

Cyanosis

Summary from Rosen's By William Fox

Epidemiology

- Rare in ED, commonly seen in patients with known cardiopulmonary disease or in patients with tissue hypoperfusion

Pathophysiology

- Seen when deoxygenated hemoglobin reaches ~5g/dL
- Can also be as a result of formation of methemoglobin due to oxidation of ferrous iron ($\text{Fe}^{2+} \rightarrow \text{Fe}^{3+}$)
 - Methemoglobin's O_2 dissociation curve is shifted to the left, resulting in decreased oxygen delivery to the tissues
 - NADH reductase prevents the formation of methemoglobinemia
 - When methemoglobin makes up 10-25% of total hemoglobin, cyanosis results

Differential Diagnosis

Central cyanosis

- Decreased arterial saturation (altitude, decreased pulmonary function, V-Q mismatch, respiratory compromise)
- Anatomic shunts (Pulmonary, cerebral, hepatic, or congenital cardiac defects)
- Abnormal hemoglobin (met-/sulf-hemoglobinemia)

See Box 14-2 and Figures 14-3/4 in Rosen for complete explanations

Peripheral cyanosis

- Low cardiac output (Shock, LV failure, hypovolemia)
- Environmental exposure (cold)
- Arterial occlusion (thrombosis, embolism, vasospasm)
- Venous obstruction
- Redistribution of blood flow

Signs and Symptoms

- Important to note onset, duration, time, and any previous precipitating factors
 - Changes in temperature, activity level, or altitude
- Exposures to dyes or heavy metals can result in pseudocyanosis
- Any current or prior cardiac issues such as cardiovascular disease, congenital heart defects
- Symmetrical clubbing of the fingers and toes can indicate chronic hypoxemic states
- Nail bed hemorrhages and end-organ damage (specifically in the eye or kidney) can indicate thrombotic processes

Work-up

- Complete blood count with smear, can consider D-dimer if PE is on DDX, CXR, EKG
- Pulse oximetry is not reliable, ABG testing needs specific CO-oximetry measurements
- Look for changes in condition after administration of high-flow O_2
 - If improvement noted, diffusion impairment is likely cause
 - No improvement on O_2 likely due to V-Q abnormalities and respiratory status should be reassessed (auscultation, CXR, CT)

Empiric Management

- High-flow O_2 is first line treatment, along with fluids if hypovolemia or polycythemia (goal Hct~45%) is suspected
- If methemoglobinemia is secondary to aniline dye exposure, decontamination followed by O_2 and methylene blue IV 1-2mg/kg/5 min if symptomatic or methemoglobin/hemoglobin>30%
- If peripheral cyanosis, consider the following treatments
 - Raynaud's phenomenon is treated by warming affected digits and administration of vasodilatory agents
 - If no improvement with supplemental O_2 and warming, consider vascular occlusion and administer heparin

Disposition

- All primary episodes of cyanosis should be admitted for full evaluation
 - Consider cardiology consult for new onset cyanosis in children
 - Vascular surgery consult for acute arterial occlusion
- Patients with known primary pulmonary disease, vasospasm-related peripheral cyanosis, and methemoglobinemia less than 15% can be discharged after observation over several hours