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The Investigation and Management of Preoperative Anaemia

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Patient blood management (PBM) is a term that has become popular in transfusion medicine. The central message that PBM aims to promote and champion is that by taking an individualised, evidence-based approach to the issue of blood transfusion, outcomes for patients can be improved. PBM refers to the management and preservation of a patient's own blood to reduce, or hopefully avoid, the need for a transfusion through a range of interventions.

Patient blood management

The three 'pillars' of PBM reinforce the importance of conservation of the patient's own blood, whilst attempting to reduce the requirement for transfusion.

The three pillars of PBM are summarised in Figure 1, and include:

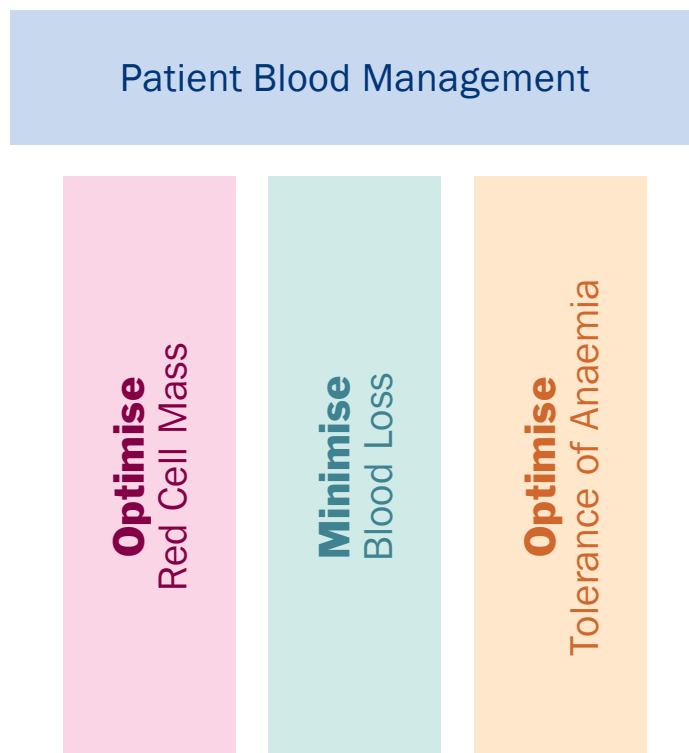
- The optimisation of the patient's red cell mass
- The minimisation of blood loss
- The optimisation of the patient's tolerance of anaemia.

Patient blood management guidelines have been released by the National Blood Authority, and comprise of six situation-specific, patient-focused, evidence-based modules. These include available modules covering Critical Bleeding/Massive Transfusion, Perioperative, Medical and Critical Care, with two modules still to be released covering Obstetrics, and Paediatrics (including neonates).

Driving factors, including the recognition of risks associated with transfusion, variability in transfusion practice, supply-demand pressures of the available blood supply and economic considerations, have contributed to the implementation of these guidelines.

The second module - Perioperative - forms the basis of the following discussion, and the interested reader is referred to these guidelines for further information. The PBM guidelines are available online (www.nba.gov.au), or as a free iPad App (available through the App store).

Figure 1: The Three Pillars of Patient Blood Management



Anaemia in the surgical patient

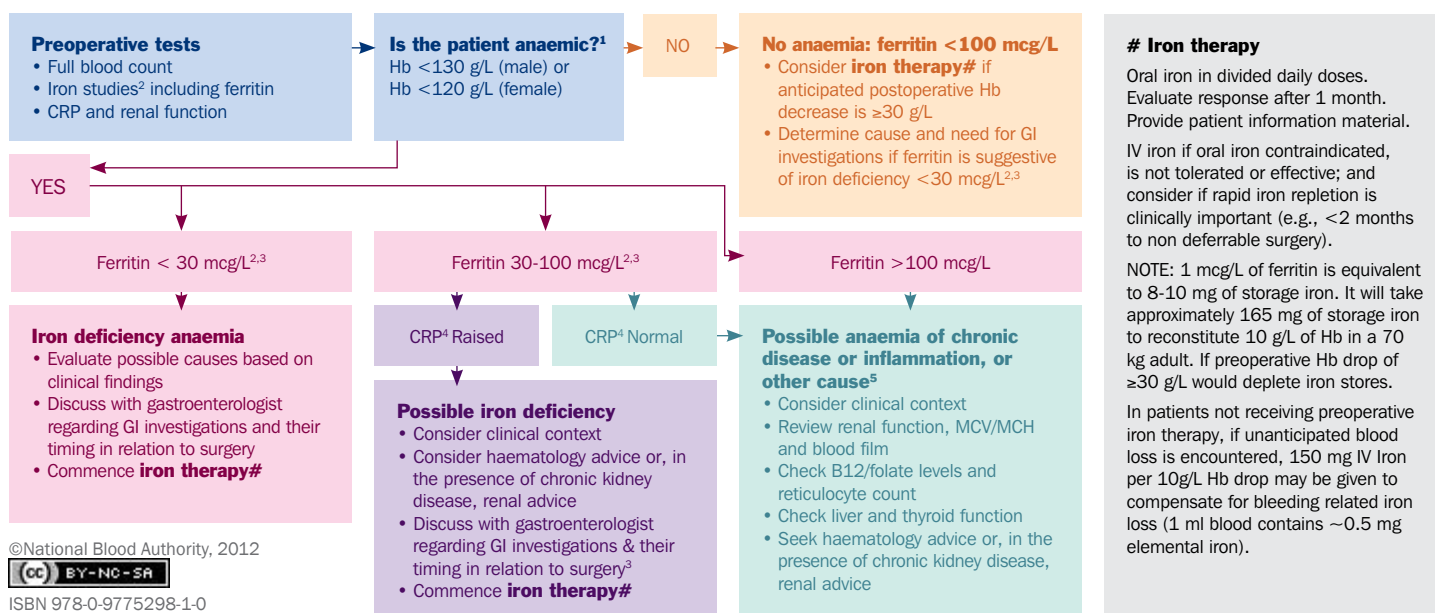
Anaemia is common in surgical patients, with the prevalence increasing with advancing age. Various estimates in different groups of surgical patients have ranged from 19% in elderly women with hip fractures, to 75% in patients with advanced colorectal cancer. In the setting of elective arthroplasty patients, around 25-40% have been found to be anaemic preoperatively with similar numbers in the group of cardiac surgery patients. A significant proportion of these diagnoses of preoperative anaemia represent previously undiagnosed cases.

