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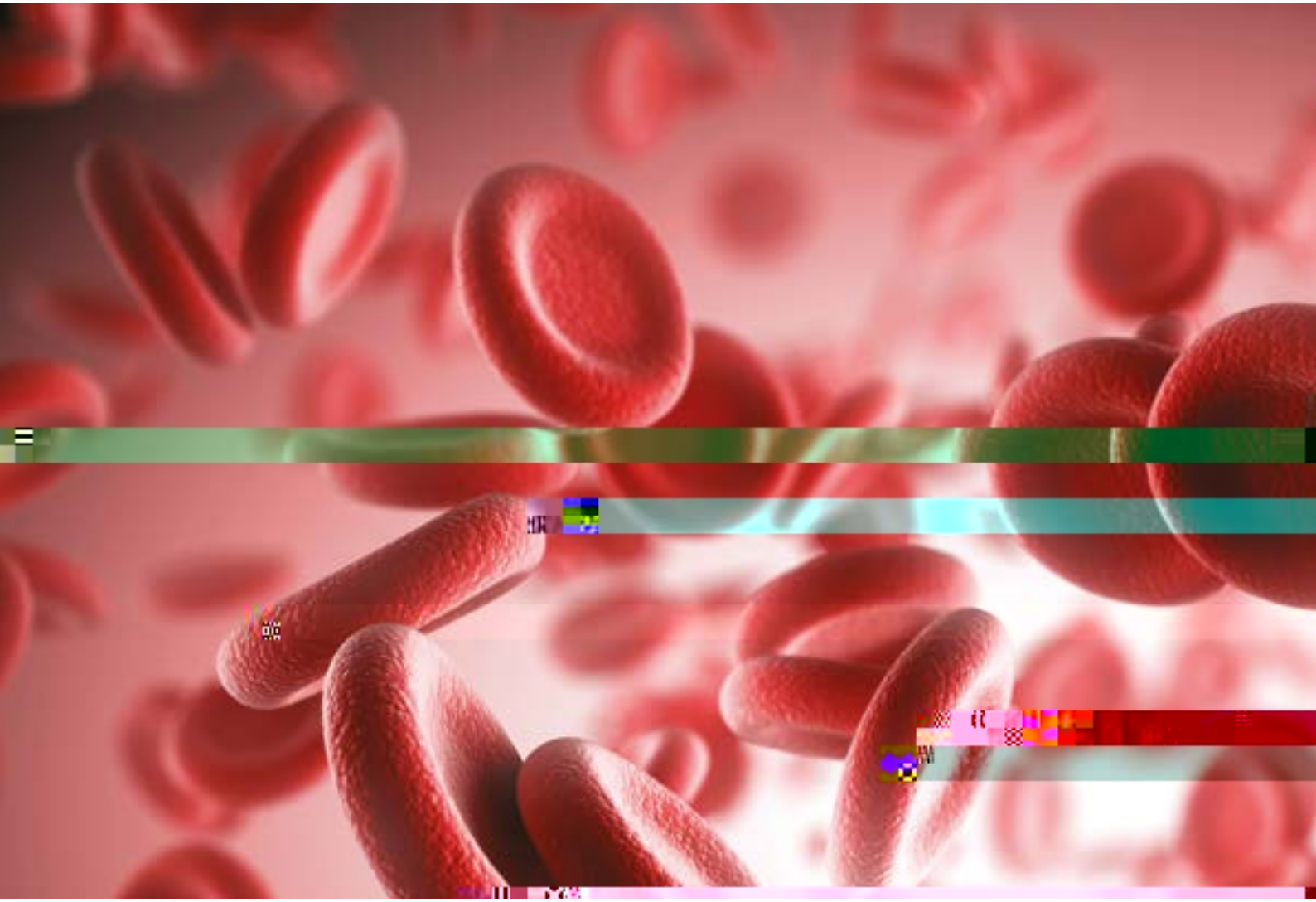
Iron Deficiency and Anaemia in Adults

RCN guidance for nursing practice



Th b cą ed b d

Iron deficiency anaemia (IDA) is a widespread

Anaemia is defined as a reduced number of red blood cells (RBCs) or less than the normal amount of haemoglobin (Hb) in the blood. It can also be defined as a lowered ability of the blood to carry oxygen.

