Morphological and Histological Study on Thyroid Gland Toxicity in Male Rats Exposed to Mercury

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Abstract

The present study investigated the effect of heavy metals (Mercury chloride) on the morphological and histological feature of the thyroid gland. Rattus norvegicus male rats were selected for experimental use. the rats given doses of Hg salts (3mg/kg, Ip.3times weekly for 4 week) $HgcL_2$ admin is tration altered the body weight, thyroid weight, length and width of thyroid gland. Morphologically, the thyroid gland was consisted of two labs of reddish brown in color, the lobes were located on ventral Lateral side of trachea connected caudally with isthmus. While the thyroid gland treated rats recorded changes in color (pale), swollen and enlarged. histologically, the architectural cellular structure gland of the thyroid gland of exposed rats recorded variations in the follicular thyroid, congested blood vessels and depletion of para follicular cells in the rats treated to Hg in a comparison to that of the control rats. This signify that animals exposed to Hg could at a risk of thyroid gland.

Keywords: *thyroid gland, mercury chloride, male rats.*

Introduction

The toxicity of Heavy metal is bearing a worldwide problem as they intervene in the detoxification pathway [1]. Mercury contamination of the environment continues to be of concern and a major source of this contamination is from human activities Such as mining which smells extensive industrial and agricultural use of fossil fuel combustion and other industrial waste which liberation mercury into the environment [2] . Mercury has adverse effects on systems that differ with doses, duration of exposure, length of exposure and type of mercury [3]. The Mercury toxicity mainly affects the nervous system, but depending on the particular form of mercury and the degree of exposure, it is also extremely important for the kidneys, liver, lungs and thyroids [4,5]. the thyroid gland is a the only endocrine gland being largest, superficially located, It is caudal to the trachea at the level of the first or second tracheal ring [6]. It take the shape of a butter fly and it is composed of two lobes, one on each side of the trachea , and connected by a narrow piece of tissue called the isthmus [7]. Thyroid gland consists of numerous follicles of various size which from the Thyroid Gland functional and histological structure .It consists of three main components; follicular lining,, para follicular cells or C cells could be seen through follicular epithelium or as group outside of follicles with the luminal colloid, and the follicular cells vary in height, depending on the state of activity of the follicle . the lining epithelium changes from squamous or low cuboidal in the resting state and cuboidal or columnar in the active stat [8,9]. The thyroid follicles produce thyroid hormones (triiodothyronine, and tetraiodothyronine, which playing an important role for reproduction; differentiation [10]. The C cells are secreted mainly calcitonin hormone which regulate the calcium level in the blood [11]. the aims of this study investigate the changes of thyroid structure in mercuric chloride.

Materials and Methods

- Mercuric chloride ($HgcL_2$) was obtained from Merek India LTD. and dissolved in distilled water and administered three times intraperitoneal injection at dose of 3 mg / kg body wt. for 4 weeks. In current study, it was found that LD50 of Hgcl2 was 40mg/kg body. wt. (12). The experimental protocol was approved by the College of Veterinary Medicine in Basra University / Animal House. twenty male rats (Rattus norvegicus) aged between 8- 10 weeks, weighting between (150_160) gm were used in this experimental. they were located in

an air – conditioned, stainless steel cage. Animals were fed the rat with standard pellets and provided with clean water. the animals were separated in to 2 groups (N=10); Group(A) has given i.p injection with 1 ml normal saline as a control group. Group, (B) given I.P injection of ($HgcL_2$) (3 mg/kg. wt /3/ week for 4 weeks.

- **Morphological study:** when the experimental ends, the body weight of male rats were measured by digitalis balance. Rat were anaesthetized using chloroform in a closed container. The rats were humanly sacrificed and an incision was made in Its cervical region, the thyroid glands Were dissected. the glands were located on the lateral aspect of the trachea. photograph of glands was taken before glands were dissected. the weight of glands was determined using the digital weighing balance while the lengths and widths were determined using digital Vernier Calipers.

Histological study

Tissue samples were fixed in 10% formalin solution for 24 hrs. After fixed tissues had been dehydrated progressive increased ethanol concentration and cleared in xylene, impregnated in liquid paraffin wax and embedded in paraffin blocks then cutting by rotary microtome, later the section was stained with hematoxylin and eosin. the histological section of this study was examined by using light microscope type (Olympus / japan).

Statistical Analysis

The data from this analysis were analyzed using the ANOVA test in all studies. Both statistical calculations were made using the Statistical Program SPSS V.17 (SPSS Inc). The data was expressed as mean + standard (X - +SD) deviation.

