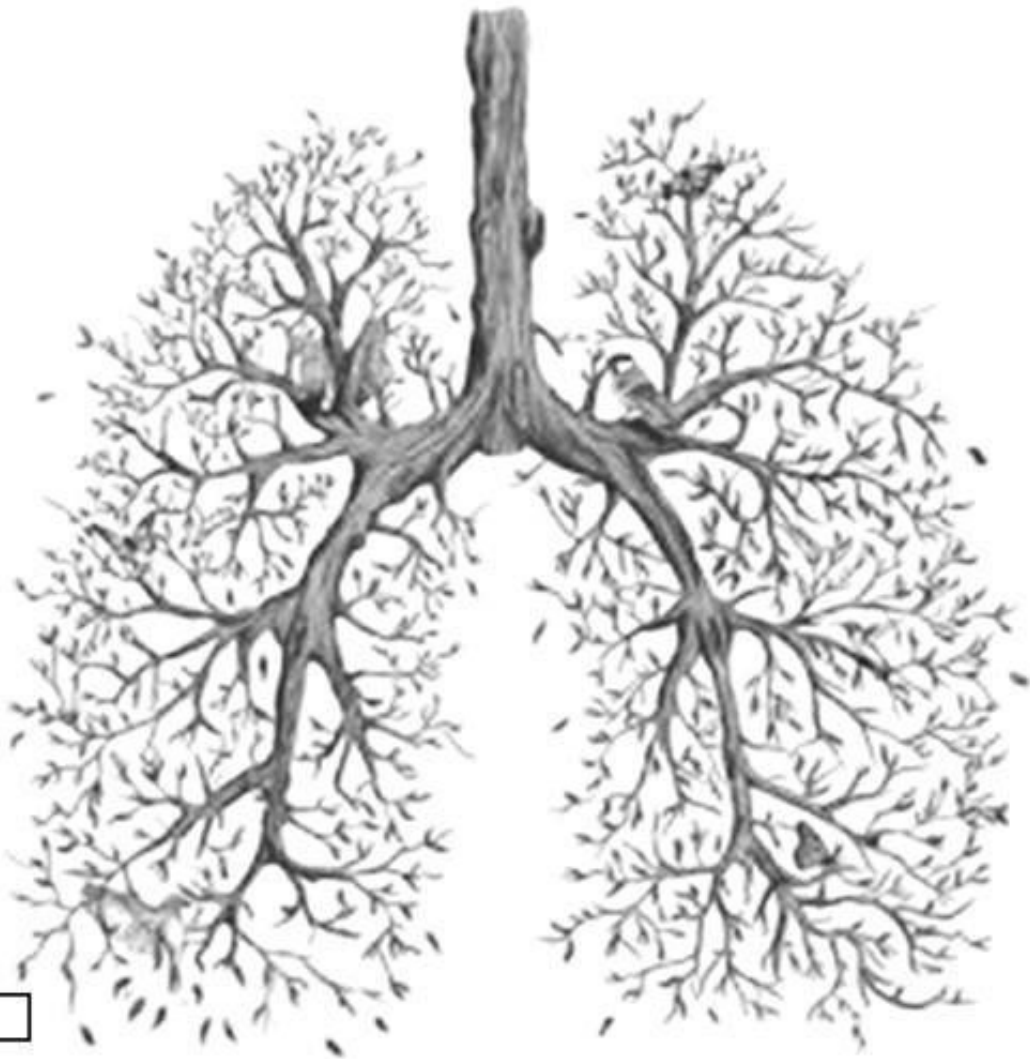


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# Community Medicine



Slides

Sheet

Lecture # **20**

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## TYPES OF CHEMICAL MATERIALS IN WATER

Last time we was talking about lead , the resources of lead and the signs and symptoms of the lead toxicity .

### Signs and symptoms of lead poisoning :

lead affects mainly the children before school age, it affects their IQ , they will be labeled as an unintelligent people , it may affect the peripheral nervous system, Causing at the end drop foot and it can affect other parts of the body including the blood causing anemia so there are some acute cases that will cause different abdominal pain as an example of the signs of acute lead poisoning .

- Now, we finished with lead and we will start with mercury .