World Health Organization (WHO) Haemoglobin thresholds used to define anaemia (Pavord et al., 2011)

Age or gender group	Hb threshold (g/l)
Children (0.5 to 5 years)	110
Children (5 to 12 years)	115
Teens (12 to 15 years)	120
Women, non-pregnant (over 15 years)	120
Women, pregnant	110 in first trimester
	105 in second and third trimesters
	100 post partum (up to six weeks post-delivery)
Men (over 15 years)	130

The normal range for Hb also varies between different populations in the UK. There are several different types of anaemia and each one has a different cause, although IDA is the most common. IDA is a condition where a lack of iron in the body leads to a reduction in the number of red blood cells. Iron is normally stored in the liver and is essential to red blood cell production. If there is a shortage of stored iron then red cells

Iron

Measuring iron status

If Hb is reduced, further blood iron studies identify if the anaemia is caused by iron deficiency. Iron tests can also help differentiate iron deficiency from other causes of anaemia (such as pernicious anaemia or anaemia of chronic disease).

Common symptoms of anaemia

Blood donation

Regular donations of blood require a blood test to check that the donor's haemoglobin level is sufficient for them to be able to donate safely. If the person has recently been unable to meet that threshold after previously having no problems,

Ma ag g def c e c

Dietary iron

In general, a broad range of foods should be used to prevent iron deficiency. A normal balanced diet contains a total of 12 to 18mg of iron per day. However, only a small amount of iron eaten is absorbed (3 to 5mg per day). It is advised that eating 70g of red meat per day is safe to meet iron requirements. Iron in the diet comes in two forms: haem iron and non-haem iron. Haem iron is found in animal derived foods and non-haem iron in plant derived foods. Non-haem iron (plant iron) is less easily absorbed through the gut. Therefore a balanced diet with iron enhancers is recommended (Derbyshire, 2012).

Foods that enhance or inhibit iron intake and absorption (Derbyshire, 2012)

Foods that enhance iron intake

Lean red meat.

Oily fish.

Vitamin C (fresh fruit and juices).

Fermented products (such as soy sauce and bread).

Foods that inhibit iron absorption

Calcium, particularly from milk and dairy products.

Phytates (present in cereal brans, grains, nuts and seeds).

Polyphenols and tannin (in tea, coffee, herbal infusions, green leafy vegetables).

General tips

Don't drink tea or coffee before or immediately after meals; wait at least one to two hours. Include vitamin C with meals where possible (such as a glass of fruit juice). Eat dairy products as snacks rather than with meals. Eat five portions of fruit and vegetables each day (Food Standard Agency, 2007).

For more patient information on iron in your diet please go to:

www.bda.uk.com/foodfacts/iron_food_fact_sheet.pdf

Oral iron supplements

Oral iron supplements should be considered for all people diagnosed with iron deficiency. These will help to correct anaemia and replenish iron stores. However, there are some instances when it is inappropriate to take oral iron, particularly if someone:

- has inflammatory bowel disease that is active (see Appendix 2 on page 22)
- has an oral iron intolerance
- is taking erythropoiesis stimulating agents.

There are several iron compounds available as tablets (ferrous sulphate, ferrous fumarate, ferrous gluconate). Oral iron preparations contain varying amounts of ferrous iron and the frequency of gastrointestinal side effects related to each different preparation tends to be directly related to the content of ferrous iron.