Results

The table (1) showed that a significant decrease ($p \leq 0.05$) in body weight of the $HgcL_2$ group compared with the control group. The mean weight increased ($p \leq 0.05$) in the thyroid gland of $HgcL_2$ group compared with the control group. Also, the length and width of the gland are significant different in treated group Hgcl2 ($p \leq 0.05$) as compared with control group during experimental periods. Morphological result of the thyroid gland of control group showed that was consisted of two lobes of Reddish brown in color located on ventrolateral side of trachea connected caudally with isthmus which were oval in shape with smooth surface (Fig 1, a,b) While the thyroid gland in ($HgcL_2$) group was pale, swoollen and it include grey area with enlarged (Fig 2)

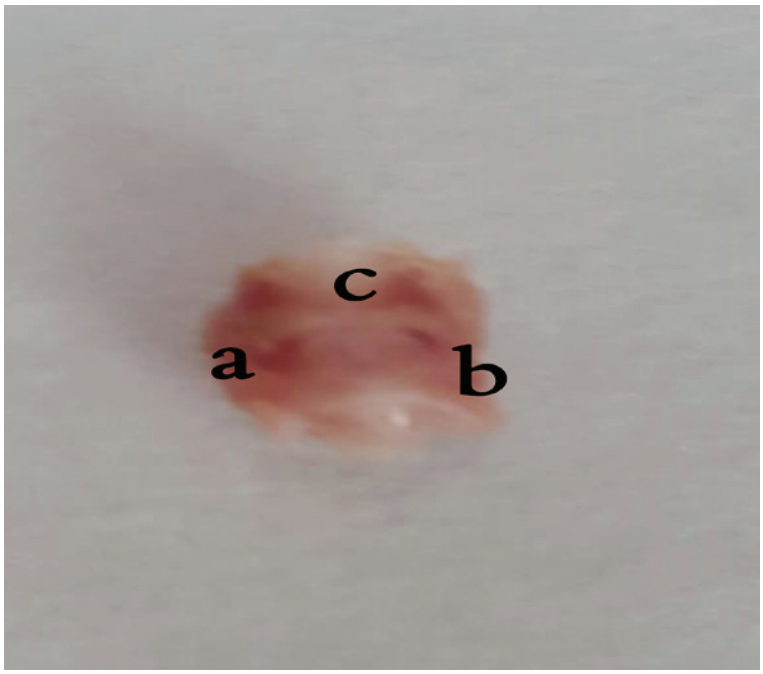
Histological results.

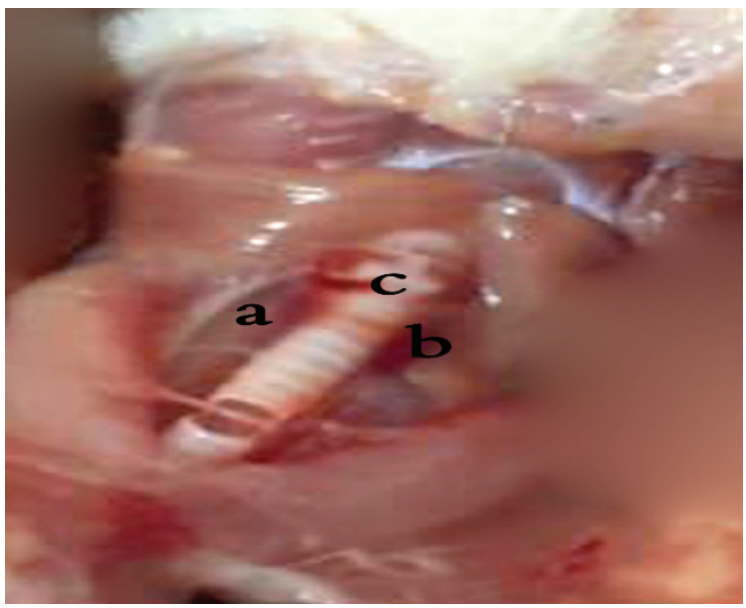
The histological results of control group were showed that a thin capsule of dense irregular connective tissue enclosed the thyroid gland, from the capsule thin trabeculae contained blood vessels extended into the parenchyma of the gland and di

Separated it into small lobules (Fig3). A lobule was consisted of an aggregation of a various sizes of thyroid follicles were appeared with variable size and shapes which lining with epithelial cells ranged from low columnar cuboidal to squamous cells another follicles layer completely filled with colloid. In addition , showed parafollicular cells (C-cells) could be seen concentrated in the center of the lobe, as group outside of follicles and they are larger than follicular cells and these cells formed clumps with rounded nuclei and eosinophilic cytoplasm (Fig 4).While the gland in the exposed group for $HgcL_2$ showed multiple histological changes in the thyroid gland of rats , which includes disintegration and disorg anization of thyroid follicles . some follicles occurred with interrupted follicular wall. Congested blood vessels and increased with stroma connective tissue with infiltration of inflammatory cells. Also seen depletion of para follicular cell (fig 5,6).