Preoperative anaemia is a risk factor for poor outcomes following surgery. It has been associated with increased morbidity, mortality, nosocomial infection, and has been shown to be independently predictive of need for transfusion. In turn, transfusion is itself an independent risk factor for increased morbidity, mortality, increased length of hospital stay, and increased duration of ICU admission. Therefore, anaemia is both a predictor of poor outcomes, and a risk factor for an intervention associated with poor outcomes.

There is early observational data to indicate that preoperative intervention resulting in optimisation of a patient's red cell mass combined with active perioperative minimisation of surgical blood loss is associated with lower rates of transfusion, and shorter length of stay, however, more work is needed in this area.

A multidisciplinary team approach to the early identification of anaemia, adequate investigation of the cause, and the appropriate therapy being instituted in a timeframe that is adequate to see a response, is essential to produce the best outcomes for patients.

Figure 2: Preoperative Haemoglobin Assessment and Optimisation Template



Abbreviations: CRP = C-reactive protein GI = gastrointestinal Hb = haemoglobin IV = intravenous MCV = mean cell/corpuscular volume (fL) MCH = mean cell/corpuscular haemoglobin (pg)

Footnotes: **1.** Anaemia may be multifactorial, especially in the elderly or in those with chronic disease, renal impairment, nutritional deficiencies or malabsorption. **2.** In an anaemic adult, a ferritin level <15 mcg/L is diagnostic of iron deficiency and levels between 15-30 mcg/L are highly suggestive. However, ferritin is elevated in inflammation, infection, liver disease and malignancy. This can result in misleadingly elevated ferritin levels in iron-deficient patients with coexisting systemic illness. In the elderly or in patients with inflammation, iron deficiency may still be present with ferritin values up to 60-100 mcg/L. **3.** Patients without a clear physiological explanation for iron deficiency (especially men and postmenopausal women) should be evaluated by gastroscopy/colonoscopy to exclude a source of GI bleeding, particularly a malignant lesion. Determine possible causes based on history and examination; initiate iron therapy; screen for coeliac disease; discuss timing of scopes with a gastroenterologist. **4.** CRP may be normal in the presence of chronic disease and inflammation. **5.** Consider thalassaemia if MCH or MCV is low and not explained by iron deficiency, or if long standing. Check B12/folate if macrocytic or if there are risk factors for deficiency (e.g., decreased intake or absorption), or if anaemia is unexplained. Consider blood loss or haemolysis if reticulocyte count is increased. Seek haematology advice or, in presence of chronic kidney disease, nephrology advice.

Identification of anaemia

Referral of a patient for an elective procedure should be a trigger to start thinking about the patient's current clinical state, and their fitness for surgery. Increasingly, a proactive approach to the early identification and adequate assessment of preoperative anaemia is being instituted, integral to which is the early and active engagement of the patient's general practitioner.

Ideally, the identification of anaemia should occur as soon as possible in order to allow adequate workup of the underlying cause, and provide a therapeutic window for correction of anaemia prior to surgery. A minimum timeframe of approximately one month prior to the planned procedure is suggested, however in general, the earlier, the better.

Current recommendations for a preoperative assessment include full blood count, iron studies (focusing mainly on ferritin), C-reactive protein, and renal function, as an initial panel of screening tests. These can be ordered as part of a more comprehensive 'preoperative' panel, which could include a group and antibody screen, coagulation studies, and full electrolyte and liver function tests (ELFTs) if needed.

An algorithmic approach to the assessment of preoperative iron and haemoglobin status is summarised in Figure 2.