### Mercury :

#### A. Resources of mercury :

- 1- Some pesticides like : fungicides .
- 2- Thermometers, barometers , blood pressure meters :But why we use mercury ?? because it is heavy , its density is 14.6 , ( if we put water instead of Hg , the column of water will be very high in comparison with the one of the Hg ) , it is very sensitive to the temperature and it will not stick to the walls of the thermometer . We are saying that because we don't expect much change in the dependence on that material , although we have now digital thermometers, but if we go to the hospital , they will not rely on their result ,they will go back and measure it by the old – fashion ones .
- 3- Explosives industry .
- 4- Certain kinds of colors and paints (the **purple** one, they are not commonly used but they are still there) like in vases.
- 5- One of the major use of Hg is in the detergents field : when we prepare Chlorine for detergents industry , one way to do it is to use huge cell with cathode and anode and fill it with Hg {it is the conducting material of the current that's why we use it in some batteries ( the solid ones )}(lead is used in liquid car batteries, and Hg is used in solid ones ) , it is the medium of it so it will let the current pass through} . After that we let the current flow

through the cell, then we put sodium chloride (NaCl) and that will let the chlorine to be separated from the sodium, so we can use the Cl in the detergents industry like : chlorics and hypex ( products that contain Cl) and many other detergents that have the ability to clean the dirt . when they finish this after several times of use , they will throw that Hg and it will be at the end in the environment (( this old technique was used in Jordan to manufacture the CL and after that they threw several tones of the Hg outdoor by digging a hall and put the Hg and cover it with soil , so the Hg didn't stay down BUT it came up , and there were a group of students came to that place and saw those shiny bubbles and they played with them so they ended up with sever intoxication of Hg )) .

6- Looking for different alloys such as the golden ones in the soil .

### **B- Health effects of mercury :**

Mercury can be found in 3 forms: organic , inorganic and metallic and for that reason we will see different effects of it on the health ,the worst one is the organic one which can reach the brain.

- One of the previous use of the mercury was in the manufacturing of the leather (for hats as an example) in order to make the leather smoother they used Hg (they soak it in mercury), and those people who they were exposed to it will suffer from health effects and that's why in old leather books , there was a say "mad as a hatter" so it can cause certain kind of madness which is so sever and so bad if they were exposed to these material.  
(The doctor hope that this technique was stopped after they knew about this )

- After looking for the workers in the industry of the chlorine detergents by the ministry of health , they find a lot of these workers are severely toxicated with the Hg . They saw line on their gums as an evidence of Hg intoxication because some of us are mouth breathers ( they use their mouths instead of their noses especially in starting to practice a job) and for that Hg will reach their gums and damage it to an extent that they can remove their teeth by their hands as well as some bad conditions of their kidneys which can cause kidney damage .

### **Arsenic:**

Our ancestors were using it more than now , they were calling it the poison of the kings , they used to kill each other by this material or they could commit suicide by it when they were captured , and if we look to the literature we can

see that they were developing antidote for that toxin , and they came to have 2 rings one of them filled with arsenic and the other one with the antidote , if they suspect somebody put some toxins in their foods they will use the antidote , they were having a way of controlling things , they usually don't eat before somebody else eat before them to be sure that there is nobody want to kill him and even though some of them was died poisoned .

(مثل الخليفة الراشدي الخامس عمر بن عبد العزيز – رحمه الله - الذي قد وضع له السم في اللحم الذي كان في طعامه )

### Health effects and uses :

- It can be used as a killer but there is a mystery about this compound .
- It will cause hair fall , so it is used in the products which are used to remove the hair from the skin .
- It is used in some of the shampoos which are used to clean up the fur of some animals.
- It is a killer yet it is used as feed additives (الاعلاف) ,so it is feed for animals that are used as food for humans in order to make them gain weight quickly . you might use- if it is allowed to you – different kinds of arsenic compounds and that will make the animal to get weight more than usual and this is useful for the farmers, sometimes if the chicken eat these feeds it will produce eggs with double yolk **so it works differently in humans than in animals** .

Our doctor was working on one compound of arsenic which was **Monosodium methyl arsenate** to provide a toxicokinetic profile for this material on water and he detected the way that it can enter the body , how it can be get out and how much time it needs to be excreted . And to complete the picture he completed his work on the animals like rabbits and after giving them this material to see how much time they need to get rid of it and the result was **4 weeks at least** . So if the animal has been fed with this compound we can't slaughter it before 4 weeks(at least) because the animal tissues will be filled with this arsenic compound and we will consume this arsenic.

- It can be found in the nails and the hair .

