



NMNEC Concept: **Perfusion**

Mega Concept: Health and Illness

Category: Oxygenation and Hemostasis

Concept Name: Perfusion

Concept Definition:

Mechanisms that facilitate and or impair the circulation of blood through the tissues and organs for the purpose of delivering nutrients and oxygen to cells.

Scope:

The concept of perfusion and associated problems range from optimal to no perfusion. Impaired perfusion results in tissue and or cellular ischemia.

Categories:

- Central perfusion: the amount of blood pumped by the heart that is targeted to organ perfusion. Cardiac output creates central perfusion.
- Local/Tissue perfusion: the volume of blood that flows through arteries and capillaries to the target tissues.

Risk Factors:

Populations at Risk: Risk for alteration in perfusion extends across the lifespan.

- Congenital cardiovascular defects.
- Pregnancy
- Middle and elder aged adults at increased risk due to atherosclerosis.
 - African American males

Individual Risk Factors:

- Non modifiable risk factors:
 - Age: Elders, very young for congenital defects
 - Gender: Men earlier and higher incidence, women more likely fatal
 - Genetics: African Americans higher incidence, family history, familial hypercholesterolemia
 - Prenatal infections



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- Modifiable/ preventable risk factors
 - Smoking
 - Obesity
 - Diabetes
 - Alcoholism
 - Sedentary lifestyle
 - Hyperlipidemia
 - Hypertension
 - Coagulopathy

Physiological Processes and Consequences:

- Threats to central perfusion and cardiac output
 - Preload: Hypovolemia or hypervolemia
 - Contractility: Loss of the myocardial contractile force, either acutely, e.g. acute ischemia, or conduction abnormality, or from chronic changes, e.g. ventricular remodeling, endocarditis, pericarditis, and valvular disorders
 - Afterload: Increased or critically decreased systemic vascular resistance (SVR)
- Threats to local or tissue perfusion
 - Decreased cardiac output
 - Vasoconstriction or blockage of the arteries or capillaries supplying the tissue, e.g. atherosclerosis or thrombosis
 - Conditions that interfere with cellular gas and nutrient exchange, e.g. edema.

Consequences of Ischemia

- **Coronary:** Coronary perfusion impairment results in ischemia, injury and infarct. These result in:
 - Pain
 - Dyspnea
 - Decreased oxygen saturation (O₂ sat)
 - Crackles
 - Heart rate changes
 - Hypotension
 - Slow capillary refill
 - Pale, clammy skin
- **Brain:** Clot formation, vessel rupture and, trauma results in brain ischemia. Neurological deficits findings include:



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- Confusion
- Change in level of consciousness (LOC)
- Syncope
- Paresis
- Paralysis
- Lungs: Impaired pulmonary perfusion affects gas exchange.
- Renal: Perfusion deficits result in pre renal failure and intra-renal failure. Signs include:
 - Decreased urinary output
 - Increased blood urea nitrogen (BUN)
 - Increase creatinine
- Local ischemia results in the pain and dysfunction of the affected tissues and organs.

Assessment/attributes:

Subjective:

- Baseline history:
 - Acute or chronic pain
 - Paresthesia
 - Dyspnea
 - Edema |
 - Central nervous system (CNS) symptoms:
 - Dizziness
 - Fainting
 - Visual changes
 - Changes in ability to speak

Objective:

Central

- Hypoxia
- Hypotension
- Hypertension
- Change in level of consciousness
- Decreased urine output

Peripheral

- Edema



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- Capillary refill
- Temperature
- Pain
- Pallor
- Paresthesia
- Pulselessness
- Organ dysfunction
- Syncope

Diagnostic Tests:

- Blood tests:
 - Creatine Kinase (CK)
 - Creatine Kinase (heart) (CK-MB)
 - Creatine Kinase (skeletal muscle) (CK-MM)
 - Creatine Kinase (brain) (CK-BB)
 - Troponin
 - Lipid profiles
 - Brain natriuretic peptide (BNP)
 - Homocysteine
 - C-reactive protein (CRP)
 - Lactate dehydrogenase (LDH)
 - Lactate/Lactic acid.
- Cardiac evaluation:
 - Electrocardiogram (EKG)
 - Stress test
 - Echocardiogram (Echo)
 - Nuclear cardiology
 - Cardiac catheterization
- Radiographic Studies:
 - Chest x-ray
 - Ultrasound, Arteriogram (Cardiac, Pulmonary, Peripheral, and Cerebral)
 - Computerized tomography (CT) scan
- Hemodynamic monitoring
- Electrophysiology studies