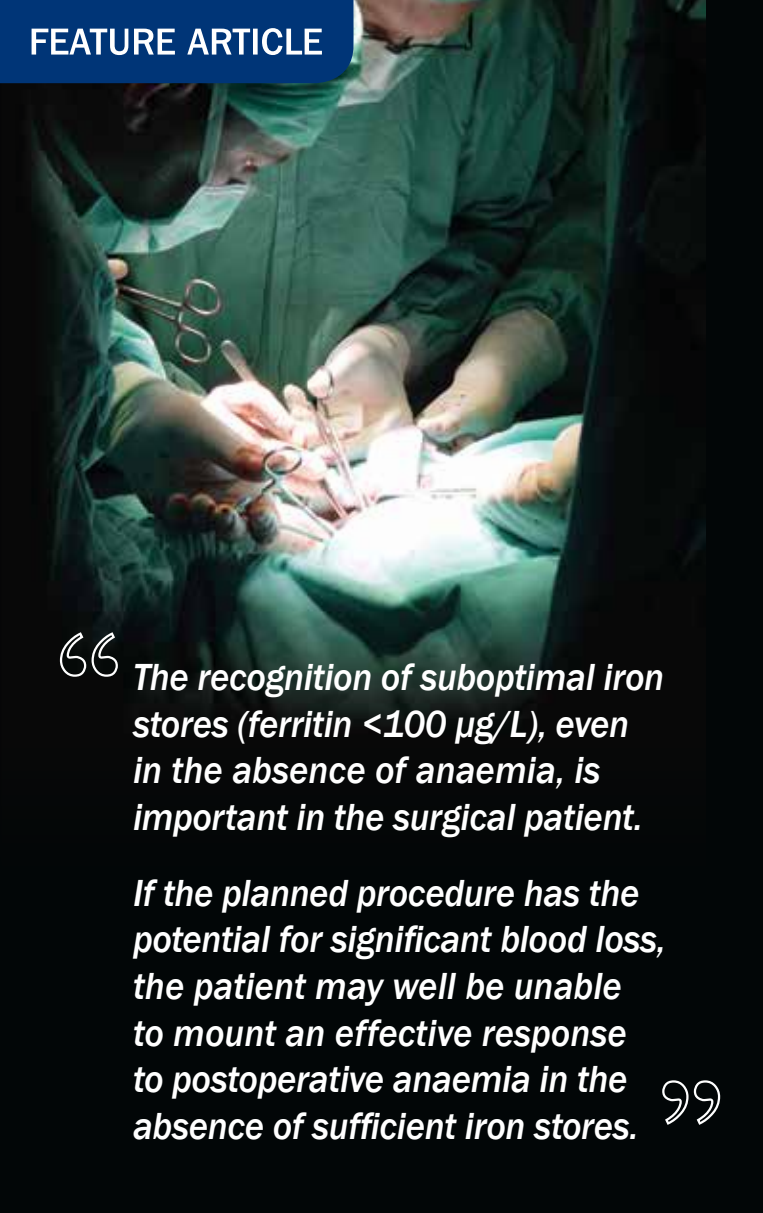
Approach to assessment of anaemia

There are many different approaches that can be utilised in the initial investigation of anaemia, however, a common scenario is that a mildly decreased haemoglobin goes unnoticed, and uninvestigated. Therefore, the most important initial step is to identify that anaemia exists. Clinical trials and PBM programmes have recently used World Health Organisation definitions of anaemia: <130 g/L in men and <120 g/L in non-pregnant females.

Several useful classification systems can be utilised in the work-up of anaemia, however, in the context of a preoperative screening programme, a triage system, in which the most common form of anaemia, namely iron deficiency, is first identified or excluded, has been recommended. This is a reflection both of the relatively high prevalence of iron deficiency, and also the effectiveness of rapidly instituted iron replacement therapy in the treatment of iron deficiency anaemia.

The inclusion of CRP and renal function in the initial screening panel also reflect the prevalence of inflammatory conditions causing elevation of ferritin and masking possible iron deficiency, and of renal impairment, which contributes to anaemia due to reduced renal erythropoietin production (note, renal impairment of a moderate-severe degree with a creatinine clearance <30-40 ml/min is generally necessary to affect erythropoietin production).

When these more common causes of anaemia have been excluded, a useful classification of anaemia based on the assessment of the mean cell volume (MCV) can provide a useful schema for further investigations. (Note: these investigations assume that anaemia is an isolated abnormal finding in the FBC. The presence of other abnormalities, including other cytopenias, or circulating abnormal cells, should prompt advice from a haematologist to determine appropriate further investigation).



66 **The recognition of suboptimal iron stores (ferritin <100 µg/L), even in the absence of anaemia, is important in the surgical patient.**

If the planned procedure has the potential for significant blood loss, the patient may well be unable to mount an effective response to postoperative anaemia in the absence of sufficient iron stores. 99

Microcytic anaemia (MCV < 80)

Microcytic anaemia has only a few possible causes, the most common of which is iron deficiency. Others, including thalassaemia, haemoglobinopathies, some cases of anaemia of inflammation (AI, also known as anaemia of chronic disease), heavy metal exposure or sideroblastic anaemia, are less common causes of microcytic anaemia.

Further tests that could be considered after iron deficiency has been excluded are examination of the blood film, haemoglobin electrophoresis, and in specific situations, testing for heavy metals (e.g., lead, arsenic) could be considered. Sideroblastic anaemia is a rare inherited condition that requires a bone marrow examination to diagnose.

Macrocytic anaemia (MCV > 100)

Macrocytic anaemia has several possible causes, which include vitamin B12 or folate deficiency, blood loss or haemolysis with a reticulocyte response (reticulocytes are larger than mature RBC), hepatic dysfunction, excess alcohol consumption, hypothyroidism, medications (anticonvulsants, antimetabolites, antivirals, and some antibiotics, amongst others), or myelodysplasia (a bone marrow disorder which requires bone marrow examination to diagnose).

Testing should include an assessment of the blood film, B12/folate studies, reticulocyte count, LFTs, TFTs, and clinical correlation with alcohol intake and medication use.

Normocytic anaemia (MCV 80-100)

Normocytic anaemia is commonly due to anaemia of inflammation (AI) but can result from acute blood loss or haemolysis, renal failure, bone marrow disorders resulting in reduced red blood cell production, as well as a number of other disorders. In the evaluation of normocytic anaemia, a useful parameter to subclassify these disorders and assess whether the bone marrow is responding appropriately to anaemia, is the reticulocyte count.

If the reticulocyte count is elevated, the bone marrow is attempting to correct anaemia, and the anaemia is unlikely to result from a primary bone marrow disorder, pointing instead to blood loss or haemolysis. A review of the blood film can be especially useful in the evaluation of a suspected haemolytic anaemia, and can guide further testing. A haemolysis screen including haptoglobin, bilirubin and lactate dehydrogenase, can be requested, direct Coombs test (DCT) to evaluate for autoimmune haemolysis, faecal occult blood test if GIT blood loss is suspected (although this test can give both false positive and false negative results), and clinical review for a possible source of blood loss is required.

If the reticulocyte count is inappropriately normal or low, a hypoproliferative anaemia would be suspected, which could include AI, anaemia of renal disease, or disorders of bone marrow.

Exceptions

Although using the MCV to subclassify anaemia can be a useful system, it should be remembered that there are caveats. Factors that cause macrocytosis can mask the development of a microcytosis, and vice versa. For example, a patient with macrocytosis due to pre-existing liver dysfunction could develop iron deficiency, resulting in a fall in MCV, which could potentially manifest as normocytic, rather than microcytic, anaemia. The MCV can also be normal in the case of dual deficiencies (e.g., coexisting iron and vitamin B12/folate deficiencies), and risk factors such as coeliac disease, veganism, or the use of proton pump inhibitors (PPIs) can predispose to the development of multiple haematinic deficiencies.