## 2 stories about death from the arsenic :

*Napoleon was died from arsenical poison , when they captured him and put him in a cell it was painted in green and this rich color was arsenical compound and because the place of death was with no proper ventilation so he breath it and then he died . This have been proven later when we took a sample of his hair it was full of arsenic at high level .*

*Criminal acts also , people can kill each others by it as an example : a woman married to an old millionaire and she suspected him to die quickly but he was not , so she give him little bit of arsenic and put it in his food and she killed him peacefully but his Lawyer suspected that and he hired a scientist from the university and he asked him to look at his body excluded different reasons and he concluded that he might be poisoned with arsenic when he cut his hair and show at what time was the first dose and how much it was and also he showed when the second dose was and how much it was so hair might be a lead in some cases of the intoxication.*

- It can be used as a herbicides and this gains monetary and commercially use. If I have a big forest that I would like to finite it I can use arsenic or if I want to make a road in the forest we prefer to use arsenic rather than cut them because the cutting will damage other trees so we just inject the tree with the arsenic then it will die .

USA used it in the Vietnam war against the Vietnamese camps to expose them inside the forests to these arsenical compounds so we can learn from that one of the bad effect of the arsenical compound : some American soldiers by accident were exposed to the arsenic and when they returned back to their country they showed some signs and symptoms of arsenical intoxication .

- It can cause skin cancer , lung cancer ,liver cancer which is strange that a material can cause different kinds of cancers to the humans and it depends on the way that you are exposed to that material (contact with skin, inhaled , swallowed ) .

Another source of it , nowadays , it becomes a problem recently in the last few years, soil in some sites of the world they have high amount of arsenic and when there is underground water in these areas it gets polluted with arsenic and millions of people nowadays in the far east starting from turkey to the far east side are exposed to high amount of arsenic in that water and without doing much about it because they don't have other resources and treating water from



arsenic is very expensive, they are exposed to high amount of it so it is becoming back again as a problem .

- Arsenic effect on the humans can be manipulated or differ according to the genetic make-up of them ; for example Taiwanese was drinking water with arsenic then they show a disease called dark foot disease which is a gangrenous foot(which had to be cut sometimes) due to the damaged blood vessels which affecting the blood supply of legs .
- Other people in other states which are exposed to arsenic , they will show problems in the conductivity of the heart and the T- wave which appears in the ECG(Electrocardiography) will disappear ,so it affects the peripheral NS and affect the other nerves . Therefore, different people can show different signs of the same toxins .

In the forties, a group of American students had a dinner was contaminated with arsenic and some of them died , some they got sick severely and some others they had some mild symptoms. After 40 years in 1982 a scientist came up with a theory that one time exposure to arsenic compound is enough to increase your chance of having cancer, so he can't give people arsenic to see the effect of it ,so he went back to those people in the university and he asked the university because they trace their students and he had the majority of them . He asked them questions and he find that they had rodent cancer (more than the general public) which is a cancer of the skin on the face by one time exposure.

Can the arsenic get eliminated from the body?

It takes time but during that time it can cause damage for example before it is eliminated it can cause DNA changes (carcinogenic ) and if arsenic isn't excreted from the body it will still cause damage until it will be excreted.

If we look to water criteria and standards in Jordan compared to the world aspect we will see how much we allow lower water standards because you can see the word arsenic in these standards .

## **Nitrate:**

Sources:

- 1- Some fertilizers that contain nitrate and it is mostly common in the rural areas
- 2- Nitrogen cycle in the environment and that's why human and animal excretion could be a source and it starts as nitrogenous compound and by the bacteria it

will be changed into nitrate and Nitrite and we use this phenomena to know how recent a water source have been contaminated with human excretion but why it is most common in the rural area ? because they don't have good sewage system but they have a pit حفرة امتصاصية and it is not far away from the well بئر and there will be movement from one place to another or by the animals that are close to the well and might excrete near some site to the well so it is mainly a problem of rural areas rather than urban areas.

