

THE PREVALENCE OF GASTRIC AND DUODENAL ULCER IN PATIENTS WITH OCCUPATIONAL CHRONIC LEAD POISONING

DANA RUSU¹, D. I. BARDAC², R. BULICREA²

¹ County Clinical Emergency Hospital of Sibiu, ² "Lucian Blaga" University of Sibiu

Abstract: Recent studies suggest that lead exposure is related to several chronic disorders, including disorders that have been associated with oxidative stress and may be a factor in the etiology of gastrointestinal ulcers. In this study, we proved that the prolonged occupational lead exposures is associated to the risk of ulcer of the stomach and duodenum; yet, we did not find statistically significant associations with the level of urinary lead and of the urinary d-ALA in the area of the severely increased values and none with the severe anemia

Keywords: intoxication, lead, ulcer, oxidative stress

Rezumat: Studii recente sugerează că expunerea la plumb este asociată cu mai multe boli cronice, inclusiv cu cele produse de stresul oxidativ și expunerea prelungită la plumb poate fi un factor în etiologia ulcerului gastrointestinal. În studiul prezentat am demonstrat că expunerile ocupaționale îndelungate la plumb sunt asociate cu risc de ulcer al stomacului și duodenului, dar nu am găsit asocieri semnificative statistic cu nivelul plumburiei spontane și al acidului delta aminolevulinic din zona valorilor sever crescute și nici cu anemia severă.

Cuvinte cheie: intoxicație, plumb, ulcer, stres oxidativ

INTRODUCTION

Lead toxicity has been recognized for thousands of years and still exists today. The majority of increased blood lead levels in adults are the results of occupational exposure (1). Today, there has been considerable progress in the understanding of the potential toxicity of lead exposure and new terms, such as subclinical or asymptomatic lead toxicity occur (2). Recent studies suggest that lead exposure is related to several chronic disorders, including disorders that have been associated with oxidative stress and may be a factor in the etiology of gastrointestinal ulcers (3).

PURPOSES OF THE STUDY

The study tries to assess the presence of the gastric and duodenal ulcer in persons occupationally exposed to lead, establishing its prevalence as morbid associations to the occupational disease.

MATERIAL AND METHOD

The study was developed between January 2005 and December 2007, on a group of patients hospitalised in the Occupational Diseases section of the County

Emergency Clinical Hospital of Sibiu. The criteria of inclusion in the study group were: the presence of occupational exposure to lead, the absence of dyspeptic symptomatology upon the hiring examination or of the diagnosis of gastritis/duodenitis, gastric or duodenal ulcer in the pathological personal history previously to hiring, the absence of chronic ethylism. The exclusion criteria were: the presence of gastroduodenal affections previously to hiring, chronic ethylism, chronic consumption of non-steroid or steroid anti-inflammatory drugs. According to these criteria, the study group included a number of 137 patients, coming from intensely polluting workplaces, where the environmental toxicological determinations exceeded the maximum allowable concentration values for lead (0,05 mg per m³) in proportions varying between 14,25 mg per m³ and 0,09mg per m³. The interesting data have been extracted from the observation sheets, following the following variables: age, sex, workplace, the period of occupational exposure, smoking and alcohol consumption; clinical symptoms and the results of suggestive paraclinical examinations for chronic gastritis/duodenitis, gastric/duodenal ulcer, the results laboratory trials for the biological indicators and lead exposure indicators, respectively the values of the urinary delta-aminolevulinic acid (d-ALA), of hemoglobin(Hb) and urinary lead level. The group of witnesses was chosen from the employees of a factory belonging to the branch of machine construction industry. The medical files of the employees were analyzed and people with no exposure to lead were selected. The age, physical effort and work conditions (schedule, rhythm, industrial microclimate) of these people were similar to those of the batch of patients. Smoking and alcohol consumption of those selected in the witnesses group were also taken into consideration.