A normal MCV also does not exclude iron depletion, particularly early in the course, or B12/folate depletion, and a haematinic screen is a useful inclusion in all anaemia investigations.

Iron metabolism and the assessment of iron status

Iron deficiency is the most common form of anaemia seen in the surgical patient population, with non-anaemic reduction in iron stores also clinically relevant in the situation of expected surgical blood loss.

Normal body iron stores approximate 4 g (less in menstruating females), with about two thirds contained in haemoglobin, and another quarter contained in reticuloendothelial storage as ferritin, mainly in the liver, spleen and bone marrow. Only a small proportion is complexed with transferrin (~3 mg), which serves to transport iron from the gut and to tissues.

Normal absorption of 1-2 mg/day balances the daily losses from gastrointestinal and skin cells. When the loss of iron outstrips absorptive capacity, either by decreased absorption or intake, or increased losses, gradual depletion of storage iron results. When storage iron is exhausted, iron-deficient erythropoiesis (red blood cell production) ensues, the end result being iron-deficiency anaemia.

Table 1: Laboratory Values in the Spectrum of Iron Deficiency

	Normal Iron Stores	Iron Depletion	Iron-Deficient Erythropoiesis	Iron Deficiency Anaemia
Iron stores (graphical representation)				
Ferritin	N	↓	↓	↓
TSAT	N	N	↓	↓
Haemoglobin	N	N	N	↓
RBC morphology	N	N	Occasional hypochromic microcytes	Hypochromic, microcytic, pencil cells

TSAT: transferrin saturation; RBC: red blood cell

Although ferritin is an imperfect measure of total body iron, being an acute phase reactant and therefore elevated in inflammatory states and hepatic disease, it remains the best indicator of low iron stores, with a level $<20\text{--}30\text{ }\mu\text{g/L}$ (depending on your laboratory's reference range) being diagnostic of iron deficiency. Ferritin levels can increase by about three times the baseline value in the presence of an acute stimulus, and so, iron deficiency can exist even with ferritin levels approaching $100\text{ }\mu\text{g/L}$. Other tests that could be considered in select cases could include erythrocyte zinc protoporphyrin (ZPP) or soluble transferrin receptor (sTfR) assays, both of which show elevated levels in iron deficiency and can be used in cases where there is a co-existing inflammatory component.

The recognition of suboptimal iron stores (ferritin $<100\text{ }\mu\text{g/L}$), even in the absence of anaemia, is important in the surgical patient. If the planned procedure has the potential for significant blood loss, the patient may well be unable to mount an effective response to post-operative anaemia in the absence of sufficient iron stores. Blood loss sufficient to drop the haemoglobin level $30\text{--}40\text{ g/L}$ (which can be experienced in cardiac, joint replacement and general surgery) will also result in a fall in ferritin of about $60\text{--}80\text{ }\mu\text{g/L}$, rendering the patient with a preoperative ferritin of $100\text{ }\mu\text{g/L}$, iron-deficient and unable to produce sufficient red blood cells to compensate for the surgical blood loss. Although less common, low or borderline B12/folate levels could also represent the limiting factor for postoperative recovery of red cell mass, and should be considered in at-risk patients, including those with a history of dietary restriction or gastrointestinal malabsorption, PPI use or Metformin use.

Management of iron deficiency anaemia and low iron stores

If iron deficiency is identified, management is two-fold and simultaneous, comprising investigation into the cause, and iron replacement therapy to correct the deficiency. Investigation into the cause of iron deficiency should include a detailed history of dietary iron intake, use of aspirin/NSAIDs, menstrual and pregnancy history in females, present or prior history of blood donations, family history of gastrointestinal (GI) malignancy or bleeding disorders, and systems review for evidence of blood loss or GI symptoms. Investigation into the cause of iron deficiency could include screening for coeliac disease (coeliac serology and IgA levels), clinical correlation with dietary intake, as well as menstrual history in females. Investigation for upper and lower gastrointestinal sources of bleeding should be considered in males unless there is a history of overt non-gastrointestinal blood loss, post-menopausal females and any patient with GI symptoms or a strong family history of colorectal cancer. A gastroenterologist should be consulted as to appropriate investigations and their timing in relation to surgery. A surrogate GI screen – FOBT, *H. Pylori* screening (see page 7), Coeliac Serology, Tumour markers (CEA/CA19.9/Lymphocyte Markers) – may help the gastroenterologist prioritise any endoscopic procedure in relation to surgery.

Iron replacement therapy can be instituted immediately, whilst investigation as to the cause is ongoing. Both oral and intravenous iron are effective in replenishing iron stores, and the choice between them will depend on the timeframe available, the degree of deficiency, and importantly, the patient's preference and tolerance of either therapy.

Oral iron in adequate doses ($100\text{--}200\text{ mg}$ elemental iron daily) is an effective means of iron replacement, with reticulocytosis occurring within 3–5 days, and haemoglobin levels rising by about $5\text{--}10\text{ g/L}$ per week. Importantly, after normalisation of haemoglobin levels, oral iron should be continued for at least 12 weeks in order to replenish iron stores. This timeframe could necessitate rescheduling of elective procedures, or else consideration of intravenous therapy (discussed subsequently) as an alternative in the case of non-deferrable surgery. The replenishment of iron stores is essential to enable the patient to mount an erythropoietic response to surgical blood loss/postoperative anaemia.

