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The Effect of Inorganic Mercury Intoxication on Heart Myofibrils in Rats

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***Abstract*:** *Many populations are exposed to multiple species of mercury. The reports indicate that inorganic mercury may have intoxication effect on heart. This study was exerted to determine the effect of inorganic mercury intoxication on heart myofibrils in rats. In this laboratory experimental study , rats were exposed to 5mg/kg, 10mg/kg, 15mg/kg and 20 mg/kg of mercury. After 28 days, tissues samples placed on lam and checked with microscope. The data was analyzed using ANOVA. Our results indicated that intoxication of 5kg/mg dose of inorganic mercury resulted in significant increase in heart myofibrils compared to control group ($p<0.01$). Intoxication of 10kg/mg, 15 kg/mg and 20 kg/mg did not significantly change heart myofibrils compared to control group ($p>0.05$). According our researches, low doses of inorganic mercury has affected on heart myofibrils in rats.*

Keywords: *Inorganic Mercury, Heart Myofibril, Rat*

1. Introduction

Many population are exposed to multiple species of mercury [1] Inorganic mercury compounds exist in two oxidative states (mercurous, Hg^{+}; mercuric, Hg^{++}), which are generally in solid states as mercurous or mercuric salts and mercury compounds with chlorine, sulfur, or oxygen. [2] A myofibril (also known as a muscle fibril) is a basic rod-like unit of a muscle cell. [3] They are created during embryonic development in a process known as myogenesis. [4] The myofibrils are causes contractions of the heart muscle. [5] More than 2500 A.C., the prehistoric man used the cinabrio (mercury sulfide), due to its red-gold color, to draw on cave walls and perform face painting. Subsequently, mercury has been used in the amalgamation (direct burning of metallic mercury on the gravel, promoting the separation of gold), in photography and as an antiseptic in the treatment of syphilis. [6,7] Human toxicity varies with the form of mercury, the dose and the rate of exposure. The target organ for inhaled mercury vapor is primarily the brain. Mercurous and mercuric salts chiefly damage the gut lining and kidney, while methyl mercury is widely distributed throughout the body . Toxicity varies with dosage: large acute exposures to elemental mercury vapor induce severe pneumonitis, which in extreme cases can be fatal. Low-grade chronic exposure to elemental or other forms of mercury induces subtler symptoms and clinical findings, as discussed hereinafter. [8] Increased cardiovascular risk after mercury exposure has been described but cardiac effects resulting from controlled chronic treatment are not yet well explored. We analyzed the effects of chronic exposure to low mercury concentrations on hemodynamic and ventricular function of isolated hearts.

Wistar rats were treated with $HgCl_2$ (1st dose 4.6 µg/kg, subsequent dose 0.07 µg/kg/day, im, 30 days) or vehicle. [9] Studies show that Methyl mercury can cause neurological problems and cardiovascular diseases in adults. [10] In a case of acute voluntary massive arsenic in toxicaction, the muscles showed hypercontracted fibres, myofibrillar disruption, mitochondrial abnormalities and cytoplasmic vacuoles. [11] On the other hand researches show that some doses of inorganic mercury have intoxication effect on heart diseases. [12], [13] This study was exerted to determine the effect of inorganic mercury intoxication on Heart myofibrils in rats.

2. Material And Methods

In this laboratory experimental, white male rats was prepared from Pasteur research complex and different doses of mercury (5mg/kg, 10mg/kg, 15mg/kg and 20mg/kg) were used in our study. Briefly, the procedure was continued and carried out in the following steps: Mercury was injected to rats until 28 days. After this 28days period, that rats were anesthetized with chloroform and blood samples were taken by syringe 10ml from the right atrium animal's heart and samples transferred to container. After washing samples, heart and aorta were placed in 10% formalin in samples container and then samples are cut for molding and were placed within liquid paraffin and after samples molding, samples are ready for tissues cutting. After removal of the samples, they are cut by microtome devices and placed into hot water and after this stage, samples placed on lam and coloring by eosin _ Haematoxylin color and checked our tissue with microscope.

Statistical significance was evaluated b one-way analysis variance (ANOVA) using SPSS 16. Differences with $P<0.01$ were considered significant.

3. Results

Our results indicated that intoxication of 5kg/mg dose of inorganic mercury resulted in significant increase in heart myofibrils compared to control ($p<0.01$). Intoxication of 10kg/mg, 15 kg/mg and 20 kg/mg did not significantly change heart myofibrils compared to control ($p>0.05$).