The primary statistical analysis followed the demographical features of the groups, the seniority in the workplace, and the habit of smoking or alcohol consumption. Subsequently, the prevalence of the associated ulcerous disease was assessed, by comparing the frequency with the one found in the witnesses group. We quantified the association between the gastric and the duodenal ulcer and the occupational exposure to lead using the logistical regression after making the adjustments according to smoking, age and alcohol

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consumption. In order to estimate the relation with the indicators for lead exposure and the biological ones, we used the Pearson's correlation test.

RESULTS

The average age of the group of patients was **42,10 ± 6,85 years**. The batch comprised 135 men (**98,54%**) and 2 women (**1,46%**). The witnesses group comprised a number of 124 persons, **2,42%** of them being women and **97,58%** men, with an average age of **42,84 ± 6,85 years**, the difference not being significant, statistically speaking (t test Student: p= 0,38). The

average seniority at the workplace with lead exposure for the cases group was of **17,76 ± 5,92 years**, and the average of those of the witnesses group was of **19,15 ± 8,02 years**, the seniority difference between the groups being statistically insignificant (t test Student p=0,11). The distribution of demographic variables and the potential confusion factors (smoking, alcohol consumption, age) in the two groups is shown in Table 1. The values of exposure and biological indicators with regard to the cases group, determined under hospital conditions were the ones centralized in Table 2.

Table no. 1. The distribution of the variables for the case group (n=137) and for the witnesses group (n=124)

Variable	Cases group number (%)	Witnesses group number (%)	P value (chi square)
Age			0,52
20-30 years old	4 (2,91)	4 (3,22)	
31-40 years old	56 (40,87)	49 (39,51)	
41-50 years old	65 (47,44)	53 (42,74)	
over 51 years old	12 (8,76)	18 (14,51)	
Sex			0,91
Men	135(98,54)	121(97,58)	
Women	2 (1,46)	3 (2,42)	
Smokers			0,54
Nonsmokers	45	36	
1-5 cigarettes/day	5	9	
6-20 cigarettes/day	84	75	
over 20 cigarettes/day	3	4	
Alcohol ^x			0,0049
A0	23	20	
A1	72	88	
A2	36	14	
A3	6	2	

^xA0 does not consume alcohol; A1 occasional alcohol consumption; A2 beer-type daily alcohol consumption; A3 daily strong alcohol consumption.

Table no. 2. The distribution of the case group according to exposure and biological indicators

	Normal values	Slow increased	Mild increased	Severe increased
Urinary lead	Max. 150 µg/l	150 -200 µg/l	200-400 µg/l	Above 400 µg/l
Number (%) of cases	14 (10,21%)	10 (7,3%)	74 (54,01%)	39 (28,46%)
Urinary d – ALA	Max. 10 mg/l	10-20 mg/l	20-40 mg/l	Above 40 mg/l
Number (%) of cases	23 (16,78%)	37 (27,00%)	59 (43,06%)	18 (13,13%)
Hb	13 – 17 g/dl			
Number (%) of cases	58 (42,33%)			

The prevalence of gastric and duodenal ulcer on the group with lead exposure was of 9,46%, 10 of the 13 cases being duodenal ulcers and 3 of them being gastric ulcers.

The relative unadjusted risk of gastric and duodenal ulcer is higher in those with lead exposure, compared to the witnesses group, as shown in Table 3; however, this risk is not statistically significant

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Table no. 3. The relative risk of gastric and duodenal ulcer for a trust interval of 95%

	No. of cases with gastric and duodenal ulcer	No. of cases without gastric and duodenal ulcer	No. of witnesses with gastric and duodenal ulcer	No. of witnesses without gastric and duodenal ulcer
	13	124	8	116
OR	1,52			
95% CI	0,60 – 3,80			
p (chi square)	0,5			

The exposure period for the 2 groups was divided into 4 categories, as shown in Table 4. For each category we calculated the risk of ulcerous disease, which

seemed to be significantly higher for seniorities of more than 25 years of lead exposure, in comparison with those with similar seniority, but not exposed to lead.