The main drawback of oral iron is patient intolerance, with $>35\%$ of patients experiencing GI side-effects of sufficient degree to warrant cessation. In patients on proton pump inhibitors, or with achlorhydria, oral iron is relatively ineffective, requiring an acidic

Table 2: Oral Preparations for Treatment of Iron Deficiency Anaemia (IDA) in Australia

NAME (Manufacturer)	FORMULATION	ELEMENTAL IRON CONTENT	OTHER ACTIVE INGREDIENTS	RELATIVE COST* 2011 MIMS / (PBS) [†]	Usual ADULT dose for IDA is around $100\text{--}200\text{ mg}$ elemental iron daily in divided doses* (1–2 tablets per day of above preparations, ideally 1 hr before or 2 hrs after food). GI upset may be reduced by taking tablet with food at night and increasing dose gradually. When a rapid increase in Hb is not required, intermittent dosing (1 tablet 2–3 times a week) or lower doses of iron (e.g., $30\text{--}60\text{ mg}$ of elemental iron, increasing to twice daily or three times a day if tolerated: try Ferro-tab or titrate liquid) may reduce GI upset. Multivitamin-mineral supplements should not be used to treat IDA as iron content is low and absorption may be reduced.
FERRO-GRADUMET (Abbott)	325 mg Ferrous Sulphate Controlled release tablet	105 mg	nil	\$6.56/30 tablets	
FERRO-GRAD C (Abbott)	325 mg Ferrous Sulphate Controlled release tablet	105 mg	Ascorbic acid 500 mg	\$8.16/30 tablets	
Ferro-f-tab (AFT pharmaceuticals)	310 mg Ferrous Fumarate Non-controlled release tablet	100 mg	Folic acid 350 mcg	\$9.47/60 tablets PBS listed (\$12.79) [†]	
FEFOL Iron and Folate Supplement (Pharm-a-care)	270 mg Ferrous Sulphate Controlled release capsule	87.4 mg	Folic acid 300 mcg	\$9.95/30 tablets	
FGF (Abbott)	250 mg Ferrous Sulphate Controlled release tablet	80 mg	Folic acid 300 mcg	\$3.92/30 tablets	
Ferro-tab (AFT pharmaceuticals)	200 mg Ferrous Fumarate Non-controlled release tablet	65.7 mg	nil	\$8.95**/60 tablets PBS listed (\$11.62) [†]	
FERRO-LIQUID (AFT pharmaceuticals)	Ferrous Sulphate	30 mg/5 mL	nil	\$16.00/250 mL bottle PBS listed (\$19.35) [†]	

* Intended as a guide to the relative cost NOT price to the consumer (actual cost of OTC medicines may vary). Price guide from MIMS August 2011 except ** Ferro-tab (RRP from AFT).

[†] For PBS listed products, the PBS cost for concession holders is \$5.60 (at time of writing). BloodSafe Oral Iron Table Version 1.7 Oct 2011, TP-L3-410. Reproduced with permission from the Department for Health and Ageing (SA Health), Government of South Australia (CC) BY-NC-ND

milieu for its absorption. In these groups of patients, intravenous iron replacement is the preferred option.

Oral preparations available for the treatment of iron deficiency are listed in Table 2.

Intravenous iron is available in several formulations, with the main indications being requirement for rapid replenishment of iron stores prior to non-deferrable surgery, demonstrated intolerance or lack of response to oral iron supplements, intestinal malabsorption, or ongoing blood loss.

Three formulations of intravenous iron are currently available in Australia: iron polymaltose, iron sucrose, and iron carboxymaltose. There are varying degrees of side effects associated with the different formulations, different timeframes for infusion, and referral to a day unit would generally be indicated for their administration.

It should be mentioned that intramuscular iron injections are not recommended due to the potential for irreversible staining of the skin, and the possibility of allergic reactions.

It is anticipated that preoperative anaemia services will become more common in Queensland hospitals as the principles of PBM gain wider support.

A service currently operates out of North West Private Hospital through Dr Fleser's rooms, as well as other institutions, and iron infusions can be performed on patients with adequate cover.

Conclusion

Preoperative anaemia has the potential to result in suboptimal outcomes for patients, and requires early and adequate investigation into the cause. The most common cause of anaemia in the surgical population is iron deficiency anaemia, which can be managed with oral or intravenous iron supplementation. Preoperative low iron stores can result in postoperative iron deficiency anaemia, which is preventable with adequate preoperative iron supplementation. Otherwise, unexplained anaemia or other abnormalities of the blood count identified during pre-operative screening should be discussed with or referred to a clinical haematologist.

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Dr Rebecca Adams graduated from the University of Queensland in 2004 with first class honours and was the recipient of academic prizes as well as being awarded the University Medal. She started as a resident medical officer at the Princess Alexandra Hospital in 2005. In 2007, she commenced her training in haematology with the RCPA at the Princess Alexandra Hospital, and in 2013 continued her training with QML Pathology.

During her training, she has been actively involved in research projects, and has published review articles, research articles, and case studies as well as being the recipient of several grants.

She completes her training mid-2014.

Pathologist Profile

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QML Pathology.

¹⁴C-Urea Breath Test for *Helicobacter pylori*

Safe, non-invasive
collection process,
simple to perform.

The 'gold standard'
for the detection of
Helicobacter pylori.

Get results
fast - 24 hr
turnaround.

Helicobacter pylori

Helicobacter pylori (*H. pylori*) is a common bacterium which lives only in the gastric mucosa. Approximately one third of adult Australians are infected, and prevalence of *H. pylori* infection increases with age and with lower socio-economic status. The consequences of undetected and untreated infection are adverse, and include peptic ulceration, gastritis and gastric cancer (Table 1). *H. pylori* is present in almost all patients with gastritis. It is the principal cause of peptic ulcer disease and the main risk factor for the development of gastric cancer.

Successful treatment and eradication of *H. pylori* infection relieves symptoms of gastritis, facilitates ulcer healing, reduces the risk of ulcer recurrence, and reduces the risk of development of gastric cancer in previously infected individuals.

