CLEARANCE OF PARTICULATE MATTER FROM THE LUNGS

Myra Cruz MD, MOH
Kevin Chamberlain DO, MOH
What is Particulate Matter (PM)

– PM is a mixture of:
  • Acids
  • Metals
  • Organic chemicals
  • Soil or dust particles

– Particles which are 10 micrometers in diameter or smaller are of particular concern
  • These can be inhaled into the lungs
The Lung’s Clearance Mechanisms

• Once inhaled, the body’s natural defense system is activated to process foreign substances
• Three important mechanisms for defense include:
  – Lung lining fluid
  – Mucociliary escalator
  – Macrophages
Lung Lining Fluid

• Likely the most important mechanism of our lung’s defense system composed of:
  • Water
  • Antioxidants
  • Enzymes
  • Lipids
  • Proteins
Lung Lining Liquid

- Fluid has antimicrobial properties
- Particles > 5 micrometers are trapped in the lining-fluid of the airways
- The high water content allows for the transfer of momentum from the beating cilia to the mucus “blanket” in the escalator system
Mucociliary Escalator

- Particles deposited in the upper airways are removed by the mechanical upward-beating fibers of cells that line the airways
  - The particles move upward until they can be swallowed and excreted from the body
Macrophages

- Some particles are inhaled into the terminal airways (alveoli)
Macrophages

- Signaling chemicals are released by Macrophages that attract other macrophages and inflammatory cells
Macrophages

- Usually, macrophages ingest particles in the airways before the particles can be transported into the lung tissue or blood vessels.
Macrophages

- Particles that escape initial ingestion by macrophages can get transported into the lung tissue by cells lining the airways

- Macrophages residing the tissues will then be able to ingest and process the particles