Table no. 4. Risk of ulcer, divided on groups based on the exposure period

Seniority	Cases	Witnesses	OR	95% CI	p
1-10 years	16	20	0,66	0,03-11,93	
11-20years	81	46	0,36	0,05-2,25	
21-25years	24	27	0,8	0,16-4,10	
Over 25years	16	31	23,33	2,52-215,65	0,002

The Pearson correlation test was applied in order to estimate the relation between the presence of gastric/duodenal ulcer and the occupational exposure to lead (seniority at the workplace), as well as the relation with the exposure and biological indicators. The results are shown in Table 5 and reveal the existence of a significant correlation between the exposure periods over 25 years and the presence of the disease. We found no significant correlation with any of the studied exposure or biological indicators. In order to eliminate the influence

of other variables which may be involved in the occurrence of ulcer we used the test for logistic regression. According to literature existing data, ulcer is more frequently found in people after the age of 40, in smokers and alcohol consumers (4, 5). The results centralized in Table 6 show that after the adjustment made for the above-mentioned confusion factors, the relation between ulcer and the period of lead exposure over 25 years is significant, from the statistical point of view.

Table no. 5. Correlations between ulcer and occupational lead exposure, exposure and biological indicators

Correlations	No. of cases	Correlation coefficient r	p	95% confidence interval for r
Ulcer – occupational lead exposure (≥ 25 years)	137	0,3599	0,0001	0,2045 - 0,4976
Ulcer – urinary lead (≥ 400 $\mu\text{g/l}$)	137	0,0112	0,8967	-0,1568 – 0,1786
Ulcer – urinary d-ALA ($\geq 40\text{mg/dl}$)	137	- 0,0522	0,5446	-0,2180 – 0,1165
Ulcer – Hb ($\leq 11\text{g/dl}$)	137	- 0,0754	0,3810	-0,2401 – 0,0935

Table no. 6. The logistic regression test in terms of seniority, age, smoking and alcohol consumption

Variable	Coefficient	Standard error	P
Seniority over 25 years	1,8883	0,7045	0,0074
Age over 40 years old	1,8091	1,1210	0,1065
Smoking presence	0,2887	0,7243	0,6902
Daily alcohol consumption	-1,5001	0,8875	0,0910
Constant	-4,0276		

Odds Ratio and 95% confidence interval

Variable	Odds Ratio	95% CI
Seniority over 25 years	6,6080	1,6610 to 26,2893
Age over 40 years old	6,1050	0,6784 to 54,9371
Smoking presence	1,3347	0,3227 to 5,5200
Daily alcohol consumption	0,2231	0,0392 to 1,2703

DISCUSSIONS

Lead may determine the appearance of ulcers of the gastric mucosa by interfering with the oxidative metabolism within the stomach (3). The increased oxidative stress is induced by pro-ulcerative factors, such as the infection with *H. pylori*, the use of non-steroid or steroid anti-inflammatory drugs, smoking, stress or the lack of sleep. Lipid peroxidation, resulted from the reaction between oxyradicals and poly-unsaturated acids, was suggested as attack factor on the gastric mucosa. The lead would cause the increase in the production of free radicals, which in the absence of antioxidants, absence also induced by lead exposure, would bring about inflammatory injuries at stomach level.

In the above study, we proved that the prolonged occupational lead exposures is associated to the risk of ulcer of the stomach and duodenum; yet, we did not find statistically significant associations with the level of urinary lead and of the urinary d-ALA in the area of the severely increased values and none with the severe anemia. The explanation may be the fact that after absorption, the blood lead is removed by sedimentation in parenchymous organs, then in bones. The urinary lead level, as the blood lead level, is a clear indicator of exposure in measuring the lead exposure in the previous weeks; however it is a week indicator of lead reserves accumulated in the bones (6). Measuring the lead deposited in the skeleton during large periods of time, will significantly improve the assessment of chronic exposure to lead; this may be done using the method of K-shell X ray fluorescence (K-XRF); for the moment, is a technique designed for research (7).

CONCLUSIONS

1. Large period of time, over 25 years for the occupational lead exposure, is a factor which increases the risk for stomach and duodenal ulcer.
2. The assessment of the relation between the level of the lead in the organism and the risk of gastric or duodenal ulcer requires techniques for measuring the lead reserves, such as K-shell X ray fluorescence method.

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