



OCCUPATIONAL METHEMOGLOBINEMIA

UNDER SUPERVISION OF

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Introduction

Hemoglobin is the oxygen-carrying pigment of red blood cells that gives them their red color and serves to convey oxygen to the: occurs in reduced form (deoxyhemoglobin) in venous blood and in combination with oxygen (oxyhemoglobin) in arterial blood

- ❖ There are three species of hemoglobin which can't transport oxygen known as dyshemoglobins which consist of three group: Carboxyhemoglobin , Sulfhemoglobin & **Met hemoglobin** which is a naturally occurring oxidized metabolite of hemoglobin that should not exceed 1% of the total HB under normal physiological conditions

Methemoglobinemia

A condition occurs when red blood cells (RBCs) contain methemoglobin at levels > 1% of total HB that can occurs due to congenital causes due to deficiency of certain enzymes that reduce met –HB to normal HB or acquired causes due to exposure to substances in amounts that exceed enzymatic reduction capacity of RBCs and this will precipitate symptoms in affected persons.

- ❖ Examples of these inducer substances Organic and inorganic nitrites and nitrates



Industrial/household agents – Aniline dyes, nitrobenzene, naphthalene & Ammonia

- ❖ **Higher levels of Met HB** are caused when defend mechanisms against oxidative stress within RBCs are overwhelmed & the oxygen carrying (Fe⁺²) of heme group of HB molecule is oxidized to (Fe⁺³) This structural change causes an alteration in the blood's ability to bind oxygen as ferric heme cannot bind oxygen resulting in **tissue hypoxia**
- ❖ **Clinical presentations** depend on the concentration of Met hemoglobin in blood once its level increase that can be up to CNS toxication and death if level of Met- HB > 70% of total HB.
- ❖ **Management** depends on changing the structure of the molecule by reducing iron molecule from (Fe⁺³) to (Fe⁺²) by certain reducing substances with oxygen therapy

Aim of the work

To determine the impact of occupational exposure to certain inducers of methemoglobin on red blood cells normal hemoglobin

Subjects & Methods

After taking permission from dean & vice dean of our faculty to visit some companies after we reported to their managerial system to enable us to enter, take photos and collecting samples from workers . Only two which accept; RACTA Company for paper industries & ABOQUIR Company for fertilizer industry.

We collect samples from **30 workers** who are only males, age (30-45ys) and with at least 3years of continues work in same field and **15 healthy control**

- **Analyses to both groups were** (CBC, Reticulocytes, LDH, ESR, Iron profile, heinz bodies measuring level of Met Hb by (ELIZA)**THESE ANALYSIS WERE DONE AT ALLIED MEDICAL SCIENCE LABORATORIES**
- Arterial blood gases and finally using pulse cooximeter.

Results:

- 1- We found that workers with moderate to high level of Methemoglobinemia suffer from the following: **Anemia, Cyanosis & Breathlessness**
- 2- We used a reference filter paper method to relate the colour of the blood to % of met hb



- 3- Workers had a significantly higher LDH, ESR & a significantly lower ALC, HB, LMR & platelet count than control
- 4- Reticulocytes were higher & Heinz bodies were positive
- 5- Categorizing workers according to % of Met HB we found that 40% of workers had % (0-3), 24% (10 -20), 31% (20-50) & 5% of workers had met Hb level > 50% of total HB
- 6- Ammonia was more positively correlated with % of Met Hb than nitrites
- 7- Co oximeter was used to confirm the presence of Met HB
- 8- ABG showed normal PO₂, PCO₂ & metabolic acidosis

Conclusions

From all the following we conclude that

- 1- Occupational hazards in an emergency department will remain an important topic that needs to be faced in the future.
- 2- Causes of Met HB can be congenital or acquired (from exposure to chemicals)
- 3- Awareness of the condition and the importance of prevention will avoid cases being missed & reduce morbidity and mortality

Recommendations

Our recommendations were introduced to the previous two compnies

- 1- Identification and control of hazards are the proper approach to preventing occupational hazards**
- 2- Investigation of the workplace factors that may contribute to over exposure to the causative chemical**
- 3- Total isolation of the entire industrial operating process and a general cleanliness of the industrial environment**
- 4- Periodic educational programs for workers about personal protection & health education, sanitary surveillance, and environmental control of toxic chemicals in the neighborhood**