

Please read this bit first

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The Thistle QA CEU No is: **MT00025**.

Each attendee should claim **THREE** CEU points for completing this Quality Control Journal Club exercise, and retain a copy of the relevant Thistle QA Participation Certificate as proof of registration on a Thistle QA EQA.

CHEMISTRY LEGEND

FEBRUARY 2009

IRON DEFICIENCY

In clinical medicine, a low plasma iron concentration usually indicates iron deficiency; however it may also reflect a low plasma transferrin level. Free iron is toxic and all the iron in plasma is bound to transferrin. Therefore, before attempting to interpret low plasma iron levels, some estimate of the plasma transferrin concentration should be done.

Iron deficiency is usually associated with a low plasma iron and a high transferrin, whereas a low plasma iron associated with a low transferrin suggests other diseases. Transferrin can also be increased in the absence of iron deficiency in the following situations:

- ✚ Acute infections
- ✚ Infancy
- ✚ Pregnancy
- ✚ Oestrogen therapy

In these condition however, the plasma iron is usually increased or at the upper reference limit.

Causes of low plasma iron concentrations

Physiological

Pre-menstrual

Iron Deficiency

Low intake: nutritional

Increased requirements: growth, pregnancy, lactation, therapy of pernicious anaemia

Increased loss: Acute/chronic haemorrhage

Low Transferrin level

Infection

Collagen diseases

Malignancy

Renal failure

Protein-losing states: nephrosis

Atransferrinaemia

The plasma transferrin is normally 20-50% saturated with iron and the index, percent transferrin saturation (plasma iron / TIBC x 100), can provide useful information, e.g. iron deficiency is usually associated with low levels (<10%). However it can be misleading as low percent saturation values may be seen in the absence of iron deficiency, e.g. in the pre-menstrual state, acute infections and chronic diseases.

If iron deficiency is suspected two questions must be addressed:

- + Is iron deficiency present?
- + If so, what is the cause?

Diagnosis of iron deficiency

The approach to a patient with suspected iron deficiency should be along the following lines:

- + Full Blood Count - Hb, RBC morphology
- + Iron studies - plasma iron, transferrin, ferritin
- + Therapeutic trial of iron
- + Bone marrow examination

The classical haematological feature of iron deficiency is hypochromic, microcytic anaemia and the characteristic biochemical findings are a low plasma iron, a high transferrin and low percent saturation and a low ferritin. Iron deficiency may however be present without anaemia while hypochromic anaemia may be seen in a number of chronic disorders in the absence of iron deficiency.

The definitive diagnosis of iron deficiency rests on the demonstration of reduced body iron stores e.g. the iron content of bone marrow is absent or low in iron deficiency but normal or increased in anaemia of chronic disease. Fortunately such estimations are rarely necessary as the diagnosis can usually be confirmed clinically and if there is any doubt, plasma ferritin estimations will clinch the diagnosis.

The plasma ferritin level reflects iron stores: low levels (<12 µg/l) are found in iron deficiency and high levels mostly indicate iron overload. However, in infections, neoplasia, liver disease and chronic renal insufficiency, the relationship between the ferritin level and iron stores is disturbed. In these disorders the plasma ferritin level is higher and more visible than in the normal subject. Iron deficiency is however the only known cause of a low plasma ferritin.

Iron parameters in various clinical conditions

	<u>Plasma iron</u>	<u>Transferrin</u>	<u>% Saturation</u>	<u>Plasma ferritin</u>	<u>Marrow stores</u>
<u>Low iron states</u>					
Iron deficiency	↓	↑	↓↓	Usually ↓	Absent / ↓↓
Acute illness	↓	N	N or ↓	N or ↑	N
Chronic illness	↓	↓	N or ↓	N or ↑	N or ↓

Case Presentation

A 72 year old woman complained of weakness, weight loss and fainting attacks. On examination she appeared pale. Her Hb level was 6.5 g/dl and blood smear revealed hypochromic microcytic red blood cells. Her plasma iron levels were as follows:

Iron	4 μmol/L	(10-32)
Transferrin	83 μmol/L	(45-72)
Ferritin	6 μg/L	(10-200)

Differential Diagnosis

Iron deficiency anaemia: Nutritional? Blood loss? Malignancy?

Treatment

The most effective therapy for iron deficiency is administration of ferrous sulphate. During therapy the patient's response should be monitored. If this is inadequate over the following 4 - 6 weeks the diagnosis should be reviewed and possibilities such as continued bleeding and non-compliance with medication considered. Parenteral iron therapy may be necessary if there is intolerance to oral iron, non-compliance and gastrointestinal disorders such as malabsorption.

References

Cases in chemical pathology - A Diagnostic approach 4th edition

Questions

1. What are the causes of low plasma iron concentrations?
2. How would you diagnose a patient with iron deficiency?
3. Discuss the difference between the iron parameters in iron deficiency, acute illness and chronic illness.