The Effects of Lead exposure to workers in electric generator and car mending

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SUMMARY

From the ancient times, Man had known lead. He used it in so many fields. Lead impairs Man's health.This impairmant appears on environmental and professional levels. Lead enters human's body through food, drink,air and it is absorbed by the skin because of the use of cosmatics in which lead is an ingredient.

The aim of this study to diagnose the lead toxication by studying haematological changes of blood cells of those who are exposed to lead and then comparing the results with blood of persons who are not exposed to lead.This study is done through the period from July to end of september , 2011 in Al-Jamhiri and Al-Andulus quarters at the centre of Anbar province. Hundred samples have been collected; forty samples are collected from generators employees and those who work in cars mending. Sixty samples are from persons who are not exposed to lead. All samples are collected from the quarters mentioned. Also, samples are collected from women who are not exposed to lead to measure lead toxication in men and women and then compair the results to the normal level.It is concluded that there are changes in blood of persons who are exposed to lead. These changes differ from those who are not exposed to lead. It is apparent that there is reduction in total count ofwhite and red blood cells.

Keywards: Lead exposure- workers electric generator

Introduction

Heavy metal toxicity represent an uncommon, If unrecognized or inappropriately treated, heavy metal toxicity can result in significant morbidity and mortality [1].

The major source of lead is occupational exposure from jobs dealing with lead based component, resulting in high prevalence of lead toxicity in the population exposed to such activities. Lead is one of the oldest known and most widely studied occupational and environmental toxin [2]. It enters human body through food and water consumed, air inhaled and is even absorbed through the skin from cosmetics [3].

Lead poisoning is said to be the most common environmental illness of children in the US. The incidence varies with age, socioeconomic status, the population of a given community, race, and the age of the home. Lead poisoning occurs in every group, only the frequency varies. Generally, adults develop lead poisoning as the result of an occupational exposure or from exposure through a hobby. Lead poisoning has been reported in almost every country on earth. The highest environmental exposures to lead generally affect children of lower–income families living in degraded housing[4].

Lead is relatively insoluble in water and dilute acids, but will dissolve in nitric, acetic, and hot, concentrated sulfuric acids [5]. There is no known physiologic role for lead, and any lead found in human body fluids represents environmental contamination[6]. Lead can exist both organic and inorganic forms[7]. Inorganic lead poisoning usually result from industrial inhalation of large quantity of lead oxide while organic lead exposure occur in the course of cleaning gasoline storage tank from sniffing leaded gasoline. [8] About 300µg of lead is ingested each day in normal adult diet .[9] 10% of which absorbed, while 50% of ingested lead is absorbed in children [3], gastrointestinal absorption of lead is enhanced by fasting and by dietary deficiencies in calcium, iron and zinc [10]. Absorption from the respiratory tract is rapid because lead enter directly into the general circulation . While in dermal exposure the absorption is poor except in case of organic lead since it is lipid-soluble rather than water soluble [11].The highest environmental exposures to lead generally affect children of lower–income families living in degraded housing [12].

Mortality is rare today. However, death during the 1960s from lead encephalopathy was not rare in urban centers of United States[13]. Morbidity is common. Because lead is an enzymatic poison, it disorders multiple essential bodily functions, producing a wide array of symptoms and signs. Mounting evidence suggests that lead poisoning in childhood produces along–term problem with learning, intelligence, and earning power(14].

Morbidity and mortality occur by effect on many body systems includes .Hematological changes (anemia,leukopnia…)[15,16],cardiovascular.system(cardiac arrhythmia ,hypertension…)[17,18,19,20,21,22].Skeletal system(Impaired bone growth…)[23,24] .GIT(dyspepsia weight loss…)[23],renal system(glomerular sclerosis and interstitial fibrosis…)[23,25,26] ,reproductive system (Abnormal sperm morphology and decreased sperm count [27], psychological and neurobehavioral effects (from simple headache to coma and death)[23,28].

Aim of study

The aim of this study to diagnose the lead toxication on human by studying haematological changes of blood cells.

Material &Method

This study is done through the period from July to end of september , 2011 in Al-Jamhiri and Al-Andulus quarters at the centre of Anbar province. Hundred samples have been collected; forty samples are collected from generators employees and those who work in cars mending. Sixty samples are from persons who are not exposed to lead. All samples are collected from the quarters mentioned. Also, samples are collected from women who are not exposed to lead to measure lead toxication in men and women and then measure the results to the normal level.