TABLE 1: CONSEQUENCES OF *H. PYLORI* INFECTION

Disease	<i>H. pylori</i> - related cases (%)
Chronic non-erosive gastritis	95
Gastric ulcer disease	70
Duodenal ulcer disease	90
Gastric adenocarcinoma	80
MALT lymphoma	90

¹⁴C-Urea Breath Test

The ¹⁴C-Urea Breath Test considered to be the 'gold standard' non-invasive diagnostic method for detection of the presence of current infection with *H. pylori* in the stomach. The ¹⁴C-Urea Breath Test offers highly accurate (positive predictive value 100%, negative predictive value 98%) and reliable diagnosis of *H. pylori* infection. It is useful both for initial diagnosis and for post-treatment follow-up to demonstrate *H. pylori* eradication. QML Pathology is now offering this test bulk billed at all our collection centres.

HOW THE TEST WORKS

If *H. pylori* is present in the stomach, it produces large quantities of urease which protects the organism against the acidic conditions in the stomach. The ¹⁴C-Urea Breath Test detects and quantifies the amount of urease in the stomach.

The urease produced by *H. pylori* breaks down the ¹⁴C-Urea in the test capsule into carbon dioxide and ammonia. The labelled carbon dioxide is then measured in exhaled air. If there is no urease present, labelled carbon dioxide is not detected, indicating the absence of *H. pylori* infection.

Patient preparation

The patient should fast for 6 hours prior to taking the test.

The patient must discontinue the following medications prior to testing as they may cause false-negative results:

- antibiotics and bismuth-containing products 1 month prior to testing;
- cyto-protective medicines, e.g., sucralfate, 2 weeks prior to testing;
- proton pump inhibitors 1 week prior to testing.

Although the radiation dose is extremely small, the test has not been sufficiently tested in children or pregnant females and should not be performed in these groups.

When to order

H. pylori infection is significantly underdiagnosed as the majority of individuals with uncomplicated infection are asymptomatic. Testing is currently recommended in the following circumstances:

- patients with known or suspected *H. pylori* infection, gastritis, peptic ulcer disease or gastric malignancy
- patients with epigastric pain and discomfort or non-ulcer dyspepsia
- patients experiencing unexplained anorexia, weight loss, nausea or vomiting
- patients receiving or about to receive long-term proton pump inhibitor therapy
- 4-6 weeks after treatment in all patients treated for *H. pylori* infection to confirm eradication of infection
- first degree relatives of patients with gastric cancer.

Further Information

For any further enquiries regarding this test, please contact Dr Kerry DeVoss, Biochemistry Pathologist on phone (07) 3121 4444 or email DrKerry.DeVoss@qml.com.au.



National Centre of Excellence for Cytogenetics

Cytogenetic analysis is a method of screening of human chromosomes to find out information about the number and structure of chromosomes in an individual. Traditionally metaphase spreads of chromosomes have been analysed by a scientist by using a high-powered light microscope. The unique pattern on pairs of chromosomes is compared to detect changes in genetic material. These changes can be used in the diagnosis of cancer and identification of causes of fetal loss, congenital abnormalities and mental retardation.

Recently QML Pathology has introduced a digital imaging system for the robotic screening of slides and digital imaging of metaphase spreads. Using this technology, scientists can detect changes in the unique pattern of chromosomes by scanning many images and sorting the chromosomes into pairs.



The introduction of the CytoVision Digital Imaging system at QML Pathology provides a national approach to cytogenetic services. Images can be streamed across Australia, with analysis done at Brisbane, Sydney and Perth. Using this technology specially trained scientists can review and discuss patient karyotypes optimising exposure to the expertise required for accurate cytogenetic analysis and clinical interpretation. The robotic system can scan slides 24 hours of the day, ensuring rapid turnaround time for conventional cytogenetic results across all laboratories.

QML Pathology has further expanded the cytogenetic service with the establishment of chromosomal microarray. This technology enables expert scientists to detect very small changes in DNA that may be involved in the pathogenesis of disease. It is regarded as the gold standard and has replaced conventional karyotyping for the investigation of patients with intellectual disability, two or more congenital abnormalities, autism spectrum disorders and products of conception. Chromosomal microarray can detect copy number changes as small as 200,000 DNA basepairs (0.2 Mb) compared to conventional karyotype analysis of metaphase spreads at 5-10 million DNA basepairs (5-10 Mb), representing a 50-fold increase in information and resolution. This technique represents an increase in the diagnostic detection rate in these clinical settings (15% molecular karyotype vs. 2-3% by conventional karyotype). [continued >](#)

The establishment of these technologies at QML Pathology represents a major advancement in cytogenetic services offered by QML Pathology, facilitating a higher standard of patient care than previously experienced. This service is extended nationwide with the support of expert scientists and a Genetic Pathologist ensuring excellence within genetic services provided by QML Pathology and our national network.

Our Senior Genetics Team



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Nicole Chia is the Genetics Manager for QML Pathology and our national network (Specialist Diagnostic Services Pathology). Nicole has been working in the field of

Clinical Cytogenetics since 1983 and is passionate about her role with QML Pathology. She is a fellow of the Faculty of Science, RCPA (FFSc) and the Human Genetics Society of Australia (FHGSA), has a Master of Science degree in Medicine and is currently completing her PhD thesis.

Nicole has an international reputation in the field of medical laboratory science including a role as consultant to the International Standing Committee on Human Cytogenetic Nomenclature, has been an invited speaker at numerous international and national meetings and has a number of peer reviewed scientific publications.

Over the years, Nicole has been an active promoter of continuing education and has been a senior board member of the HGSA including roles as Chief Examiner and Chair of the Cytogenetics Board of Censors. In her role as Senior Lecturer and Adjunct Associate Professor at Canberra University, Nicole continues to pursue that commitment to the education of medical scientists in the field of clinical and molecular cytogenetics, a rapidly expanding field of diagnostic pathology.



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Dr Melody Caramins graduated from the University of Newcastle in 1992 and worked as a Clinician for more than 15 years. From 2001 – 2006 Melody undertook vocational training as a Genetic Pathologist at Royal Prince Alfred and Prince of Wales Hospitals and in 2006 was admitted to the Royal College of Pathologists of Australasia with a Fellowship in Genetics as Australia's first graduating Genetic Pathologist.

