

- Anemia develops insidiously and due to physiologic compensatory mechanisms it may not cause symptoms until it is severe.
- Symptoms: Fatigue, pallor, dyspnea on exertion, headache, dizziness, tachycardia, nausea, diarrhea, glossitis, and jaundice.
- Vitamin B12 deficiency can interfere with myelination and produce peripheral neuropathy which varies from subtle loss of vibratory sensation and proprioception to frank dementia.
- Diagnose with complete blood counts, red cell indices, and assays of the vitamin B12 and folate.
- Dietary insufficiency of cobalamin and folate can be treated with appropriate changes to the diet and the administration of supplements.
- Vitamin B12 1000-2000 µg orally can be given once per d but if pts have neurologic signs, vitamin B12 1 mg IM is usually given 1 to 4 times/wk for several wk.
- Folate 400-1000 µg orally once per d.
- Vitamin B12 deficiency must be ruled out before treating with folate alone as this would treat anemia but not the neurologic manifestations.

Treatment

- The treatment of megaloblastic anemia depends upon the underlying cause of the disorder.

Assessment Points

System	Effect	Assessment by Hx	PE	Test
HEENT		Headaches and dizziness or vertigo, sore tongue	Yellow eyes, large beefy red tongue	
CV	Increased cardiac output Increased plasma volume	Angina, chest pain, palpitations, tachycardia	Hypotension and tachycardia	Decreased Hgb and Hct, red cell count MCV >100 May have decreased WBC and platelet count
RESP/HEME		Poor exercise tolerance Resp distress	Pallor, DOE, SOB	Large oval cells with hypersegmented neutrophils and large platelets in bone marrow diagnostic feature; Howell-Jolly bodies, nuclear fragment, may be seen in RBCs; low reticulocyte count
GI	Splenomegaly	Symptoms of liver disease, nausea, vomiting, diarrhea	Splenomegaly, jaundice	Liver enzymes, increased LDH
ENDO	Low erythropoietin levels			Bone marrow—macrocytosis, low folate, and B12 stores
CNS		Headaches, fatigue, dizziness, confusion	Dementia, neuropsychiatric disease	Low B12
PNS	Peripheral neuropathy		Loss of vibratory and proprioception especially in LE	Low B12
MS		Fatigue	Easy bleeding, bruising	

Key References: Khanduri U, Sharma A: Megaloblastic anaemia: prevalence and causative factors, *Natl Med J India* 20(4):172–175, 2007; Aslinia F, Mazza J, Yale S: Megaloblastic anemia and other causes of macrocytosis, *Clin Med Res* 4(3):236–241, 2006.

Perioperative Implications

Preoperative Preparation

- Preop workup of cause of megaloblastic anemia; treat cause and any vitamin deficiencies.
- Schilling test was used to identify origin of vitamin B12 deficiency but is no longer available in most hospitals and has been replaced with antiparietal cell and anti-intrinsic factor antibody assays.
- Treatment with folate alone with correct hematologic but not neurologic manifestations.
- May benefit from periop hematology/oncology consult.
- Bone marrow megaloblastic changes are reversed within 12 h after treatment with folate and vitamin

B12, and bone marrow morphology appears to be normal within 2 to 3 d.

- Watch for hypokalemia and hypophosphatemia after treatment.

Monitoring

- ST segment changes for myocardial ischemia.
- Large-bore access to facilitate transfusion.

Induction/Maintenance

- Both regional and general anesthesia are options.
- Caution with neuraxial anesthetics or regional anesthetics in case of bleeding diathesis or preexisting neuropathy.
- Avoid nitrous oxide as it inactivates vitamin B12, even with short exposure.

Etiology

- Most common cause is vitamin B12 and/or folate deficiency due to:
 - Decreased absorption due to gastric or intestinal disease (pernicious anemia, Crohn disease);
 - Decreased intake seen in strict vegan diet, elderly, or alcoholics;
 - Increased requirements seen in pregnancy, patients on hemodialysis, and hemolytic anemia.
- Some drugs and toxins impair vitamin absorption, including methotrexate, chemotherapeutic agents, phenytoin, antacids, and nitrous oxide.
- Much rarer causes include enzyme deficiencies, myelodysplastic syndromes, and acute myeloid leukemia.

Intraoperative Management

- Intraoperative transfusion as clinically indicated.
- Some pts at risk for increased bleeding and transfusion.

Postoperative Period

- Increased risk for anemia and bleeding diathesis.
- If transfusion given, worry about volume overload due to compensatory increased plasma volume.

Anticipated Problems and Concerns

- Vigilance for prevention, diagnosis, and treatment of ischemic events.
- Be prepared to treat bleeding diathesis.
- Treat symptoms (e.g., resp distress, fatigue, angina, heart failure, tachycardia).

Angina, Chronic Stable

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Risk

- Incidence in USA: 3 million.
- Annual rates per 1000 new episodes of angina for non-African American men are 28.3 for ages 65–74, 36.3 for ages 75–84, and 33.0 for age 85 and older. For non-African American women in the same age groups, the rates are 14.1, 20.0, and 22.9, respectively. For African American men, the rates are 22.4, 33.8, and 39.5, and for African American women, the rates are 15.3, 23.6, and 35.9, respectively.
- African Americans have highest death rates, although overall death rates are decreasing over time.

Perioperative Risks

- Increased risk of periop MI and death varies, depending on study (3–12%).
- Risk of LV dysfunction, myocardial ischemia, hypotension, and MI.