Five milliliters of venous blood were collected by a veniuncture using disposable dry plastic syringe . the blood put in EDTA tube and then put in ice box transport for measuring the CBC and the sample then used to measure the blood lead level . the peripheral blood film

was examined by specialist hematologist for the assessment of basophilic stippling of erythrocytes, The whole blood were used for quantitative analysis of lead. Lead exmination with atomic absorption spectometry device,The toxic or action blood lead level is >25 ugl dl [16].In poisoning consultation center in Iraq , toxic or action blood lead level considered in value >25ugl dl .

Results and discussion

The total sample examined in this study consisted of 100 subjects distributed into two main groups : first group consisted of 40 lead exposed subject . The second group consisted of 60 subjects as control group. The First group was sub classified into two subgroups according to the blood lead level into subjects with toxic blood lead level and non toxic blood lead level.

Table 1 Distribution of the two study groups by age and gender.

	Healthy control		Exposed Pb	
	N	%	N	%
Age group (years)				
18-28	11	18.3	11	27.5
28-38	18	30	12	30
38-48	18	30	11	27.5
48-58	9	15	5	12.5
58--	4	6.6	1	2.5
Gender				
Female	10	16.6	0	0
Male	50	83.4	40	100
Total	60	100	40	100

As seen by the table 1 the healthy control group and exposed to Pb group were divided in to groups according to the age . In the healthy control group the majority of cases were of age <18 years while in the exposed to Pb group the majority of cases were of 58+ years .

Table (2) Frequency distribution of lead exposed group Duration of occupational exposure to lead industry:-

(years)-tertiles	Year	No.	%
First tertiles()	<=7.0	18	45
Second tertiles	7.1-12.0)	12	30
Third tertiles	12.0+)	10	25
Total		40	100

As clarified by table 2 the lead exposed group was divided into three tertiles according to the duration of occupational exposure , the majority of cases were in the second tertile which include the lead exposed subjects whom had a duration of exposure (<=7.0) year .

Table (3) Frequency distribution of lead exposed group (Toxic blood Pb level >=25µg\d1)

	Healthy control	Exposed Pb Non – toxic	Exposed Pb –toxic
Number	60	26	14
%	100%	65%	35 %

As seen in the table 3 the subject of both healthy control and lead exposed group were divided according to the blood lead level into non-toxic group (which include the subjects with blood lead level <25µg\d1) and toxic group (which include the subjects with blood lead level >=25µg\d1).

In the lead exposed group the number of subjects with toxic blood lead level was 14 subjects and they representing 35% of this group.

Table (4-a) Differences in mean of selected hematological parameters

	Healthy controls (n=60)	Exposed to Pb (n=40)
1-(pcv)Range	(31-50)	30-49)
Mean	40.2	40.3
SD	4.5	5.1
SE	1.14	0.7
2-(Hb)Range	(9.6-16)	(9.3-15.6)
Mean	12.6	13.4
SD	1.7	1.5
SE	0.39	0.2
3-(WBC)Range	(2.4-8.1)	(2.2-10)
Mean	5.5	4.6
SD	1.6	1.4
SE	0.36	0.2

Table4-bDifferences in mean of WBC types: control(n-60) exposed(n-40)

4-(Neutrophil)Range	(0.96-5.83)	(0.5-6.2)
Mean	3.729	2.802
SD	1.252	1.146
SE	0.2799	0.1532
5-(ymphocytes)Range	(0.57-2.58)	(0.6-3.2)
Mean	1.502	1.58
SD	0.539	0.658
SE	0.1347	0.0729
6-(monocytes)Range	(0-0.456))	(0.052-0.52
Mean	0.303	0.189
SD	0.119	0.126
SE	0.027	0.0164
7-(eosinophils)Range	(0-0.126))	(0-0.61
Mean	0.07	0.079
SD	0.036	0.083
SE	0.012	0.0133
8-(basophils)Range)	(0-0)	(0-0.044
Mean	0	0.002
SD	0	0.012
SE	0	0.0013

As shown in the table (4) the range ,mean,SD ,and SE were calculated for each hematological parameters which includes blood (PCV, Hb ,WBC count and differential count)Statistically

the hematological parameters show no significant differences except the blood WBC count the mean count in healthy and exposed groups.