Iron salt	Dose	Preparation	Content of ferrous iron
Fe hą e	200 g	ab ę	65 g
Fe g c ą e	300 g	ab ę	35 g
S d fe edę ą e (S)	380 g/ 10	e	55 g

Limitations to iron supplements

There are several limitations to taking iron supplements. Only a small amount is actually absorbed (particularly if there is inflammation). Between 10 and 40% of people taking oral iron supplements experience gastrointestinal (GI) side effects, including diarrhoea or constipation, and don't fully adhere to the prescribed course.

Tips for successful supplementation

- Lower doses are better tolerated (start daily and build up dosing).
- Check FBC and iron levels monthly. Once Hb is normal, continue oral iron for three months.
- Combine ascorbic acid (vitamin C) as it may help absorption.
- Warn of potential GI side effects.

When people are able to take and tolerate iron supplements effectively, haemoglobin should rise by 2 g/l every three weeks.

Intravenous iron: practical administration

Using iron intravenously (IV) used to be thought as a last resort. However, modern IV iron preparations are becoming standard practice now in the management of IDA (Arnott et al., 2013). Randomised controlled trials show that:

- intravenous iron is at least as effective as oral iron
- intravenous iron delivers a faster response rate than oral iron.

In some instances, using IV iron is recommended as the first line of treatment. For example:

- if surgery is planned less than six weeks ao-15.3.3 (u)-1.4-25.9 () u)-cerr im]TJ0 --13b-9.5 (3)203f4 (t)-27.5 (t-,6e0 I8n-13.9 (e56.4 (e t)-23t0 -1.2o .3 (e)29 (.)8TJ-1.8 -2.05 Td[(I)-7.2 (n s)-4.5 (o)11.6 (s2.2411.5 7 (n d)7u)-11.58(-)-5. I]Tyt

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Dosing and infusions differences between IV iron preparations					
	Ferinject (Ferric carboxymaltose)	**Monofer (Iron isomaltoside 1000, 10%)**	**CosmoFer (Low molecular weight iron dextran)**	**Venofer (Iron sucrose)**	**Diafer (Iron isomaltoside 1000, 5%)**
Indication	I def c e c	I def c e c	I def c e c	I def c e c	I def c e c hae d a
Total vs. Repeated dosing	T a d g	T a d g	T a d g	Re ea ed d g	Re ea ed d g
Dose estimation	SPC f ed ab e	SPC f ed ab e O Ga / f a	Ga / f a	Ga / f a	N ec f c d g. A e d a e e e
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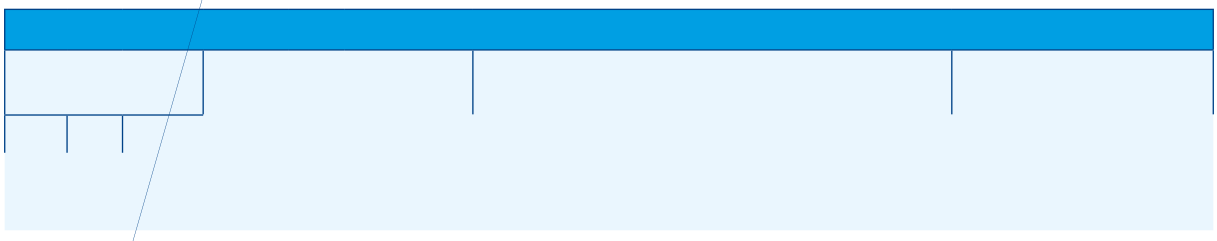
should be administered at a rate of 100mg/min. For doses greater than 500mg and up to 1000mg iron, Ferinject should be administered over 15 minutes.



Minimum observation is required to monitor for adverse reactions (pulse and blood pressure should be checked before and after infusion).

Administration of intravenous bolus injection

No test dose is required for this. Inject up to 500mg (up to three times a week) at an administration rate of up to 250mg of iron per minute. It may be administered undiluted or diluted in a maximum of 20mls of sterile 0.9% sodium chloride.

Haemodialysis patients

Monofer can be administered either as an intravenous bolus injection, as an intravenous drip infusion or as a direct injection into the venous limb of the dialyser.

