



Protocol for excluding B12 deficiency (Megaloblastic anemia/ Pernicious Anaemia) from adult and child patient presentation

Relevance

This protocol is relevant to all diagnosing clinicians, ie GPs and Nurses. HCAs and other staff should be aware of the possible 'presenting symptoms' and suggest that patients see a diagnosing clinician for further investigation.

Presenting Symptoms

If a patient presents with Tiredness, depression, hair loss, pins and needles, numbness in hands or feet, tremors and palsies, palpitations, recurrent headache or dizziness, B12 deficiency should be considered.

Beginning a diagnosis – presenting to GP/ Nurse

Using Appendix A –1 Minute Health Check –

If B12 deficiency is suspected order a blood test for FBC, Serum vitamin B12, Folic Acid, TSH, U+Es, LFT, Serum ferritin, Glucose and other tests you feel are required for symptoms/exclusion/ differential diagnosis.

Refer to Appendix B for diagnosis and treatment and await blood results if appropriate. Note that for patients with severe Signs and Symptoms, treatment may need to be initiated without waiting for the results of blood tests.

Once blood results are available: if the serum B12 level is below 180ng/L (or local laboratory threshold) then staff should make a 15 minute appointment with the GP or nurse who requested the blood test.

Confirming B12 deficiency

Blood tests are categorised as follows when combined with with signs and symptoms indicative of B12 deficiency

Blood serum B12 ng/L	classification
<180 or <200	Clinically significant/ severe B12 deficiency
200-300	Moderate deficiency
>300	"Subtle" (subnormal/normal B12 but with signs & symptoms)

- Based on Harrison's "Principles of Internal Medicine" 16 ed 2005 p606

In addition to these classifications, patients can be assigned to a therapeutic trial (to confirm a suspected diagnosis) or prophylaxis (where the clinician has evidence to suggest this is needed to prevent symptoms developing or getting worse). For example, if the patient is diagnosed as moderate or subtle deficiency (>180ng/L or >200ng/L with signs and symptoms, other autoimmune condition or family history) then they should be clinically reviewed every 4 weeks until you reach a clinical decision whether to commence treatment – even when the B12 level does not drop below 180-200ng/L. A deterioration of condition demonstrated by signs and symptoms is sufficient to commence a therapeutic trial.

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Prophylaxis of vitamin B12 deficiency

In the following instances B12 replacement therapy should be instituted as a prophylactic measure (to prevent further deterioration or even development of symptoms) regardless of blood serum B12 concentration: Prophylaxis is expected to continue for life.

- 1- Specific medical history renal imbalance, diabetes, >65 years old, or following GI surgery, Crohn's colitis, early onset dementia
- 2- Moderate/ subtle B12 deficiency with mild signs & symptoms
- 3- Moderate/ subtle B12 deficiency with severe signs & symptoms: patient presenting with strong family history, presence of other auto-immune conditions, major signs and symptoms which could become irreversible if treatment is not commenced urgently eg optic neuritis/ neuropathy, sudden onset blindness, subacute combined degeneration, ME, CFS, MS-like presentation, single limb paralysis, sudden loss of muscle mass (Motor Neurone Disease-like presentation), non-epileptic seizures, dysphagia, Bell's Palsy/ Ramsey Hunt syndrome, Parkinson's like presentation, dementia, total alopecia, migrainous headache, temporal arteritis, recurrent miscarriages, dysfunctional uterine bleeding, or psychosis

Other Actions to Take

- If clinical depression is suspected – complete PHQ9 and treat/refer as appropriate
- Neurological manifestation – neurological examination and refer to neurologist for further investigation
- Provisional diagnosis of any other condition – refer to appropriate speciality.

Mother & Foetus, Neonate, Child - B12 deficiency: prevention, early diagnosis and treatment

An undiagnosed, untreated B12 deficient mother receiving only folic acid supplement could deliver her child with neuromuscular damage, sub-acute combined degeneration of the spinal cord, congenital abnormalities, tumours including brain damage and spina bifida. This can be avoided with B12 replacement before and during pregnancy (treat as for B12 deficiency (PA¹) with neurological signs and symptoms).