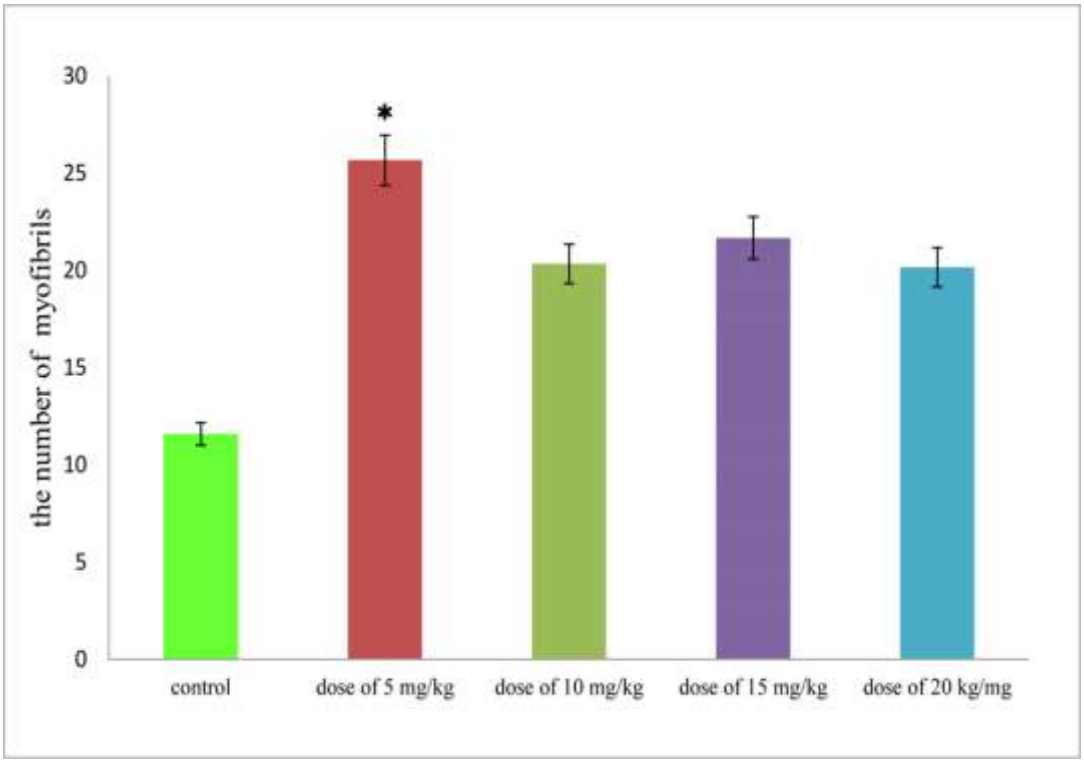

Fig. I .Viability of heart myofibrils in rats compared to control group. * indicates significant difference compared to control group at $p<0.01$.

4. Discussion

According to our finding, Low exposure levels of mercury may affect the endocrine system in animals and people by disruption of the pituitary, thyroid, adrenal glands and pancreas.[14] The cardiovascular effects of cadmium have been observed in in vitro studies and in experimental animal models. [15],[16] Mercury is a toxic heavy metal which is widely dispersed in nature. Most human exposure results from fish consumption or dental amalgam[17] Other studies also correlate mercury exposure with increased risk of hypertension, myocardial infarction, coronary dysfunction, and atherosclerosis. However , it has been shown that Guallar et al. (Nov. 28 issue) report that a toenail mercury level as low as 0.11 to 0.66 μg per gram (estimated hair level, 0.34 to 2.03 μg per gram) was directly associated with a doubling of the risk of myocardial infarction. [18],[19] Other studies show that Inorganic mercury salts are not lipid soluble; hence, they do not readily cross the blood-brain barrier or blood-placenta barrier. Inorganic mercury salts are mainly excreted in the urine and feces. The excretion rate is biphasic and dose-dependent, with an initial rapid excretion phase followed by a slow excretion later. The biological half-life is estimated to be about 60 days.[20] Furthermore, mercury may affect intestinal functions during absorption processes, thus inhibiting the enzyme synthesis and activity. Simultaneously, plasma urea concentration revealed a significant increase during the whole chronology of experiment. This result is undoubtedly related to acute and persistent renal injuries, thus confirming that the kidneys are very sensitive to Hg exposition. [21]

5. Conclusion

According to our findings, low doses of inorganic mercury has affection on heart myofibrils in rats and in high doses hasn't any affection on hearts myofibrils in rats. In this case, different doses of inorganic mercury can absorb in tissues and endanger our safety.

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7. References

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