- 3- One of the uses of the nitrate that it can be added to meat to make it look fresh after slaughter the animal and cut the pieces then putting them in the refrigerator and when you take piece of it which was in touch with the paper it will be dark and oxygenated and it is normal process and we don't like the meat like this so we can spray it with nitrate and it will appear pink . Major stores of the country are using this and there's a limit before they will become dangerous . if we take can meats (لحوم معلبة) they will contain nitrate that's why when we look at it they will not be dark color

### Health effects :

- What we are concern about in the nitrate is the Methemoglobinemia (reduced form of Hb) which are not ready to carry o<sub>2</sub> to the tissues, it won't do it ,although it can carry it from the lungs it can't give it to the tissues for that reason the patient will look blue ( the fingers , around the lips) so you will receive the baby like that so keep it in your mind it could be because of nitrate, it is not the only cause, sometimes ventricular septal defect (inherited genetic problem) can cause these symptoms or even some babies cry loudly and Longley so they will stop breathing and look blue so we must differentiate and keep in mind that it is a possibility .

So those are different kinds of chemicals we keep give example. Actually here in mentioning these chemicals we don't talk about water exposure only but we mention the occupational exposure , too . Like in lead toxicity from pesticides , who will face it ? either the manufacturers ( workers) or the one who spray and the general public, as well as in the Hg intoxication in the industry , so they begin as occupational problems and ends with an environmental (general problem) one.

- So now we completed the 1<sup>st</sup> group which are the toxic substances in the water and then we will begin with group 2 which are chemical substances that can affect the acceptability of the water for drinking purposes .

## **2<sup>nd</sup> group (they interfere the acceptability of the water for drinking purposes) :**

### **Rust :**

People of rural areas ( mostly poor people )they store water in old barrels and they which may be already rusted or can get rusted later on . The water in it may be **brownish** in color and may have changed smell or taste. If we drink this water nothing will happen. (Sometimes we must prescribe iron for the anemic patients so it is not harmful but people don't want to drink such water )

### **Sulfur :**

It gives the water the smell of rotten eggs , and if we drink this water nothing will happen, some amount of it will cause diarrhea ,so it is allowed to small amount of it to stay in water .

### **NaCl :**

Do you remember when we talk about the northern part of Libya and the intrusion of salt in that place .

In Jordan you might visit some places with salty water but the people in these places had adapted to the taste of their water. (If they drink normal water they will say it is not palatable) . The normal amount of the salt in the water is 250mg \liter, if it's above that point it can cause this problem (salty water).we are not talking about huge amounts of salt which will cause hyperpressure.

### **Detergents :**

We talked about detergents, they form bubbles and other things that we don't like to drink. We like to drink a clean cup of water without even one or two bubbles on the surface , drink it will not make a problem , we discover a new source of water (underground water) some of these new sources when they are opened we can see bubbles are coming out , this means that this must have been exposed to sources of pollution by detergents near by the houses and nearby other places so it can be used by close it down and leave away from it .

**Oil :** Whether we are talking about petroleum or the other kinds of oils which are plant oils , if we put a drop of oil on the surface of water it will be above of it - like on top of the surface of water- and if we see that we will not drink it, so again we are losing these water sources .



- There are other kind of substances but not chemical which are related to the second group ,like : remnants of plants, remnants of animals , hair.
- This what happen in nineties in Jordan in water sources when we was taking water from Israel that was filled with algae , it has bad taste and bad smell, though in some countries the algae can be eaten as a source of protein but we don't want to see something that we don't want to be in water , so the government decided to clean that water by adding more Cl to kill these creatures but the chlorine will give you a very bad taste , so we do this fischer circle for several days until we recall some clean water , so this group of material don't have health impacts

### 3<sup>rd</sup> Group: chemicals that are beneficial at a certain limit

Cl , F, I as an example .

All of them are halogens in addition to brome but the brome is not one of them because it is very toxic and we don't need it at all in the water(brome is related to 1st group ).

And this is the problem with the toxicology we will find difficulty in generalization the knowledge to certain group of chemicals , sometime when you have one of these chemicals and the other is different .{39;15}

- Chlorine can be used to disinfect the water .If you add more than allowed this will cause health problems.
- If we have low amount of iodine you will get **goiter**(abnormal enlargement of the thyroid gland) and if you have high iodine level that will lead to **hyperthyroidism**
- Low fluoride will cause dental caries and excess of it will lead to damage to the teeth and fluorosis with broken borders or even in the animals it will cause damage to the major bones and discoloration of the teeth , they become dark and brown .

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لم يعطيك منه شيئاً

- واعلم ان من اراد الدنيا فعليه بالعلم ومن اراد الاخرة فعليه بالعلم ومن ارادهما معا فعليه بالعلم

**Sura bassam**