The neonate 0 – 1 month born to an untreated B12 deficient mother should receive intensive IV B12 replacement treatment in the hospital neonatal department. Folate deficiency frequently accompanies B12 deficiency and folate may be offered in combination.

See treatment for B12 deficiency (PA) with neurological signs & symptoms.

Child 1 month – 13 years

If an untreated B12 deficient mother opts to breast feed, mother and infant will require B12 replacement and regular monitoring as per BNF guidelines. Please note, baby milk powder fortified with vitamin B12 may not be sufficient to correct the moderate to severe deficiency in a new-born.

A child, whether born to a known B12 deficient mother or not, who presents with delayed development, hyper activity, behavioural problems, dyspraxia, learning disability, autistic spectrum disorder like presentation, should initially be screened by blood test, to exclude B12 deficiency, underactive thyroid, inborn errors of metabolism, and any other condition suspected.

Treatment as per BNF guidelines for children. Review the signs and symptoms and vary the frequency according to the child's needs (following the loading doses of alternate day injections); 1mg weekly, fortnightly, monthly, 2 monthly or 3 monthly.

When required, refer to appropriate paediatric speciality.

¹ PA – Pernicious Anaemia

B₁₂ DEFICIENCY

Deciding how to treat B12 deficiency with neuro-psychiatric signs and symptoms, with or without anaemia or macrocytosis

B12 deficiency is a multi-system, poly-glandular, multi-point poisonous syndrome. It is also called Megaloblastic anaemia or Pernicious Anaemia.

Before treatment starts, patients should agree to B12 replacement therapy by signing and dating the appropriate consent form.

Where 1-3 body systems are affected (see Appendix A – symptoms) and blood serum B12 is below the local lab threshold (200ng/L usually) then treat as for B12 deficiency (PA) without neurological involvement.

Where 1-3 body systems are affected and blood serum is above the local lab threshold, then monitor the patient and review. Following specific medical history, prophylaxis may be initiated.

4-6 body systems affected, blood serum > 300ng/L (subtle deficiency) then offer a therapeutic trial to confirm diagnosis. Blood serum less than 300ng/L (moderate and severe deficiency), follow treatment for B12 deficiency (PA) with neurological signs & symptoms.

If more than 6 body systems are affected, commence treatment immediately without waiting for blood tests. Treat as B12 deficiency (PA) with neurological signs & symptoms.

Treatment regimes:

B12 deficiency (PA) and other macrocytic anaemias without neurological involvement. A small number of people have B12 deficiency and do not exhibit neurological signs and symptoms: hydroxocobalamin² by intramuscular injection Initially 1mg 3 times a week for 2 weeks then 1mg every 2-3 months. *Clinically review every 3 months with or without serum B12 test and if clinically indicated increase the frequency to every 2 months or every month

B12 deficiency (PA) with neurological signs and symptoms. Initially hydroxocobalamin (or methylcobalamin) 1mg on alternate days until no further improvement (maximum reversal of neuro-psychiatric signs and symptoms are achieved), then 1mg every 1 or 2 months. *Clinically review every 2 months with or without serum B12 and if clinically indicated increase the frequency to every month or more frequently

Note: treatment should be tailored to patient need; some people need injections more frequently than once per month.

Prophylaxis of B12 deficiency for specific medical history and patients presenting with moderate or severe symptoms but may not have low blood serum B12 ('subtle' B12 deficiency): 1mg hydroxocobalamin or methylcobalamin IM or SC alternate days for 6 doses (2 weeks), then 1mg IM or SC every 1-2 months: review and increase frequency to minimise the development of symptoms

Oral B12 treatment may also be offered for mild deficiency, and where a B12 deficiency has been demonstrated through a therapeutic trial but absorption of B12 from the gut is normal (ie no autoimmune conditions, no GI tract surgery or disorders, no IF or parietal cell antibodies) and dietary deficiency is suspected (vegetarian or vegan, or limited intake of red meat). Oral (OC³) B12 1mg/ 3mg/ 5mg per day. The patient's blood serum B12 should rise rapidly. If the patient's signs and symptoms do not improve then review and consider treatment for B12 deficiency (PA) without neurological signs.