In 2011, Melody was awarded a PhD by thesis, from the University of New South Wales following submission of a thesis entitled 'Quantitative Genetics of Platelet Count'. From 2008 – 2012 she worked as the Acting Clinical Director, SEALS Genetics, (Prince of Wales, Sydney Children's, Royal Hospital for Women Campus), Sydney. In 2013, she joined QML Pathology (and Specialist Diagnostic Services) as a Genetic Pathologist.

Dr Caramins has contributed to a number of journal articles and book chapters and was involved in the development of a centre for medical genomics within the SEALS Genetics Laboratory. She has been actively involved in teaching both through the University of New South Wales (Conjoint Senior Lecturer in the School of Medical Sciences) and also in specialist training through the RCPA.

Special Interests: Prenatal genetics, adult-onset disorders including oncogenetics, and neurogenetics; implementation of novel diagnostic methodologies; bioinformatics.

Memberships and Appointments: Ministerial appointment to Membership of the Federal Department of Health and Ageing Genetics Working Party (2011-2013), Member of the Scientific Committee and the Organising Committee for the Human Genome (HUGO) Annual Meeting (2012), Ministerial appointment to PSAC (2013), Chair and Organising Committee for RCPA Genomic Bioinformatics Workshop (2013), Chair of the RCPA Genetics Advisory Committee (2014).

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Collection Centres

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3 Captain Cook Drive

Mon - Fri: 8.00am – 11.00am

BLACKWATER (07) 4986 1179

Suite 1

14 Blain Street

Mon - Fri: 9.00am – 12.00pm

BROADBEACH (07) 5504 7266

Suite G01

2681 Gold Coast Highway

Mon - Fri: 8.00am – 1.00pm

1.30pm – 4.30pm

FERNY HILLS (07) 3351 7590

Shop 4, Fernlands Shopping Centre

(Inside Ferny Hills Pharmacy)

10 Woodhill Road

Mon - Fri: 8.30am – 1.00pm

EAGLE HEIGHTS..... (07) 5545 0350

44 Southport Avenue

Mon - Fri: 8.30am – 11.30am

PARADISE POINT (07) 5564 1825

Shop 5

14 Bruce Avenue

Mon - Fri: 7.00am – 12.00pm

SOUTHPORT PARK (07) 5526 3666

Shop 28, Southport Park Shopping Centre

(Inside Priceline Pharmacy)

Cnr Ferry & Benowa Roads

Mon - Fri: 9.00am – 12.00pm

WESTCOURT..... (07) 4031 0861

The Cairns Doctors

192 Mulgrave Street

Mon - Fri: 8.30am – 12.30pm

Doctor's Noticeboard



Dr Raluca Fleser
MBBS RACP RCPA
Clinical Haematologist

Dr Fleser has extended her private practice and is now consulting at Greenslopes as well as North West Private Hospital.

Raluca's interests include general haematology, pregnancy related haematological issues, and diagnostic and management of haematological malignancies with the focus on lymphoma and myeloma.

Suite 4, North West Specialist Centre
137a Flockton Street
Everton Park QLD 4053

Greenslopes Specialist Centre
Greenslopes Private Hospital
Newdegate St, Greenslopes QLD 4120

For bookings, please contact her North West Hospital suites on phone (07) 3353 9026 or email admin@ralucafleser.com.au.



Dr Roderick Chua MBBS
(Syd) FRACP FCSANZ
Interventional Cardiologist
& Heart Failure Specialist

Commenced consulting sessions at 6/20 Norton Street, Upper Mount Gravatt in association with Dr Su Mien Yeoh's Practice as of 1 May 2014.

Dr Roderick Chua is an Interventional Cardiologist and Heart Failure Specialist based at the Holy Spirit Northside Hospital working with Queensland Cardiology. He also has admitting rights to the St Andrew's War Memorial Hospital. He was appointed as an interventional cardiology staff specialist at the Prince Charles Hospital from 2006.

He performs a full range of coronary interventional procedures mostly via radial artery access. He is a Level A CT Coronary Angiogram specialist. He also performs both exercise and Dobutamine stress echocardiograms.

His special interests are in the diagnosis, treatment and management of ischemic heart disease, acute coronary syndromes and heart failure. He speaks fluent Mandarin and good Cantonese.

Appointments can be made via Queensland Cardiology on (07) 3861 5522. He can be contacted directly on his mobile 0416 182 989 at anytime for advice or assistance in helping you manage your patients.

Dr Alison Sprague, ENT Surgeon and
Dr Stephen Sprague, Orthopaedic Surgeon
have relocated to: Suite 4, AHC House,
14 Carrara Street, Benowa QLD 4217

P: (07) 5597 0303 F: (07) 5597 0416



Dr Paul Teng
Consultant Dermatologist
Westside Dermatology

Paul has spent the last year working at the Royal Brisbane Hospital and now practices at Westside Dermatology. Bookings are now being taken.

Dr Paul Teng completed a postgraduate specialist training in QLD and the UK.

Paul's subspecialty interests include acne, atopic dermatitis, psoriasis and skin cancer.

Paul is able to offer rapid review and management of your patients.

P: (07) 3871 34 37 F: (07) 3871 1570



Dr Paul Campbell, Allergist
Westside Dermatology

Paul graduated in Biochemistry and in Medicine from the University

of Glasgow. He was a NHMRC Australian Postdoctoral Research Fellow in Immunology, and a Lecturer in Immunology at The Flinders University of South Australia. He was awarded a D. Phil (PhD) in Molecular Haematology from the University of Oxford in 1991, before moving to Australia.

Paul's subspecialty interests include investigation and management of food and environmental allergy, with relevance to conditions such as eczema, urticaria (hives), angioedema, anaphylaxis, allergic rhinitis and asthma.

