflammation, liver disease or malignancy.	30 - 220

How to order Iron Studies at Australian Clinical Labs

Request 'Iron Studies' on a standard Clinical Labs request form.

Specimen instructions: 5 mL of serum in SST (gold) tube.

Cost: Medicare rebatable

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Dr Barnes has joined Clinical Labs in the newly created role of National Director of Haematology and will provide strategic direction nationally for haematology at Clinical Labs. Dr Barnes is a clinical and laboratory trained haematologist who has been part of Melbourne Haematology and has worked with Clinical Labs (and previously Healthscope) for several years. Dr Barnes works at the Royal Children's Hospital and is director of the Haemophilia Treatment Centre. He has experience in both management and leadership positions. Dr Barnes has an active clinical research interest and is also director of Melbourne Haematology (Clinical) and Melbourne Paediatric Specialists.

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