² methylcobalamin is used in USA, Canada, India, Japan and other countries. Pharmacists in Wales also report that they can prescribe methylcobalamin. Methylcobalamin is considered superior to hydroxocobalamin by many people because it is one of the natural body forms of B12

³ OC – Over the Counter. B12 can be purchased as oral lozenges or spray from health food shops and the internet. Use methylcobalamin for preference

B₁₂ DEFICIENCY

Therapeutic Trial should be used where B12 deficiency is suspected because of signs and symptoms, but B12 deficiency is subtle or subclinical on the basis of blood serum results. 1mg IM or SC (hydroxocobalamin or methylcobalamin) should be given alternate days for 2 – 3 weeks (6 to 9 doses) followed by 1mg IM or SC⁴ per week for 3 months. Signs and symptoms should be monitored, and frequency varied if required. If there is no improvement in signs and symptoms after 3 months (13 weeks) then B12 deficiency can be excluded. A therapeutic trial will not interact with other medication given and other treatment can be started at the same time.

Cyanide poisoning (victims of smoke inhalation who show signs of significant cyanide poisoning) hydroxocobalamin (or methylcobalamin in some countries) the usual dose is 5g (or 70mg/kg in children) by intravenous infusion, given once or twice according to severity.

NOTE THAT cyanocobalamin is licensed for 1mg IM injection monthly; because of reduced retention in the body in comparison to hydroxocobalamin and methyl-cobalamin (not licensed). Cyanocobalamin is excreted by the kidney preferentially which is why Cobalamin is used to treat cyanide poisoning.

Nitrous oxide anaesthesia. Nitrous oxide inactivates Vitamin B12 in the body including brain cells. Therefore a B12 deficient patient (or her GP) should alert the surgeon and anaesthetist so that an alternative anaesthetic agent will be used during surgery.

Cessation of treatment

In most cases, treatment should continue for life. Treatment should be varied as follows:

- If the patient shows signs of improvement or is stable for 2 years, then the frequency of injections can be extended from monthly to every 2 months.
- If the patient suffers symptoms before the next scheduled injection, then the GP should consider injections closer together to minimise suffering
- Blood serum B12 is not considered a good measure of the effectiveness of injections,; relief from signs and symptoms is the best measure. It should be noted that the majority of B12 in blood serum is in the inactive form, and that the serum B12 test measures all forms of Cobalamin including the less biologically active cyanocobalamin form.

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⁴ Injections Intra-Muscular (IM, into the muscle of the shoulder or thigh) or Sub Cutaneous (SC, stomach, buttock etc). IM injections will be released into the blood more quickly giving faster effects but lasting less time, whereas injections into fatty tissue will be released more gradually

B₁₂ DEFICIENCY

Appendix A –1 Minute Health Check – B12 Deficiency signs and symptoms

A quick score will reveal if B12 deficiency, underactive thyroid or iron deficiency anaemia are possible diagnoses, and if the physician should order further tests.

This should be completed by the patient – it is sometimes helpful to circle the actual symptom experienced.

Name _____ DOB _____ Date _____

Where will you grade these symptoms 1-10? 1 indicates that this symptom is mild and infrequent. 10 indicates the patient has it all the time and it is severe and debilitating. A score of 5 indicates that the patient has the symptom and it affects their daily life to a moderate extent.

Signs and Symptoms	Score 1-10
Energy/ haemopoetic	
Weariness, Lethargy, tiredness, fatigue, faints	
Sleepy, tired in the afternoon	
Nervous system	
Tremor, foot drop	
¥ Loss of balance (ataxia), seizures, falls	
¥ Tingling or numbness in hands and/or feet, burning sensation	
Facial Palsy	
Spastic movements, Crampy pain in limbs	
¥ Stiffness of limbs, muscle wasting	
¥ Weakness or loss of sensation in limbs, shooting pain in back/ limbs, paralysis	
Migrainous headache	
Psychiatric	
Irritable, snappy, disturbed sleep	
Confused, Memory disturbance/ forgetful, fogginess	
Tension Headaches	
* Mental slowness, Mood swings, Anxiety/ Panic Attacks, depression	
* Psychosis, hallucinations, delusion	
Eye Ear Throat	
Blurred vision/ double vision/ drooping of eyelid (lid lag), orbital pain	
Dizziness, tinnitus	
Difficulty swallowing, persistent cough	
Immune System	
Prone to recurrent URTI, UTI, Respiratory infections	
Other auto-immune conditions	