Table (5) Show the lead exposed group was divided in two Subgroup (toxic and non toxic) according to the blood lead level .According to the age , the mean age of non toxic and toxic group were 40.4 years old (range 18-63) years old and 40.3 years old (range 29-63) years old respectively with significant differences (p= 0.03).

While according to the duration of occupationl exposure to lead , the mean of the duration of non toxic and toxic groups 11.3 years (range 1-30) years and 19.9 years (range 4-40) years respectively , with highly significant differences (p<0.001) .

Table (5) The differences in mean age and duration of occupational exposure to lead among lead exposed group

Toxic Blood Pb level (>=25ug\d1	No. of non toxic (26)	No.of Toxic (14)
Age in years	Range (18-63) Mean (40.4)	(29-63) (46.3)
Duration-of occupational exposure	Range (1-30) Mean (11.3)	(4-40) (19.9)

The discussion

1. Age and duration of occupational exposure to lead inrelation with the presence or absence of toxic blood lead level among lead exposed group

The present research revealed a statistically significant difference (p=0.03) in age between toxic and non toxic group in relation to blood lead level (i.e the older the age the higher the blood lead level) this is in agreement with Schelder et al study [29] who found that gradual increase in pbB with age should be expected for an element with a large body burden and long systemic and whole-body half-life .so Schedneitzer found that there was a

significant difference between blood lead level and age . Also Hikmet jamil et al[30] found that the blood lead level had statistically significant positive correlation with age .

Aweak linear correlation between blood pb concentration and age in years r=0.27 was notice while a significant positive correlation between pbB level and age for males (r=0.416 ,p=0.004) ,but not for females (r=-0.042 , p=0.793) was found by [31].

This correlation of pbB with age suggests that the body burden of lead is relatively dynamic and that remobilization of lead stored in the bones is continuously contributing to the lead content of blood stream . According to the duration of occupational exposure to lead industry , the mean of the duration of exposure of non toxic and toxic group were 11.3 year (range 1-30) years and 19.9 year (range 4-40) years respectively with a highly significant differences ($p< 0.001$) this was in accordance with Hikmet jamil et al study [30] who found that the blood lead level had a statistically significant positive correlation with duration of exposure .

Gender:-Regarding gender there was an association between gender and blood lead level p=0.009 (i.e. males have blood lead level higher than in females) . this in agreement , who reported that males had higher blood level than females ,by Schedneitzer et al study[29]) stated that " males had somewhat higher blood lead values than females " this difference could be attributed partly to lower hemoglobin level in women that in men , at most of the lead is absorbed to the red blood cells , Accordingly white , reported that the disparity between men and women may be attributed to the different body stress of lead in the two sexes which is related to increased skeletal mass of men . The lower concentration of red blood cells (where a large percentage of the lead is bound) in females compared to males may be also contributing factor. Moreover ,sex might play an important role in the metabolism of lead Counter SAstudy [32].

Hematological parameters

The results of the study revealed that the changes in the blood parameters (PCV Hb , WBC count) and the differential count (neutrophil ,lymphocyte , eosinophil and basophile) in both

exposed and healthy group were statistically non significant except the total blood WBC count and neutrophil cell count. The mean of WBC count in non toxic and toxic blood lead were 5.1×10^9\L (range 2.6-10×10^9 \L) and 4.2×10^9 \L (range 2-6.8×10^9 \L) respectively , which was statistically significant (p=0.02) and the mean of absolute neutrophil cell count aforementioned groups 3.15×10^9 \L (range 1.04 -6.1 $\times10^9$ \L) and 2.39×10^9\L (range 0.5 -4 .14 $\times10^9$\L) respectively , which is statistically significant result (p=0.01) Schedneitzer. [29]. found that the effect of lead on Hb started when blood lead level above 50µg\dl (p>0.05) , Peter D et al [16]. said that the hematocrit and Hb value of lead poisoned patients may be slightly to moderately reduced . The explaination for the decrease in neutrophil count might be due to decease of the neutrophil cell survival because of increased membrane fragility . In contrast to the Shaimaa Hamid study [23] whom found that the mean absolute neutrophil count was significantly higher in lead exposed worker with respect to none lead exposed worker . the difference between the results with the present study may be due to difference in the mean of the blood lead level between two groups in these two studies the mean of the blood lead level was 27µg\dl in this study where it was 20µg\dl [23]. However in an experimental study done on male adult rat . whom showed that there was an increase in count leukocyte leukocytosis) ,monocytosis ,eosinopenia and neutrophilia were observed in the test group (p=0.001) this increase in leukocyte count may be linked to the inflammatory effects of lead. From the above finding it's found that the effect of lead on WBC count especially on the neutrophil count was controversial ,the present study found that the neutrophil count is decrease while the other studies found that the neutrophil count was increased and this difference might be due to difference in the the level of toxicity , duration of exposure and extent of lead induced inflammation. Regarding the red cell morphology ,it was found that all the candidates show normochromic and normocytic red cell ,except one of them show hypochromic and microcytic red cell morphology . this in accordance to the findings of Schedneitzer. study [29] whom reported that the peripheral smear may be either normochromic and normocytic or hypochromic and microcytic this may be due to effect of lead in cell metabolism , alteration of enzyme activity .however this case may have coincidental hypochromic , microcytic anemia due to other causes other than lead exposure