3. CosmoFer

Dose calculation for CosmoFer

The normal recommended dosage schedule is 100 to 200mg of iron corresponding to 2–4ml, two or three times a week (depending on the haemoglobin level). However, if clinical circumstances require rapid delivery of iron to the body iron stores, CosmoFer can be (e)2.7 (r c)-21 (.8 (e (l)]TJ-12.8(e)/ b)-1038.1 (l)-10 (s o)9 (5))19.4 (.1.9 (i)17.

In March 2011, the Advisory Committee on the Safety of Blood, Tissues and Organs (SaBTO) (a Department of Health expert committee) initiated a public consultation on patient consent for blood transfusion, and as a result made a number of recommendations including:

- valid consent for blood transfusion should be obtained and documented in the patient's clinical record by a health care professional
- the provision of patient information is vital for valid consent.

There are patient information leaflets available from NHS Blood and Transplant (NHSBT) such as *Will I need a blood transfusion?* These can help with discussions and decision making, ensuring person-centred care and obtaining informed consent to treatment in a non-emergency setting. Although blood transfusion is often used for iron deficiency anaemia, it can be an inappropriate choice. Evidence of inappropriate practice is shown in the box below.

National Comparative Audit of Blood Transfusion (RCP and NHSBT, 2013)

The audit (which included 1,592 individual cases) revealed that 747 patients were identified as having possible reversible anaemia and that transfusion could have been avoided in 187 (25%) of these. Of those patients who received avoidable transfusion, 18% were not investigated to determine the cause of the anaemia and, in 60%, the anaemia was not adequately treated. Of the 552 patients with possible iron deficiency, 372 were documented as having definite iron deficiency. Only 73% of the 372 were prescribed iron therapy (252 oral and 20 parenteral). Of these, 37 (15%) were intolerant of oral iron and only eight (22%) were given parenteral iron.

Why were patients with potentially

People diagnosed with IDA should be aware that the increase in Hb is a slower process with oral iron and iron infusions than with a blood transfusion and that this may be a contributing factor to the clinical recommendations made. Following treatment, they should be encouraged to see their GP or usual health care practitioner to find the underlying cause of the iron deficiency anaemia (if not identified) and to check that the treatment has been effective. They should have Hb monitoring blood tests to ensure that treatment is given in a timely manner and its effectiveness monitored.

Appendix 1: Gastroenterology

Introduction

Gastrointestinal conditions account for the most common causes of IDA (Goddard et al., 2011) and these may present both with and without GI symptoms. Nursing staff working within GI practice will encounter patients with IDA in all areas of care, whether in outpatient clinics, during investigative procedures, in inpatient care or in specialist roles with patients pre-operatively or with inflammatory bowel disease (IBD) or coeliac disease.

The main body of this guidance has covered the principles of the nursing management of patients with IDA and this appendix aims to inform the care of GI patients in more detail.

GI causes of IDA

The most common cause of IDA in adult men and postmenopausal women is blood loss from the GI tract. There are other causes which include:

- colonic and gastric cancers (these can present with asymptomatic iron deficiency)
- malabsorption (most commonly from coeliac disease)
- gastrectomy or bariatric surgery
- inflammatory bowel disease
- helicobacter pylori (this decreases iron uptake)
- Giardia lamblia.

GI history

When taking a GI history of a patient with IDA consider:

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Coeliac disease

Coeliac disease (CD) is a chronic, autoimmune enteropathy that affects the small intestine. It is caused by exposure to gluten (a protein in wheat, rye and barley) in the diet. Eating gluten causes small bowel inflammation and blunting of the intestinal villi. This, in turn, leads to a range of nutritional deficiencies, particularly IDA.

CD affects up to 1:100 of the population, although only about 10 to 15% of people living with it are diagnosed (NICE, 2009). In children and adults, CD can present with a broad range of signs and symptoms. The most frequent include: abdominal pain, cramping or distension, chronic or intermittent diarrhoea, failure to thrive or faltering growth in children, fatigue, iron deficiency anaemia, nausea or vomiting, weight loss.