Signs and Symptoms	Score 1-10
Cardiovascular/ Respiratory	
Shortness of breath, wheeziness	
Palpitations, chest pain	
Pallor, lemon yellow complexion	
Bruising, Vasculitis	
Gastro-Intestinal (GI)	
Sore tongue, bleeding gums	
Red beefy tongue	
Cracking the angles of mouth	
Metallic taste, unusual taste, loss of appetite, loss of weight	
Gastric symptoms-acidity, heartburn	
Intermittent diarrhoea, IBS	
Skin hair nail skeletal	
Premature greying	
Alopecia, Unexplained hair loss	
Joint inflammation, swelling, pain	
Dry skin, brittle nails	
Genito-Urinary (GU)	
Heavy painful periods, irregular periods, infertility & frequent miscarriages	
Loss of libido	
Shooting pain from groin to perineum	
Incontinence	
Personal & Family History	
Family history of B12 deficiency (Pernicious Anaemia), underactive thyroid, diabetes, vitiligo, depression	
Vegetarian, vegan, poor diet	
Alcoholism, Smoking	

- PHQ9 Patient Health Questionnaire to be completed
 ¥ Neurological examination and appropriate referral if indicated

Physician should also order routine blood tests including serum B12 in the following cases:

- ME, CFS, MS-like presentation
- Children born to B12-deficient mothers, presenting with behavioural problems, learning disability, dyspraxia, dyslexia and autistic spectrum disorders

Before making a provisional diagnosis of B12 deficiency, exclude all other possible diagnoses, with appropriate blood tests as clinically indicated.

B12 Consent Form

Dear patient

Your blood test shows that you have low levels of Vitamin B12 in the body, and your signs and symptoms indicate that you have a deficiency of Vitamin B12.

B₁₂

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Vitamin B12 is essential for life. Vitamin B12 deficiency can result in damage to every system and gland in the body

- it is needed to make new cells in the body, including red blood cells, and for enabling genes (DNA) to switch on and off
- it is needed for maintenance of the myelin sheath around nerve cells, and deficiency can result in numbness, paralysis, or shooting pains, as well as confusion and memory loss
- it is a vital catalyst in the body's energy pathways, so without it you may suffer lethargy and tiredness, and at the same time disturbed sleep
- It helps maintain cell membranes, which means it is important for a normal immune system, for hormone production, and for the production of digestive juices.

Vitamin B12 is found in meat, fish, eggs and milk but not in fruit or vegetables. The medical view is that a normal balanced diet contains enough B12. However, failure to absorb Vitamin B12 from food will cause B12 deficiency resulting in many forms of illnesses and disabilities.

Treatment – Vitamin B12 can be administered by either injection or taken by mouth. This is an ongoing treatment and your Doctor will advise you on how this will be given. You will be monitored and have further blood tests, to check on progress.

Risks – Although injectable B12 is completely non-toxic, some people report a little local discomfort after injection.

The practice has explained:-

About the condition

Treatment required and ongoing monitoring

I fully understand and I accept the above:

Signature:

Date:

For Surgery Information:

Diagnosis

Clinically significant B12 def <180/<200 (lab threshold) (with signs & symptoms) []

Subclinical / subtle B12 Def (>180/>200 (lab threshold) (WITH signs & symptoms) []

Additional Requirements

Signs & Symptoms sheet completed..... []

Consent form signed..... []

