

IRON DEFICIENCY ANEMIA

Most common cause of anemia worldwide

- Iron is essential for the **production of hemoglobin**, and a deficiency leads to impaired erythropoiesis and iron deficiency anemia (IDA).
- critical role in **oxygen delivery**
- **DNA synthesis**
- **cellular transport**

□ **Hepcidin**, the key peptide involved in iron regulation, is produced in the liver and is a negative regulator of iron absorption.

- * ✓ production increases with inflammation
- * ✓ decreases in response to hypoxia, anemia, and iron deficiency.

Q in the small
→

TREATMENT

Severe and highly symptomatic: RBC transfusion

- ✓ Severely reduced hematocrit or myocardial ischemia

to be given once daily or every other day

Oral iron

GI side effects very common (Constipation, diarrhea, epigastric pain, nausea/vomiting, Black, green or tarry stools)

Intravenous iron

- ✓ oral iron may not be adequate treatment
- ✓ Used when GI side effects prohibit oral replacement
- ✓ Or patients with malabsorption (celiac disease, inflammatory bowel disease)
- ✓ undergone resection of the stomach or small bowel
- ✓ Pregnancy (more rapid repletion of iron)

- Frequent dosing (two or three times daily) of oral iron can lead to increased **hepcidin** production, which actually reduces iron absorption. For this reason, a **single daily or every-other-day dose** of oral iron sulfate may be the best replacement dose.

OUTLINES

- ❖ Definition
- ❖ Etiology and Types of RF
- ❖ Hypoxemic RF (ARDS)
- ❖ Ventilatory Failure (Hypercapnic)
- ❖ Other types of Respiratory Failure
- ❖ Diagnosis
- ❖ Management

- a-a gradient
- invasive vs noninvasive ventilation
- Hypoxia mechanism
- hyper of RF

Types of respiratory failure

	Type 1 (hypoxemic respiratory failure)	Type 2 (hypercapnic respiratory failure)
Definition	Respiratory failure characterized by hypoxemia and normocapnia or hypocapnia on arterial blood gas analysis	Respiratory failure characterized by hypercapnia and normoxemia or hypoxemia on arterial blood gas analysis
PaO	↓ (< 60 mmHg)	Normal or ↓ (< 80 mm Hg)
PaCO	Normal or ↓ (< 33 mm Hg)	↑ (> 50 mmHg)



HYPOXEMIC VS HYPERCAPNIC (VENTELATORY) RESPIRATORY FAILURE

Hypoxemic Respiratory Failure	Hypercapnic Respiratory Failure
Known as: Type I ARF, Lung Failure, Oxygenation Failure, Respiratory Insufficiency	Known as: Type II ARF, Pump Failure, Ventilatory Failure
Definition: The failure of lungs and heart to provide adequate O_2 to meet metabolic needs	Definition: The failure of the lungs to eliminate adequate CO_2
Criteria: $PaO_2 < 60$ mmHg on $F_iO_2 \geq .50$ or $PaO_2 < 40$ mmHg on any F_iO_2 $SaO_2 < 90$	Criteria: Acute \uparrow in $PaCO_2 > 50$ mmHg or Acutely above normal baseline in COPD with concurrent \downarrow in pH < 7.30
Basic Causes: R-L shunt V/Q mismatch ^{PL} Alveolar hypoventilation Diffusion defect Inadequate F_iO_2	Basic Causes: Pump failure (drive, muscles, WOB) $\uparrow CO_2$ production R-L shunt \uparrow Deadspace

TYPES OF HYPOXEMIA

Handwritten note: "1.4 x P_aCO₂"

Handwritten note: "A-a gradient"

ABGs: $((1.4 \times P_{aCO_2}) - P_{aO_2}) \times K$

Causes of hypoxemia			
	Example	A-a gradient	Corrects with supplemental O ₂ ?
Reduced P _i O ₂	High altitude	Normal	Yes
Hypoventilation	CNS depression, neuromuscular weakness	Normal	Yes
V/Q mismatch	Pulmonary embolism, COPD	Increased	Yes
Diffusion limitation	Emphysema, ILD	Increased	Yes
Intrapulmonary shunt (V/Q = 0)	Pneumonia, pulmonary edema, atelectasis	Increased	No
Intracardiac shunt (right to left)	Tetralogy of Fallot, Eisenmenger syndrome	Increased	No

A-a gradient = alveolar-to-arterial oxygen gradient; ILD = interstitial lung disease; P_iO₂ = partial pressure of inspired oxygen; V/Q = ventilation/perfusion ratio.