such as iron deficiency anemia or thalasemia . although not statistically significant ,basophilic stippling of the RBC also seen in number of cases.

Conclusion

1- There was association between gender and blood lead level (males have blood level higher than females).

2-The results of this study revealed that blood lead level increased with age .

3-Each individual is exposed the inhale exhausts of cars ,generators and factories the average of exposure is variable from individual to another.

4-Food and drinks are sources of toxication by lead , since are uncovered .

5-The people through their jobs in mending cars and employing generators are suffering from pains in jont - ache anxiety and a little sleep .

6-Increasing lead in blood will result in reduction in white and red cells of blood .

Recommendation

The workers should wear protective attire , mask ,safety goggles and mandatory get pre-employment and periodic medical surveillance .these measures would help to identify susceptible workers in due time , improve the technical preventive measures that will decrease the risk of occupational hazards of lead exposure in the workers whom works in :

(Employees of gasoline generators, cars mending,. industry of battrey tablets,Employees of making glass, ceramic and mirrors, oils containing lead, elastic and blastic making., printing and users of ink,..Employees of industry of televsion screens and elactric machines in which lead is essential.

Also we suggest

- Transforming gasoline used by cars to gasoline free from lead.
- Transforming cars and buses to natural gases .
- Establishing stations to measure burning average inside the cars engines.

Examining cars exhausts and putting strict procedures to those who have problems with their exhausts

تأثير الرصاص على العاملين في المولدات الكهربائية وتصليح السيارات

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الخلاصة

عرف الانسان الرصاص واستخدمه منذ اقدم العصور في مجالات شتى ولما يحمله من تأثيرات سمية على الانسان فقد القى ضلاله على مستوى واسع وعلى الصعيد المهني والبيئي . فهو يدخل جسم الانسان عن طريق الطعام والشراب والهواء ويمتص عن طريق الجلد من خلال العديد من مستحضرات التجميل التي يدخل في صناعتها.تشخيص التسمم بالرصاص عن طريق دراسة التغيرات الدمية للاشخاص المعرضين للرصاص ومقارنتها مع الأشخاص غير المعرضين للرصاص. اجري هذا البحث خلال الفترة الممتدة من شهر تموز الى نهاية شهر أيلول لعام 2011 في منطقة الحي الجمهوري وحي الأندلس في قضاء الرمادي مركز محافظة الانبار ,وتم اخذ 100 عينه, 40 كانوا معرضين وهم من مشغلي المولدات الكهربائية ومن العاملين في مهنة تصليح السيارات , و60 كانوا غير معرضين ومن نفس المنطقتين وقمت بأخذ عينات من النساء غير المعرضين لتقييم حالة التسمم بالرصاص عند النساء والرجال ومقارنتها مع المستوى الطبيعي .تمخض هذا البحث عن نتائج مفادها ان هناك تغيرات حاصلة في الدم لدى الاشخاص المعرضين للرصاص تختلف عن الاشخاص غير المعرضين للرصاص وتشمل انخفاض في كريات الدم البيض وكريات الدم العدلة ،واعراض اخرى كآلام المفاصل وقلق وقلة نوم عند الاشخاص المعرضين للرصاص.

الكلمات الدالة: تأثير الرصاص, عمال المولدات الكهربائية

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