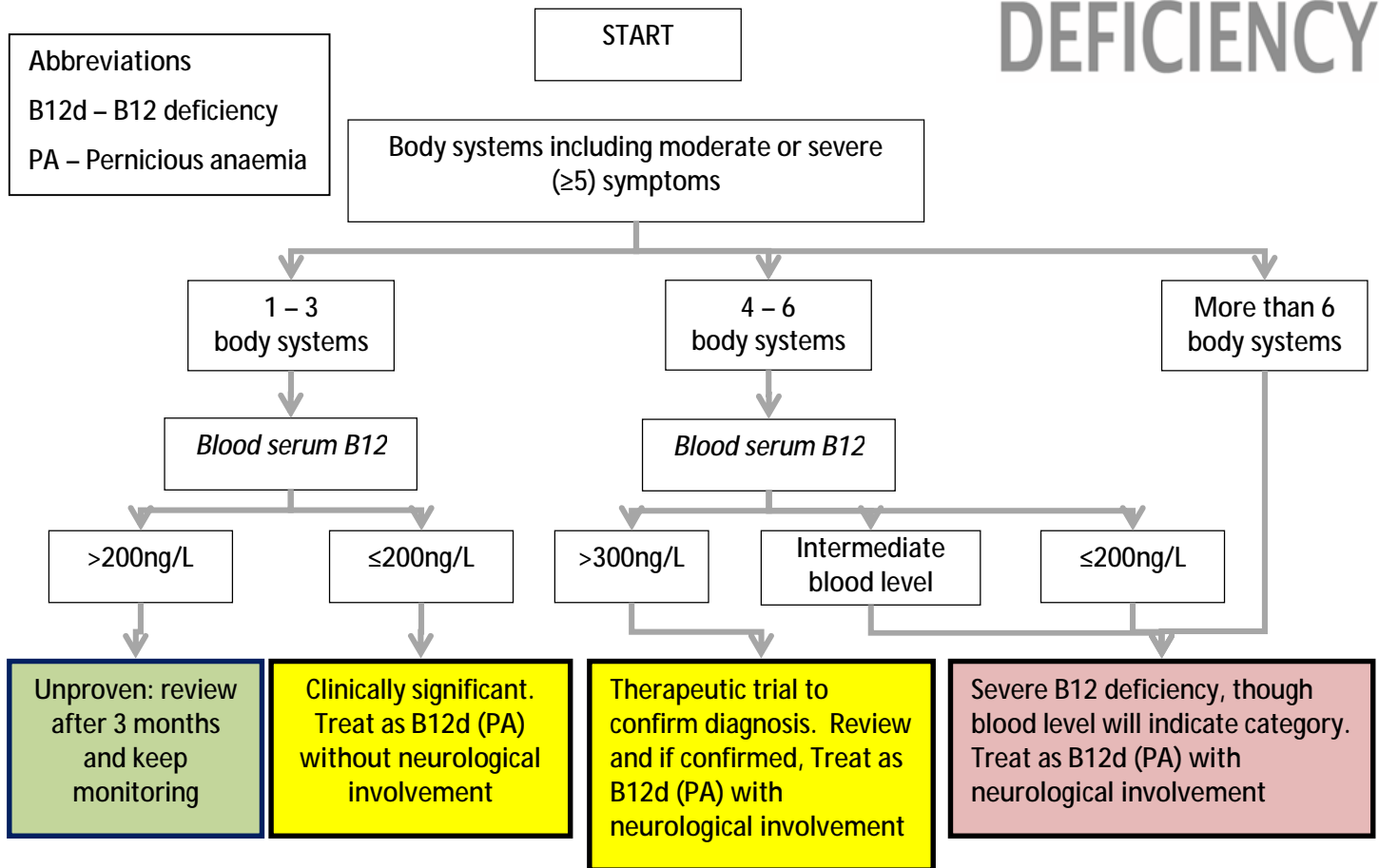
Patient Information Leaflets given..... []

Appendix B – Decision Tree to diagnose / exclude B12 deficiency

Record the MAXIMUM score of any single symptom within a body system, in the yellow header bar of the body system (on the Signs and Symptoms form).

Count scores of severity 5 or above in the yellow Signs and Symptoms bars.