☆

Indication of non invasive mechanical ventilation



Box 16.5 Some indications for the use of non-invasive ventilation (NIV)


- Acute exacerbation of COPD (pH <7.35)
- Cardiogenic pulmonary oedema
- Chest wall deformity/neuromuscular disease (hypercapnic respiratory failure)
- Obstructive sleep apnoea
- Severe pneumonia (see Box 15.7)
- Asthma (occasionally)
- Weaning patients from invasive ventilation

Contraindications include facial or upper airway surgery, reduced conscious level, inability to protect the airway.

Modified from BTS guidelines after 1997, [http://www.british thoracic society.co.uk](http://www.britishthoracic society.co.uk).

TYPES OF HYPOXEMIA

an gradient can be calculated by the ABGs if it was > expected

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↓
 This is high a_e

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Seizure

Aura, focal symptoms, olfactory hallucinations, automatism (ex. lip smacking) before

Myoclonic jerks *before* LOC

Usually between 1-2 minutes

EMS vitals: usually BP & HR generally elevated (exception: rare types of temporal lobe seizure can cause bradycardia)

Post-ictal confusion

More often horizontal deviation or flickering of eyelids, blank stare

Eyes open

Lateral tongue biting

Syncope

Prodromal presyncope, palpitations, diaphoresis before

Myoclonic jerks *after* LOC

Brief, generally <1 minute

EMS vitals: could have low BP & HR

Rapid recovery

Vertical deviation (rolling back), can also see flickering of eyelids

Usually eyes closed or rolled back

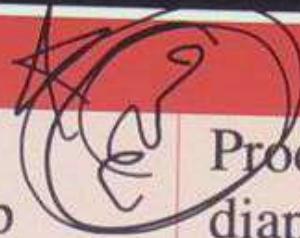
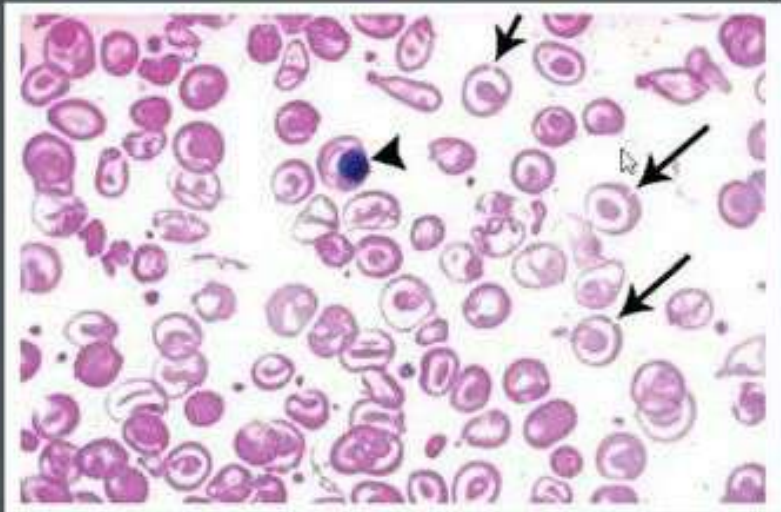


TABLE 38-2**Glasgow Coma Scale**

BEHAVIOR	RESPONSE	SCORE
Eye opening response	Spontaneously	4
	To speech	3
	To pain	2
	No response	1
Best verbal response	Oriented to time, place, and person	5
	Confused	4
	Inappropriate words	3
	Incomprehensible sounds	2
	No response	1
Best motor response	Obeys commands	6
	Moves to localized pain	5
	Flexion withdrawal from pain	4
	Abnormal flexion (decorticate)	3
	Abnormal extension (decerebrate)	2
	No response	1
Total score:	<i>Best response</i>	15
	<i>Comatose client</i>	8 or less
	<i>Totally unresponsive</i>	3

DIAGNOSIS



Blood smear: thalassemia.