Studies have shown that 3% of patients undergoing endoscopy for investigation of iron deficiency anaemia will be diagnosed with coeliac disease. Anyone with IDA should be offered serological blood testing for CD. These serological tests should include:

- IgA tissue transglutaminase (tTG)
- IgA endomysial antibodies (EMA) if the tTG is equivocal
- check for IgA deficiency if tTG is negative.

Serological testing should be carried out in primary care settings, but for those with positive serology tests, they should be referred for an intestinal biopsy which will confirm CD. Once diagnosed, treatment is to remove gluten from the diet, and this requires specialist dietetic support. Iron levels should be monitored, and iron supplemented, whilst the child or adult adjusts to a gluten-free diet. Once gluten free, iron absorption should return to normal.

Case study

Appendix 2: Inflammatory bowel disease (IBD)

In the UK, IBD is estimated to affect approximately 400 people per 100,000 (Rubin et al., (2000).

IDA occurs in 60 to 80% of people with IBD (Arnott et al., 2013). Reasons for this include:

- an increase in hepcidin, a protein produced in response to inflammation
- intestinal bleeding
- poor iron absorption
- dietary restrictions.

Diagnosing IDA in IBD

The implications of not diagnosing IDA in IBD are significant. Symptoms can substantially reduce quality of life and complications can lead to an increase in admission and post-operative problems. There are two common types of anaemia in IBD: iron deficiency anaemia (IDA) and anaemia of chronic disease (ACD). Distinguishing between the two is most important.

As more nurses are carrying out specialist roles in IBD they have increasing responsibility for interpreting and acting on blood tests. The minimum monitoring blood tests should include haemoglobin, serum ferritin, transferrin saturation and c-reactive protein (CRP). Iron deficiency can be identified using the ferritin and saturation levels but interpreting these depends on the level of inflammation (CRP).

Serum ferritin levels increase in acute inflammation, so where CRP is raised, patients may appear to have a normal ferritin level. Therefore, when CRP is raised, the cut of ferritin level indicating iron deficiency increases to <100 µg/l. In quiescent disease (where CRP is normal) the standard value (<30 µg/l) applies.

Options for oral iron

Ferric maltol (Feraccru) is an option for the oral treatment of IDA in patients with IBD. There is some evidence (Schmidt et al., 2016) to suggest that patients unable to tolerate ferrous iron, can tolerate oral ferric maltol (this should be given twice a day), with only mild to moderate adverse events, and it can improve Hb levels.

The IBD nursing role

Identifying and appropriately managing IDA is
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National Institute for Health and Care Excellence (2009) *Coeliac disease: Recognition and assessment of coeliac disease*. London: NICE.

Rubin GP, Hungin AP, Kelly PJ Inflammatory bowel disease: epidemiology and management in an English general practice population. *Alimentary Pharmacology Therapeutics* 2000;14:1553–9

Schmidt C, Ahmad T, Tulassay Z, Baumgart DC,

Appendix 3: Heavy menstrual bleeding and irregular bleeding

Definition of heavy menstrual bleeding (HMB)

These all need to be balanced with the need for contraception and fertility wishes in the future. Many of the treatments used to treat heavy periods will also provide contraception (such as the IUS), subsequently, if a woman wishes to conceive and there is no cause then there are limited options. One of the issues for women who need surgery is achieving Hb and iron stores to an optimum level pre-operatively, especially if they continue to bleed in that period.

The nursing role

The nursing role in supporting women with heavy periods can be varied and it is important that nursing staff in primary care ensure that women who present with HMB have their Hb monitored. Nursing staff in secondary care who are working in a specialist role need to ensure that Hb hhM U110.4 (s)8 (i)-1 1Td[(t)-22.6 (h)-5717a(t)-20.7 .4 ()-

Appendix 4: Patient blood management

Patient blood management (PBM) is a multidisciplinary, evidence-based approach to optimising the care of patients who might need a blood or blood component transfusion as part of their planned or emergency stay in hospital.

