

ADVERSE REPRODUCTIVE EFFECTS IN FEMALE WORKERS OF LEAD BATTERY PLANTS

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Abstract. Fifty seven female workers at mean age 32 years (range, 23–45 years), employed in a storage battery plant and a capacitor factory were investigated. The lead exposure period was 7.4 years (range, 1–17 years). The retrospective method was used to analyse reproductive functions of women: menses, libido, abortion and delivery. The results were compared with the control group (62 female workers, mean age 32 years; range, 24–45 years).

The incidence of polymenorrhea, prolonged and abnormal menstruations, hypermenorrhea was significantly higher in the lead exposed group than in controls. The incidence of spontaneous abortions was reported by 6 exposed female workers whereas it was not observed in the control group ($p = 0.01$). The authors conclude that occupational lead exposure of female workers could lead to the impairment of the functions of reproductive system, however poor working conditions and workload may prove to be additional factors responsible for functional disorders in the subjects under study.

Key words:

Lead exposure, Female workers, Reproductive function, Chronic effects, Medical assessment, Health promotion

INTRODUCTION

Lead is a toxic element that causes a significant occupational health and public health problem. In the past 10–15 years, a growing attention was paid to effects induced by lead exposure. It focused on sub-clinical and early or subtle health effects, especially on the endocrine and immune systems and reproductive function. With the growing female workforce in the lead production in the developing countries, more women are being exposed to the potential reproductive hazards [1,2].

Materials and Method

Of the 61 female workers employed in a storage battery plant and a capacitor factory at the process of smelting, casting, manufacturing, soldering, and grinding, 57 were investigated. The mean age and lead exposure period of

women were 32 (range, 23–45) years and 7.4 (range, 1–17) years, respectively. As a control we sampled randomly 62 female workers involved in administrative rear-service or non-lead-production departments, whose mean age was 32 (range, 24–45) years. There were no lead exposure measurements in the factories under investigation. The lack of any appropriate lead exposure protection was found. The informed consent and ethics approval was obtained from the local health bureau before the survey. Every participant completed a special questionnaire including age, marital status, job category, employment duration, menstruation, sexual activity, abortion and delivery as well as details related to medical care in Beibei Health and Anti-epidemic Station.

Oligomenorrhea and polymenorrhea were defined as cycles longer than 35 days and shorter than 21 days, respectively. Prolonged menstruation was defined as

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menses longer than 7 days and consumption more than three sanitary suspensories per day. The dark-red menstrual blood with blood clots was defined as abnormal menstruation. The rates of incorrect menses, sexual items and pregnancy course in the exposed and control groups were compared with Fisher's exact test.

RESULTS

The results of the survey showed that the abnormal rate of menses in the exposed group was higher than that in the control one. The incidence of polymenorrhea, prolonged and abnormal menstruations, hypermenorrhea were significantly higher in the lead exposed group in comparison with controls (Table 1). The libido decrease was claimed by 10% of lead exposed women and only by 3% of controls (not significant). The incidence of spontaneous abortions was reported by 6 exposed female workers and by none in the control group ($p = 0.01$). Only one case of premature delivery was noted in the group exposed to lead.

Table 1. Comparison of the menses items and course of pregnancies in the exposed and control groups

Item	Lead exposed group (n = 57)		Control group (n = 62)		P
	Cases	%	Cases	%	
Oligomenorrhea	5	8.77	5	8.06	0.68
Polymenorrhea	8	14.04	0	0	0.004
Prolonged menstruation	13	22.81	3	4.84	0.004
Hypermenorrhea	8	14.04	2	3.23	0.03
Abnormal menstruation	16	28.07	6	9.68	0.09
Libido decrease	6	10.53	2	3.23	0.15
Spontaneous abortion	6	10.53	0	0	0.01
Premature delivery	1	1.75	0	0	0.47

P – significance level (Fisher's exact test).

DISCUSSION

Our study revealed that working conditions in the battery plant and capacitor factory with the lead exposure could result in significant abnormalities of menstrual cycle such

as polymenorrhea, prolonged and abnormal menstruations, and hypermenorrhea.

The menstrual cycle is determined mainly by ovary (follicular growth and maturation), pituitary (LH and FSH) and hypothalamus (gonadotropins). Some studies have shown that chronic lead exposure results in sub-clinical suppression of luteinizing hormone, follicle stimulating hormone, estrogens and progesterone [3]. Chronic lead acetate exposure in monkeys resulted in subtle effects on hormone levels in the absence of any overt toxicity or detectable effects on the menstrual cycle. The lead-exposed monkeys showed a slight decrease in progesterone production by corpora lutea [4].

Some data showed that many of the exposed lead workers had lower plasma levels of follicle stimulating hormone, luteinizing hormone and cortisol, and a decrease in plasma selenium level [5]. The exposure to a low level of lead can also reduce pituitary responsiveness to a hypothalamic stimulus [6]. Many data disclosed that occupational exposure to high levels of lead had been associated with a high likelihood of spontaneous abortion in pregnant women [7]. Maternal exposure to metals was associated with a decrease in reduced glutathione in blood. Since the increased lipid peroxidation was implicated as a pathogenic factor for maternal toxemia, it was suggested that exposure to metals during gestation could enhance the development of pregnancy complications by increasing lipid peroxidation via the depletion of reduced glutathione reserves [8]. Experiments performed on squirrel monkeys exposed to lead in course of gestation revealed an increased incidence of perinatal mortality and prematurity, and reduced size of the offspring [9]. Prenatal exposure to lead may cause toxic effects in the human fetus, including an increased risk of premature delivery, low birth weight and impaired mental development [10]. However, only one case of premature delivery in the lead exposed group in our survey does not support an opinion that lead exposure may lead to premature delivery. A relatively high rate of spontaneous abortions (10.53%) in female workers of the storage battery plant and capacitor factory may be caused not only by lead exposure but also by poor working conditions and workload. There are some data suggesting

that environmental lead exposure is not strongly associated with spontaneous abortion [11], and that lead does not accumulate in human embryos in the first trimester of pregnancy [12].

CONCLUSIONS

Occupational lead exposure of female workers could result in the impairment of functions of reproductive system such as: polymenorrhea, prolonged and abnormal menstruations, hypermenorrhea and spontaneous abortions. The poor working conditions and workload may prove to be additional factors, which are responsible for physiological disorders in the reproductive system of women under study.

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