Worry About

- Increasing frequency of symptoms (i.e., unstable angina)
- Signs of LV dysfunction with ischemia
- Silent myocardial ischemia

Overview

- Chronic stable angina identifies pts at risk for developing myocardial ischemia and MI.
- Angina is present in <25% of episodes of myocardial ischemia.
- Symptoms should be stable for previous 60 d for “stable” diagnosis.
- Can result from
 - Inadequacy of myocardial O₂ supply in pts with critical coronary artery stenosis.

- Coronary vasospasm.
- Inadequacy of myocardial O₂ supply secondary to increased demand from ventricular hypertrophy.
- Endothelial cell-mediated vasoconstriction.
- Thrombosis overlying unstable plaque can lead to unstable angina/MI.

Etiology

- Acquired disease with genetic predisposition.
- Pts with diabetes have higher incidence of CAD, which is frequently silent.
- Other risk factors include Htn, hyperlipidemia, advanced age, tobacco use, and homocysteinemia.

Usual Treatment

- Medical therapy: β -adrenergic receptor antagonist, Ca²⁺-channel antagonists, nitrates, aspirin, P2Y₁₂ inhibitors, folate, lipid-reducing agents, and combination agents
- Percutaneous coronary interventions with stent placement
- CABG

Assessment Points

System	Effect	Assessment by Hx	PE	Test
CV	Myocardial ischemia LV dysfunction	Angina Sx Angina-equivalent Sx Dyspnea Exercise tolerance	Displaced posterior maximal impulse S ₃	ECG Exercise ECG Exercise radionuclide scintigraphy Pharmacologic stress testing ECHO Coronary angiography Coronary CT
RESP	CHF	Dyspnea Nighttime cough Orthopnea Chest tightness	S ₃ Rales Wheezing	CXR
GI		Angina-equivalent Sx LUQ pain Nausea, indigestion		See CV
RENAL	Decreased renal perfusion	Increased UO at night		Cr
CNS	Syncope	Syncope with chest pain		Exercise stress test
MS	Angina-equivalent Sx Arm pain/neck pain			See CV

Key References: Fihn SD, Blankenship JC, Alexander KP, et al.: 2014 ACC/AHA/AATS/PCNA/SCAI/STS focused update of the guideline for the diagnosis and management of patients with stable ischemic heart disease: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines, and the American Association for Thoracic Surgery, Preventive Cardiovascular Nurses Association, Society for Cardiovascular Angiography and Interventions, and Society of Thoracic Surgeons, *J Am Coll Cardiol* 64(18):1929–1949, 2014; Fleisher LA, Fleischmann KE, Auerbach AD, et al.: 2014 ACC/AHA guideline on perioperative cardiovascular evaluation and management of patients undergoing noncardiac surgery: executive summary: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines, *Circulation* 130(24):2215–2245, 2014.

Perioperative Implications

Preoperative Preparation

- Continuation of chronic antianginal medications associated with a lower incidence of myocardial ischemia/infarction, especially beta blockers, statins, and antiplatelet agents.
- No RCT has definitively demonstrated improved outcome acutely starting any medications.

Monitoring

- ST-segment analysis.
- PA cath for large fluid shift operations or pts with signs of LV dysfunction, although RCT unable to document benefits of routine monitoring.
- TEE is most sensitive, but technical issues of real-time interpretation may occur.

Airway

- None

Preinduction/Induction

- May develop reduced CO and hypotension with ischemia.
- Avoid tachycardia, hypotension.

Maintenance

- Myocardial ischemia may manifest as
 - CV instability.
 - Intraop myocardial ischemia.
 - Reduced CO, increased PCWP.
 - Regional wall motion abnormalities.
- No one agent or technique has been shown superior.
- Maintain normothermia and adequate hematocrit ($\geq 28\%$).

Extubation

- Period at greatest risk for developing ischemia.

Postoperative Period

- Pain management may be critical.

- Consider monitoring troponin if there are any signs/symptoms of myocardial ischemia. Some authors suggest routine monitoring of troponin in this population.

Adjuvants

- β -adrenergic receptor antagonist, nitroglycerin, Ca²⁺-channel blockers

Anticipated Problems/Concerns

- Pts with angina who develop dyspnea on exertion are at greatest risk for developing periop cardiac complications.
- Exercise tolerance may be the best predictor of periop risk. Pts with a good exercise tolerance may not require further evaluation for less-invasive procedures.
- Pts who develop periop MI are at increased risk of periop death and long-term morbidity/mortality. Elevated troponin also associated with worse long-term outcomes.

Anhidrosis (Congenital Anhidrotic Ectodermal Dysplasia)

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Risk

- Rare: 1:125,000,000
- Clusters in Japan and Israel

Perioperative Risks

- Impaired thermoregulation (risk of fatal hyperpyrexia in infants)
- Postop chest infections

Worry About

- Absence of sweat leads to impaired thermoregulation.
- Insensitivity to superficial and deep painful stimuli with intact tactile perception; still require

considerable amounts of inhalational or IV anesthetics to maintain hemodynamic stability and obtund stress response to airway manipulation.

Overview

- Innervation of the eccrine sweat glands is lacking; heat loss by evaporation is impaired.
- Absent mucous glands from resp tract and esophagus; frequent resp infections.
- Partial or complete absence of teeth.
- Hypotrichosis (absent hair).
- Self-mutilating behavior and mental retardation.
- Characteristic facies: Prominent supraorbital ridges, depressed bridge and root of nose, large

deformed ears, thick lips, underdeveloped maxilla and mandible.

Etiology

- Sex-linked autosomal recessive disorder.
- Human *TRKA* (*NTRK1*) encodes the RTKs for NGF and is the gene responsible.
- Full expression only in males; carrier females may be mildly affected.

Usual Treatment

- Protect from risks of hyperpyrexia due to infection, hot weather, vigorous exercise