Patient Blood Management – an evidence-based approach to patient care (NBTC, 2014) provides recommendations on how PBM should be implemented in hospitals. PBM has been rolled out across England and North Wales, to date. Local, national and international experts are supporting doctors, nurses, scientists and other health professionals to work together with patients on a case-by-case basis to deliver PBM.

Case study

Miss Smith, a 19-year-old female presented in the emergency department following a road traffic accident. Routine blood tests on admission revealed her Hb was 88g/l. She was distressed and feeling very unwell, showing signs and symptoms of anaemia as she was feeling short of breath and dizzy with palpitations and a headache. Her attending doctor discussed how she felt and, during the conversation, learned that she had started to suffer from very heavy and prolonged periods recently but had not had treatment for this. Taking this and her low Hb into account, as well as her symptoms, she decided that a blood transfusion would be beneficial and explained this to her. She left her with patient information leaflets on having a blood transfusion and took further samples to send to the laboratory for cross matching so that the unit for transfusion could be authorised and prepared.

As part of the preparation for the transfusion a nurse went to see Miss Smith to take a set of baseline observations and found her to be very distressed and upset. He sat with her as she explained she was very squeamish and afraid of the sight of blood and the thought of a transfusion was making her feel sick. Further conversation revealed that she was a first-year student away from home for the first time and that her diet and lifestyle had undergone significant changes. She had decided to become vegetarian as well. Although she had understood the information given to her, she was becoming increasingly distressed by the idea of having a blood transfusion and asked the nurse if there was anything else she could have instead.

In his role as patient advocate, the nurse went to the authorising physician and discussed this and the balance between the risks and benefits of a transfusion against the use of alternatives were considered. It was agreed that, as Miss Smith was otherwise fit and healthy and, although the need for a transfusion could be said to be clinically indicated, it could be managed appropriately by use of an alternative to an allogeneic blood transfusion. This would prevent a possibly inappropriate transfusion and exposure to a live human product. This option would decrease Miss Smith's anxiety and allow her to remain a blood donor if, and when, her Hb was high enough. This was explained

(p21622p21892 scnTTC

Appendix 5: Chronic kidney disease

Chronic kidney disease

Chronic kidney disease (CKD) is defined as abnormalities of kidney function or structure which are present for more than three months, with implications for health. This includes all people with markers of kidney damage and those with a glomerular filtration rate (GFR) of less

Renal anaemia

Blood pressure (BP) should be monitored closely in all patients with CKD, particularly during the initiation of ESA therapy. A rapid increase in Hb may be associated with a rise in BP. Antihypertensive therapy may need to be initiated or current antihypertensive medication increased.

The ESA dose may need to be reduced, especially if there is a rapid increase in Hb (more than 10–20 g/l (1–2 g/dL) per month) (NICE, 2006).

Examples of erythropoietin stimulating agents

Drug	Cautions	Side effects	Route/dose
E e be a (f e a e, Ne Rec)	I ade a e ea ed c ed b d e e, c ece d ea e; e c de he ca e fa ae a; chae c a c a d ea e, h b c , e e , a g a d ea e	D e-de e de c ea e b d e e agg a a f h e e a ed a e h a b d e e; d e-de e de c ea e a e e , f e /a- e , h b e b c e e , dde f e e a a e f e ed ce a a a	B bc a e ec **Correction phase** U Hb 105–115 g/dL e 20 / g h ee e e ee **Maintenance phase** Red ce d e b ha f he ad acc d g Hb e e a e a f ee . Red ce f e e c ce ee ec
Da be e a fa (f e a e, A a e)	I ade a e ea ed c ed b d e e, c e- ce d ea e; e c de he ca e fa ae a; chae c a c a d ea e, h b c , e e , a g a d ea e, he a c d ea e	Pe he a ede a; d e-de e de c ea e b d e e agg a a f h e e a ed a e h a b d e e; d e-de e de c ea e a e e , f e /a- e , h b e b c e e , dde f e e a a e f e ed-ce a a a C a d ca ed f b ea feed g	B bc a e ec **Correction phase** 450 a g a / g f e ee 750 a g a / g ce e e ee ad ed acc d g e e b 25 e ce f a d e a e a f f ee **Maintenance phase** D e e ed c ec ha e ach e e a ge Hb ca be cha ged ce h