P: (07) 3871 34 37 F: (07) 3871 1570



Dr Melinda Heywood
BSc MBBS (Hons)
FRANZCOG, Obstetrician
and Gynaecologist

Melinda has recently joined Dr Pauline Joubert as an Obstetrician and Gynaecologist at eXExpectations, based at The Wesley Hospital, Auchenflower.

Melinda's obstetric interests include gestational diabetes, medical disorders in pregnancy, twin pregnancies, inc. vaginal delivery where possible, vaginal birth after caesarean, and external cephalic version for breech presentation. Her gynaecology interests include early pregnancy complications inc. miscarriage and ectopic pregnancy, recurrent miscarriage, initial management of infertility, ovarian cysts, dysfunctional bleeding, postmenopausal bleeding, management of abnormal Pap smears, contraception, and laparoscopic tubal ligation some prolapse surgery, and hysterectomy.

P: (07) 3160 2100 F: (07) 3160 2199

E: reception@exexpectations.com



Dr Adrian J. Morris
Consultant Forensic &
General Psychiatrist,
Drug & Alcohol Specialist,
Hon. Senior Lecturer (UQ)

M.B.B.S (Lond), M.R.C.Psych, F.R.A.N.Z.C.P.,
 C.C.T. Forensic Psychiatry (P.M.E.T.B.), R.C.G.P.
 Cert. Substance Misuse, P.G. Cert. Med.
 Education

Dr Adrian J. Morris is a highly trained
 Specialist Psychiatrist. He is able to assess,
 treat and manage a wide range of Psychiatric
 conditions. He has had three years of GP
 training, prior to his extensive Psychiatric
 training in General Psychiatry (Depression,
 Anxiety, Bipolar, Psychosis, ADHD), as well
 as drug, alcohol and addiction problems.
 Dr Morris is also involved in forensic and
 medico-legal work, both criminal and civil,
 and works on the Mental Health Review
 Tribunal, QLD. Dr A.J. Morris works closely
 with GPs and Psychologists to enable swift
 assessment, treatment and support of his
 clients and their families, as well as regular
 follow-up to assist in the maintenance of
 their mental stability and wellbeing.

Telegraph Road Clinic, Cnr Norris and
 Telegraph Rds, Bracken Ridge.

P: (07) 3261 7000



Dr Elham Reda
MBChB FRACP
Specialist Endocrinologist

We are pleased to advise
 Dr Elham Reda has joined

the Pacific Private Specialist Centre: Level 5,
 Suite 2, 123 Nerang St, Southport QLD 4215.

Dr Elham Reda is an Endocrinologist at the
 Gold Coast University Hospital. She is also
 a Senior Lecturer at Griffith University Gold
 Coast and is passionate about educating
 junior medical staff.

Her interests in Endocrinology are wide
 including diabetes mellitus, thyroid disorders,
 osteoporosis and metabolic bone diseases,
 and pituitary, adrenal and ovarian disorders,
 with expertise in diabetes and endocrine
 disorders during pregnancy, and insulin pump
 therapy.

Dr Reda is happy to receive referrals through
 Medical Objects, alternatively, by fax or post.
 She can also offer Telehealth Consultations
 for your convenience if required.

P: (07) 5532 7655 F: (07) 5591 9183

ROOM AVAILABLE

Sessional Consulting Room Available at:
 St Andrew's Place, 33 North St, Brisbane
 QLD 4000 (Opposite St Andrew's Hospital).
 Please contact Aleeta Duus for further
 information on phone (07) 3236 9960.

Dr S Kumar, Dermatologist

After working as a GP in Metropolitan
 Practices in Brisbane, Dr Kumar did Physician
 training followed by Dermatology training at
 the Royal Brisbane and Mater Hospitals. He
 also spent one year as a Specialist Registrar
 in Ireland.

Areas of interest include paediatric
 dermatology, psychocutaneous dermatology,
 general adult dermatology, ethnic
 dermatology, hair biology and transplant and
 geriatric dermatology including nursing home
 visits upon request by fellow GPs.

Dr Kumar's work covers skin cancer
 management and diagnosis, treatment of
 common skin conditions including acne,
 psoriasis and eczema. Dr Kumar does not
 deliver cosmetic dermatology services.

Dr Kumar conducts urban as well as rural
 Indigenous clinics in conjunction with
 General Practice Qld through the USOAP
 and MSOAP programmes.

From 28 June 2014, Dr Kumar will be
 consulting from QML Pathology rooms
 at Forest Lake on a monthly basis. For
 appointments, phone (07) 3281 4111.

Dr Ainslie Haggitt, Child & Adolescent Psychiatrist

will continue to work in
 private practice, but now works solely
 from the Sleeman Complex, Chandler.
 She has gradually been increasing her
 hours at Chandler and has ceased work at
 Woolloongabba.

Dr Haggitt completed medical training
 at the University of Queensland, prior to
 obtaining fellowship of the college of general
 practitioners. She subsequently trained as a
 psychiatrist, and then completed additional
 subspecialty training in child and adolescent
 psychiatry. She has worked in private
 practice in the Brisbane area since 2009.

Dr Haggitt provides assessment and
 management of mental health concerns
 including anxiety, depression, attention,
 learning and behavioural issues.

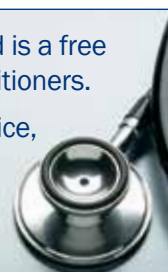
Results Medical Centre, Sleeman Complex
 Cnr Tilley and Old Cleveland Rds
 Chandler QLD 4155

P: (07) 3823 2400

Fax referrals to (07) 3245 3688 (include
 child's & parents' details on referrals to ensure
 comprehensive assessment & management).

The Doctor's Noticeboard is a free
 service for medical practitioners.

If you wish to place a notice,
 please email details to
info@qml.com.au.



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 Email: PCS1@narangba-medical.com.au
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Post: PO Box 3, Narangba QLD 4504

P: (07) 3886 6889

W: www.narangba-medical.com.au

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 on phone (07) 3205 4088 or email
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