Clinical Management:



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Primary Prevention: Health Promotion

- Diet
- DASH – Dietary Approaches to Stop Hypertension
- Diet high in fruits, vegetables, fiber; low in trans fats and saturated fats
- Exercise
- Abstinence from tobacco
- Weight management
- Hydration
- Low dose aspirin

Secondary Prevention: Screening

- Routine physicals across lifespan
 - Blood pressure
 - Glucose,
 - Hemoglobin A1C (A1C)
 - Lipid screening
- Improved access to health care

Tertiary Prevention: Collaborative intervention for altered or ineffective perfusion. Initial focus is to the specific condition or symptoms

- Fluid resuscitation
- Healthy lifestyle promotion: Nutrition, tobacco use, exercise
- Pharmacotherapy
- Vasodilators: Decrease after load and improve preload
- Vasopressors: Increase systemic vascular resistance (SVR) and enhance cardiac output
- Diuretics: Decrease volume overload
- Antidysrhythmics: Maintain normal cardiac cycle
- Anticoagulants: Prevent clot formation and altered perfusion
- Anti-platelets: Prevent platelet adherence and clot formation
- Thrombolytics: Lysis of formed clot to re-establish blood flow
- Lipid-lowering agents: Minimize plaque formation and decreasing flow
- Inotropic agents: Improve contractility
- Procedures and surgical interventions

Interventions specific to central perfusion conditions:

- Intra-aortic balloon pump (IABP)



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- Heart transplant
- Impella heart pump
- Pacemakers and defibrillators
 - Cardiac resynchronization therapy (CRT) and Internal cardiac defibrillators (ICD)
- Electrical cardioversion
- Left-ventricular assist device, right ventricular assist device
- Extracorporeal membrane oxygenation (ECMO)
- Heart valve surgery

Interventions specific to local perfusion conditions:

- Coronary artery bypass grafts (CABG)
- Stent placement and angioplasty
- Endarterectomy
- Peripheral artery revascularization
- Bypass surgery: Femoral popliteal bypass

Interrelated concepts

- Gas Exchange: Gas exchange is dependent on perfusion to the lung tissue.
- Nutrition: Nutritional imbalance increases modifiable risk factors
- Fluid and Electrolyte Balance: Alterations in fluid and electrolyte imbalances can profoundly affect cardiac function.
- Clotting: Coagulopathy increases the risk of thrombus formation that can result in loss of perfusion to tissues distal to the clot.
- Comfort: Pain can indicate tissue ischemia from loss of perfusion.
- Cognition: The deterioration of cognitive functioning is an early indicator of central and local poor perfusion.

Model case:

Mr. J. is a 76-year-old male that has been transferred from a rural facility and admitted to the cardiac care unit (CCU) with an acute left main coronary artery infarction. Onset of symptoms was eighteen hours ago and presentation to your facility has been delayed further by complications with transfer. On arrival Mr. J is significantly hypotensive, has received 2 liters of isotonic fluids, and is on high flow oxygen (O₂). Vital signs remain unstable and vasopressors are added to his infusion. On day two, cardiogenic shock is added as a diagnosis. Due to failure to respond to initial vasopressor, a second pressor is added and he is taken to the cath lab for insertion of an intra-aortic balloon pump (IABP). Heart rate is 110-120 per minute and his mean



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arterial pressure (MAP) has remained in the 50's despite aggressive therapy and on day three, Mr. J's extremities become cool with capillary refill >3 seconds. Urinary output has diminished to 15mL/hour. Arterial blood gasses (ABGs) show a partial pressure of oxygen (PaO₂) at 55 and he is intubated to improve oxygenation. On day four, his lab values show an elevated blood urea nitrogen (BUN) and creatinine. Liver enzymes are also elevated and a chest x-ray shows diffuse bilateral infiltrates. Positive end-expiratory pressure (PEEP) therapy is added to his mechanical ventilation to help with his low PaO₂.

Exemplars:

New Mexico Nursing Education Consortium (NMNEC) Required Exemplars:

- Heart Failure
- Acute Coronary Syndrome
- Hypertension

Optional Exemplars:

- Dysrhythmias
- Peripheral artery disease
- Shock



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