B₁₂ DEFICIENCY



1. B12 deficiency (Pernicious Anaemia) and other macrocytic anaemias without neurological involvement*. Hydroxocobalamin or methylcobalamin Initially 1mg 3 times a week for 2 weeks then 1mg every 2-3 months

2. B12 deficiency (Pernicious Anaemia) with neurological signs and symptoms*. Initially 1mg on alternate days until no further improvement (maximum reversal of neuro-psychiatric signs and symptoms are achieved), then 1mg every 1-2 months.

3. Prophylaxis or Therapeutic Trial. 1mg IM or SC (hydroxocobalamin or methylcobalamin) should be given alternate days for 2 – 3 weeks (6 to 9 doses) followed by 1mg IM or SC⁵ per week for 3 months. If there is no improvement in signs and symptoms after 3 months (13 weeks) then B12 deficiency can be excluded. A therapeutic trial will not interact with other medication given and other treatment can be started at the same time. Review treatment pathway after 3 months.

*Clinically review every 1 or 2 months with or without serum B12 and if clinically indicated increase the frequency to every 2 months, every month or more frequently

⁵ Injections Intra-Muscular (IM, into the muscle of the shoulder or thigh) or Sub Cutaneous (SC, stomach, buttock etc) of hydroxocobalamin or methylcobalamin 1mg/ml or 5mg/ml

B₁₂ DEFICIENCY

Appendix C – Vitamin B12 deficiency and direct or indirect causation of disease

Deficiency of vitamin B12 is a multi-system, polyglandular, multipoint poisonous syndrome. B12 is required for proper function of most of the body's systems, so deficiency leads to disease in these systems.

This appendix lists some of the common conditions that can be treated successfully by using Vitamin B12 replacement therapy, and a causative mechanism can be described.

Haematological

Unexplained recurrent anaemia
Myelodysplasia
Pancytopenia / bruising

Psychiatric

Depression
Memory loss / confusion
Anxiety
Psychosis
Angry / moody / snappy

Gastro-intestinal

Recurrent gastritis
Mouth ulcers, bleeding gums
Pernicious anaemia
IBS / diverticulosis
Unexplained diarrhoea
Crohn's Colitis

Cardio-Vascular / Respiratory Systems

Cardiac failure – artherosclerosis, stroke
Temporal arteritis
Vasculitis
Exacerbation of angina – palpitations, breathlessness
Asthma exacerbation

ENT (Ear, nose & throat)

Tinnitus / vertigo
Glossopharyngeal neuropathy (swallowing difficulties)
Persistent cough
Dizziness / falls

Endocrine / Immune systems

Post Viral Immune Deficiency Fatigue Syndrome (ME)
Poor wound healing/ susceptibility to infection
Auto-immune conditions such as vitiligo, myositis, diabetes coexisting with myoderma

If treatment is delayed, this may cause irreversible damage, or fatality. Always exclude vitamin B12 deficiency before making a final diagnosis and deciding treatment options.

If vitamin B12 deficiency co-exists with other causes, B12 therapy compliments other treatments rather than interferes

Neurological

Dementia
Alzheimer's
Optic Atrophy / blindness
Doublevision, Ptosis
Loss of sensation in limbs, trunk, face, genitalia
Pseudo seizures, non-epileptic seizures
Blackouts and faints
SubAcute Combined Degeneration (SACD)
Single limb paralysis
Multiple-sclerosis like B12 deficiency syndrome
Neuropathic pain / myopathy
Cramps / crampy pain
Babies with neuromuscular damage may be born to mothers who are B12 deficient during pregnancy
Tension / migraine headaches
Parkinson's like presentation
Motorneurone like presentation with limb muscle atrophy
Bell's palsy
Ramsay Hunt syndrome

Bone

Osteoporosis, suppressed activity of osteoblasts
Inflammatory polyarthritis

Dermatology

Alopecia
Dry scaly skin/ dermatitis
Brittle nails

Genito-Urinary

Dysfunctional Uterine Bleeding
Repeated miscarriages
Polycystic ovarian disease
Dysmenorrhoea, menorrhagia
Recurrent UTI
Loss of libido
Double-incontinence