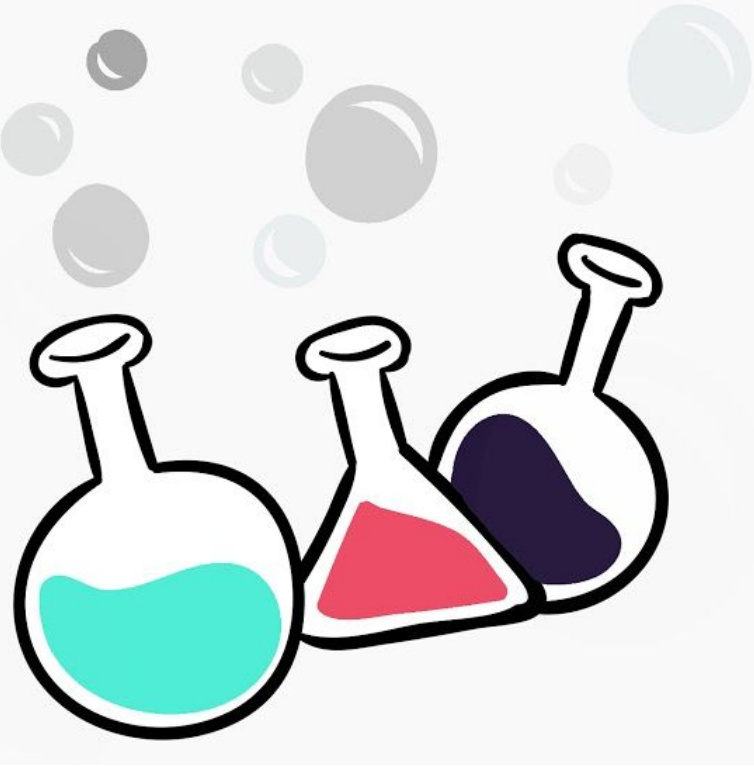


Radiation Exposure

★ Objectives:

- Not given.

★ Done by: Ahmed almasabi

★ Revised by: Atheer Alnashwan

★ Team Leaders: Khalid alzahrani, Abdullah Aljunaydil

[Color index : Important | Notes | Extra | Editing file]

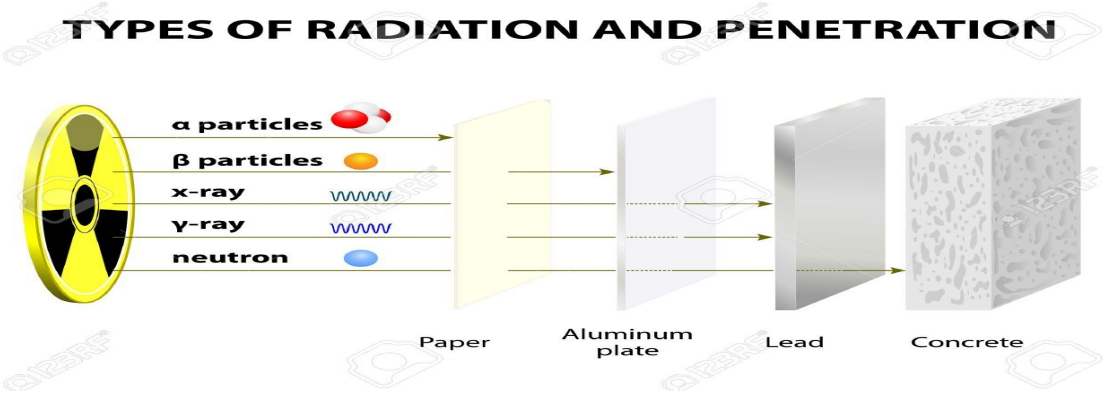
وفي النهاية نتوجه بالشكر لجميع من شارك في إنجاح فريق علم السموم ونسأل الله أن يجعله في ميزان حسناتهم

أثير النشوان
ساره الخليفه
سمر العتيبي
شهد العنزي
فتون الصالح
نوره العقيل

أحمد المصعبي
حازم باجري
خالد النعيم
خالد الزهراني
عبدالله الجنيدل
عبدالله العتيبي
عبدالله الفالح
علي الزهراني
عمر القحطاني
فهد عبداللطيف
محمد الدغيثر

Penetration Abilities of Different Types of radiation

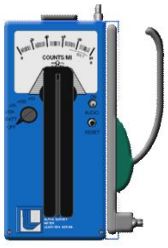
	Alpha Particles	Beta Particles	Gamma Rays (X-rays "photons")	Neutrons
Stopped by?	a sheet of paper	a layer of clothing or less than an inch of a substance (e.g. plastic)	inches to feet of concrete إسمنت or less than an inch of **lead**	a few feet of concrete
Penetra-tion	Do not penetrate the dead layer of skin	Depending on its energy: - can travel from inches to many feet in air - only moderately penetrating in other materials - can penetrate human skin to the layer where new skin cells are produced وممكن تبقى على الجسم	- Able to travel many feet in air and many inches in human tissue. - They readily penetrate most materials.	- They are able to travel many feet in concrete and thousands of feet in air - They also penetrate most materials.
Protection	stopped by a thin layer of paper or clothing	Protective clothing (e.g., universal precautions) → typically provides sufficient protection against most external beta radiation.	- Thick layers of dense materials are needed to shield against gamma radiation. - Protective clothing provides little shielding from gamma and x radiation, but will prevent contamination of the skin with the gamma emitting radioactive material.	- Thick layers of materials with lots of hydrogen in them (like water or concrete) are needed to shield against neutron radiation. - Protective clothing provides no shielding from neutron radiation. - Neutrons are not likely to be encountered except in the initial seconds of a nuclear criticality event.
Side effect	If **ingested**, can cause ionization that results in damage to tissue internally	If high enough quantities of remained on the skin for a prolonged period of time, they may cause **skin injury**. May be harmful if deposited internally		



❖ Detecting Radiation:

- **Absorbed dose** = Energy absorbed per unit mass of tissue Rad
- **Biologically effective dose** = Risk of suffering from health effects following exposure to radiation rem (USA); An annual average exposure level in US is 0.35 rem/year (most exposure comes from Radon)
- All Patients and staff should be triaged/monitored by trained staff during event for radiation exposure/contamination.