Treatment with ESAs is highly effective, correcting the anaemia of CKD in approximately 90 to 95% of treated patients. Side effects are very rare owing to the similar genetic make-up as endogenous (derived internally) EPO.

Between 1988 and 1998, antibody-associated pure red-cell aplasia (PRCA) was reported in renal patients treated with ESAs (Bennett et al., 2004). The condition has a number of causes, including pharmacological treatment. PRCA can be determined by the presence of anti–EPO antibodies, which neutralise the action of the ESA, a low reticulocyte count (immature red blood cells), and anaemia (NICE, 2006). The Hb concentration declines at a rate of 1 g/dL per day and it may be necessary to transfuse one unit of red blood cells per week to avoid severe anaemia (Macdougall, 2004).

Regular monitoring of anaemia in patients with CKD is vital for early intervention with IV iron and ESA.

Case study

Mrs Brown is an 84-year-old lady with stable stage 4 CKD due to diabetic nephropathy. She comes to the clinic complaining of feeling increasingly tired, a little short of breath and feels cold most of the time. She is taking Aranesp 40mcg once a fortnight.

What is your differential diagnosis for her symptoms?

What tests/investigations would you order?

Her renal function could have declined. She could have an under-active thyroid. She could be anaemic despite being on an ESA. A full history and physical assessment are needed to rule out other causes for her symptoms. For example, does she report any dysuria which could indicate a urinary tract infection? Does she report any chesty coughs, temperature or flu like symptoms?

Infection and inflammation affect both iron absorption and the efficacy of ESA. She did not complain of any recent infections. Bloods were checked for U and Es, FBC, CRP and iron studies. Hb was 90 g/L. Iron levels were low, serum ferritin was 74 µg/l. TSATS (transferrin saturation) 20%. CRP was within normal range.

What is your diagnosis? What is your clinical management plan?

Mrs Brown was diagnosed with absolute iron deficiency. The ESA was less effective due to iron deficiency; her Hb had dropped to below the target range. Mrs Brown was booked into the nurse-led anaemia clinic for one dose of intravenous iron which she had infused without any adverse reactions.

What would your follow-up plan and advice be to Mrs Brown?

Mrs Brown was booked back into the clinic in two weeks to recheck her symptoms and check bloods for FBC to measure the response to iron. She was advised to call should she experience any side effects from the iron infusion. A follow-up appointment letter for two weeks later was given to Mrs Brown with the contact details of the nursing team.

References

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Renal & Urology News (2017) 'Iron deficiencd

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Appendix 6: IDA in pregnancy, primary postpartum haemorrhage and post-delivery

Anaemia is the most common medical disorder in pregnancy. Pregnancy causes a two to three-fold increase in requirement of iron and 10 to 20 fold increase in folate requirement. In pregnant women who are anaemic in the UK, 90% of them are iron deficient. Iron deficiency causes maternal morbidity due to increased susceptibility to infections, physical weakness, pre-term labour, increased risk of primary postpartum haemorrhage (PPH), low birth weight babies and postnatal depression. The chronic tiredness that it can cause is also often blamed for new mothers abandoning breastfeeding, which has major health benefits for both mother and baby. Maternal iron depletion also increases the risk of iron deficiency in the neonate. Managing anaemia in pregnancy will therefore help to prevent adverse fetal and maternal outtlrs1.6 (a5)4.7 (m)-12.8 (i)3-12.8 (i12.7y(a)-18.63 (h)9.8.8 (i)3-12. (r)-5.4 (o)P8b)4.174n (t)-,7(l)8

Appendix 7: Perioperative anaemia

Perioperative anaemia covers anaemia occurring at, or around, the time of an operation and puts patients at increased risk of longer hospital stays, complications and mortality. The British Committee for Standards in Haematology sets out three key reasons for the identification and management of perioperative anaemia (Kotzé et al., 2015).