Target cells (arrows)

circulating nucleated red blood cells (arrowhead).



BLOOD TEST

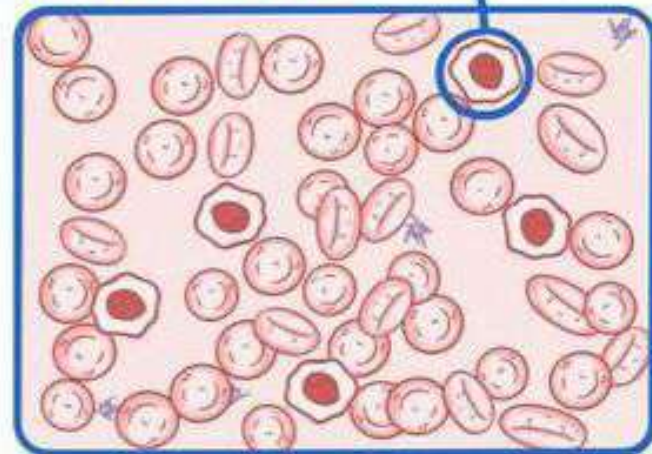
- ↳ ↓ HEMOGLOBIN
- ↳ ↓ MEAN CORPUSCULAR VOLUME (MCV)
- ↳ ↑ RED BLOOD CELL DISTRIBUTION WIDTH (RDW)



normal RDW

BLOOD SMEAR

- ↳ MICROCYTIC (SMALL)
- ↳ HYPOCHROMIC (PALE)
- ↳ TARGET CELLS



* Treatment

- 1. Symptomatic
 - a. Allopurinol (Decreases Uric Acid)
 - b. Antihistamines

- 2. Chronic phase
 - a. Tyrosine Kinase Inhibitors (Imatinib, Dasatinib, or nilotinib)
 - b. Interferon- α : may improve response to tyrosine kinase inhibitors
 - c. Hydroxyurea in palliative setting
 - d. Bone marrow transplantation (Curative)

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- 3. Accelerated phase or blast phase
 - a. Tyrosine Kinase Inhibitors
 - b. AML Chemotherapy
 - c. Stem cell transplantation (May be curative)

Treatment

- Patients with significant erythromelagia but low risk of thrombosis (< 1,500,000) ☐ give low-dose aspirin
 - Patients at high risk of thrombosis (> 60 Y.O, history of thrombosis, Cardiovascular risk or platelets >1,500,000) ☐ give cytoreductive therapy hydroxyurea (Goal is to reduce platelets to < 400,000). Anagrelide, busulfan and interferon alpha are 2nd line therapies
 - Splenectomy not recommended (increased risk of bleeding episodes, thrombosis)
-

Prognosis

- Median survival is 4 years from diagnosis
- **Poor prognostic factors :**
 - Advance age
 - Cytopenias
 - presence of circulating blast cells,
 - constitutional symptoms

Death occur mostly from infections , hemorrhage , cardiac failure postsplenectomy mortality and transformation into acute leukemia

- Dynamic International Prognostic Scoring System plus (DIPSS-plus) for IMF uses 8 factors to determine mean survival :
- Age older than 65 years
- Hemoglobin level less than 10 g/dl
- Leukocyte count higher than $25 \times 10^9 /L$
- PLATLET COUNT LOWER THAN $100 \times 10^9 /L$
- Circulating blasts of 1% or more
- Constitutional symptoms
- Red blood cell transfusion dependency
- Unfavorable karyotype

Classifications:

Low risk (0 adverse points) = 15.4

Intermediate 1 risk (1 adverse point) = 6.5

Intermediate 2 risk (2-3 adverse points)=2.9

High risk (4-6 adverse points)=1.3

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leukomoid reaction
major + minor criteria