★ **how to detect it?**



Alpha Survey Meter:

for alpha particles, rarely used
لأنه ما بنتعرض لها

Beta and Gamma Survey Meter

❖ Radiation vs. Radioactive Material:

- **Radiation**: energy transported in the form of particles or waves (alpha, beta, gamma, neutrons).
  ضرره غير متعدي
- **Radioactive Material**: material that contains atoms that emit radiation spontaneously
  pt who has exposed to radioactive material, he can contaminate us!

❖ Exposure vs. Contamination

External Exposure
when exposed to radiation but without contamination ماراح نتضرر إحنا

External Contamination
I am contaminated and hazard and I need decontamination
المريض صار عبارة عن مصدر راديشن

Internal Contamination
worse than external contamination

❖ Signs and Symptoms of Exposure

- Nausea,Vomiting,Diarrhea and Burns: Rapid growth cells are gone! e.g. hair, mucous membrane, skin...

★ Symptoms may not appear until hours after exposure

كيف يصير ال damage؟ الإشعاع يؤثر على ال mucous cells و ال rapid generating cells وهذي الخلايا موجودة في الجلد
وال bone marrow و ال gi tract و ال mucous membrane

❖ Injuries Associated with Radiological Incidents

- **Acute Radiation Syndrome**: يتعرض لدوز كبيرة، وتكون بنتريتتق ماهي بسيطة (فاللي كل يوم يتعرضون لدوزز صغيرة دوريًا ما تجيهم هالسندروم!!) من ضمن الأشياء المهمة فيها، إن البون مارو حقهم يتأثر بشكل كبير، تبعًا لذلك بتتأثر الخلايا اللي تطلع منه، خصوصًا اللمفوسايت ممكن يجيك تروما سرجري ويقول واللهِ نتابعه ونشوف بعدين لو بنسوي له عملية، لكن غلط!!! الحق عليه! لأن بعد يومين بتصير اللمفوسايتس صفر!!! فسوها الآن قبل لا تتحطم المناعة.

  for these patients we do CBC with differential to see their lymphocytes count, because if there was a major drop in lymphocyte afterwhile it correlates with his survival
- Localized radiation injuries/cutaneous radiation syndrome
- Internal or external contamination
- Combined radiation injuries with:
  1- Trauma 2- Burns
- Fetal effects

❖ Radiation Protection for Clinical Staff

- Fundamental Principles
  1- Time 2- Distance 3- Shielding
- PPE (Personal Protective Equipment)
- Contamination Control

❖ Patient Management - Priorities

- Standard medical triage is the highest priority
- Radiation exposure and contamination are secondary considerations
- **Never delay critical care because a patient is contaminated!** but without hurting myself and staff.
-

❖ Required Conditions for Acute Radiation Syndrome

- Large dose
- Penetrating
- Most of body exposed
- Acute

❖ Treatment of ARS (Acute Radiation Syndrome):

- supportive care in a clean environment (burn unit)
- prevention and treatment of infections
- **stimulate hematopoiesis** with growth factors
- **stem cell transfusions or platelet transfusions**
- psychological support
- observation for erythema, hair loss, skin injury, mucositis, parotitis, weight loss, or fever
- confirmation of initial dose estimate consultation with experts

❖ Treatment Options:

- **Diethylenetriamene pentaacetate (DTPA)**
  - Chelating agent work by binding and holding on to radioactive materials or poisons that get into the body. Once bound to a radioactive material or poison, the chelating agent is then passed from the body in the urine
- **Prussian blue** هو والبوتاسيوم أيوداید نفس مبدأ حرامي السيارات :)
  - Binds Thallium and cesium
- **Potassium Iodide (KI)** الناس اللي ساكنين في المناطق القريبة من محطة الطاقة النووية يكون عندهم البوتاسيوم أيوداید، فمجرد ما يسمعون أي تنبيه يقومون ياكلونه عشان يسوي ساتريشن للثايرويد ويقون نفسهم
  - Competes with radioactive iodine for thyroid absorption
- **Neupogen**
  - used to treat neutropenia

MCQs

1- After radiation exposure injury, which of the following is likely to happen?

a. Pancytopenia
b. Thrombocytosis
c. Hypertension
d. Hypothermia

2- After radiation exposure, in "survival impossible group" of patients, which of the following is likely to happen?

a. No symptoms and signs
b. Severe diarrhea and vomiting
c. Most of them survive the illness
d. 50% of patients survive the illness

3- Which of the following is the underlying mechanism of tissue injury after radiation exposure?

a. Deposition of energy in the tissues
b. Loss of heat from the tissues
c. Malfunction of cytochrome P450
d. Excess retention of salt and water in the tissues

4- which one of the following is the treatment of acute radiation syndrome?

a. Monitor neutrophils count
b. Give growth factors to stimulate bone marrow
c. Calcium chloride
d. Isolate in a negative room pressure

★ Answers:

1 (a) | 2 (b) | 3 (a) | 4 (b)