- To identify a potential undiagnosed disease, such as malignancy.
- To reduce the likelihood of blood transfusions, thereby limiting the demand on donors and conserving finite blood supplies.
- To avoid unnecessarily exposing patients to the potential adverse effects of anaemia, transfusion, or both.

Pre-operative care

All patients should be suitably prepared for surgery. The inclusion of anaemia screening as a key part of the surgical referral pathway is recommended by NICE (2015), the NHS National Blood Transfusion Committee (2014) and the British Committee for Standards in Haematology (Kotzé et al., 2015). In cases of routine surgery, screening should be carried out as soon as possible after referral to give time for diagnosis and treatment without causing unnecessary delays for the patient. When surgery is urgent, any available time beforehand should be used for anaemia screening and, if necessary, treatment (Kotzé et al., 2015).

Intra-operative care

Intra-operative care aims to reduce the risk of anaemia by minimising blood loss throughout the procedure. This is usually achieved through the use of minimally invasive surgical techniques and medicines that prevent the breakdown of blood clots. During surgery, maintenance of optimal temperature, calcium levels and pH means the body is more able to form blood clots and prevent blood loss naturally. In situations where there is anticipated blood loss, intraoperative cell salvage can be used to return salvaged red blood cells back to the patient (Thakrar et al., 2017).

Post-operative care

Following major surgery, up to 90% of patients may become anaemic and recent changes to transfusion thresholds have resulted in more patients being discharged with anaemia. Simple interventions, such as reducing the number and volume of blood samples and avoiding the use of postoperative drains, can have a significant impact on preventing anaemia. Maintaining adequate oxygen levels in patients who become anaemic can help the body to recover and tolerate the anaemia.

Diagnosis and treatment of anaemia

The measurement of both haemoglobin and ferritin levels prior to p-3.9 (c) (m)9.3 (o)1.1 (g (o)1f301.0112 Tm[(

Case study

Mrs Adams is a 70-year-old woman, with a fungating vulval tumour, who attended pre-assessment for proposed surgery – wide local excision of vulva. She was seen within two weeks of referral and had a short turnaround to surgery. She also had COPD and her medication included clopidogrel.

Case study

Mr Smith is a 75-year-old gentleman with known chronic heart failure, aetiology ischaemic heart disease having had two previous myocardial infarctions. He has been well for some time (NYHA I) but has found he has been able to do less, with his wife taking on more in the home. His deteriorating symptoms include increasing shortness of breath and fatigue and he is now NYHA II/III. He is unable to play nine holes of golf as he once did and is feeling isolated at home, unable to get out like previously and meet with his friends. His mood is low and his wife is also feeling the impact of his reduced independence.

Mr Smith calls his heart failure specialist nurse who discharged him six months ago

Jankowska EA, Kasztura M, Sokolski M, Bronisz M, Nawrocka S, Oleśkowska-Florek W, ... Poniskowski P (2014) Iron deficiency defined as depleted iron stores accompanied by unmet cellular iron requirements identifies patients at the highest risk of death after an episode of acute heart failure. *European Heart Journal*, 35(36): 2468–2476.

Jankowska, EA, Malyszko J, Ardehali H, Koc-Zorawska E, Banasiak W, von Haehling S, ... Poniskowski P (2013) Iron status in patients with chronic heart failure. *European Heart Journal*,

ACD anaemia of chronic disease

AID