Table (1) Estimations of body weight (g), thyroid gland weight (g), length (Cm) and width (Cm) of thyroid gland in experiment al groups.

Groups	Bodyweight(g)	Thyroid weight(g)	Length (Cm)	Width (Cm)
Control Group	152.22 ± 3.666	1.272 ± 0.046	2.250 ± 0.048	0.640-+0.031
($HgcL_2$) Group	136.4 ± 3.801	1.622 ± 0.033	2.318 ± 0.018	0.818 ± 0.025





(v) (b)

Figure.1- (a, b) shows the anatomical location of thyroid gland in control rats: a-right lobe

b-left lobe, c-isthmus.

Figure.2 show the anatomical location of thyroid gland in treated group with ($HgcL_2$)pale with swollen and enlarged.

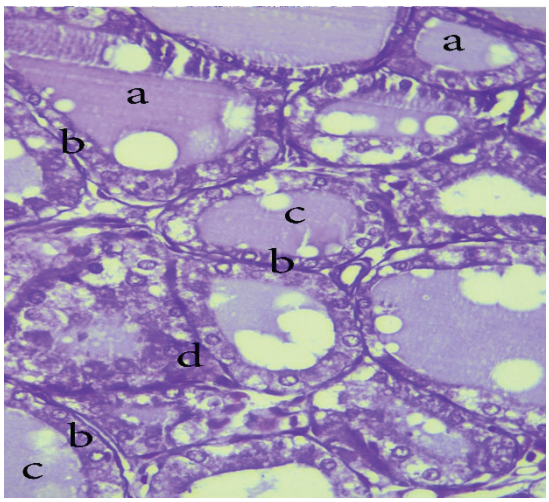


Figure.3. histological section of thyroid gland in control rats shows. a-capsule, b-trabeculae, c-blood vessels, d-lobule , H&E stain. 10.

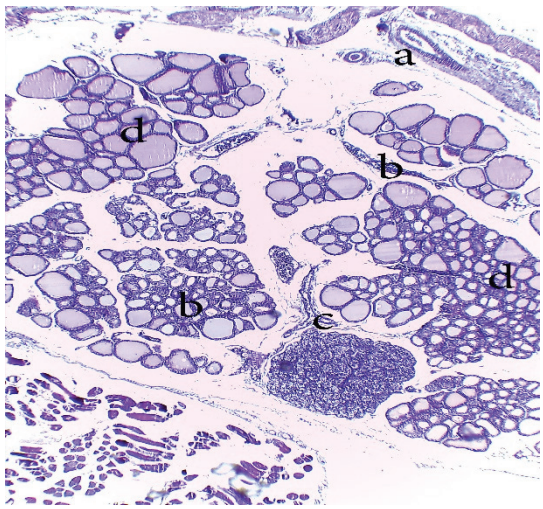
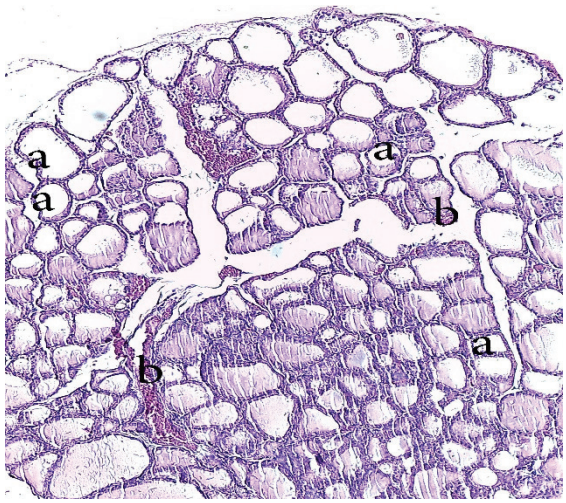


Figure.4. Histological section of thyroid gland in control rats shows a various size of thyroid follicles, b- lining epithelial, c- colloid, d-parafollicular cell, H&E stain. 40X



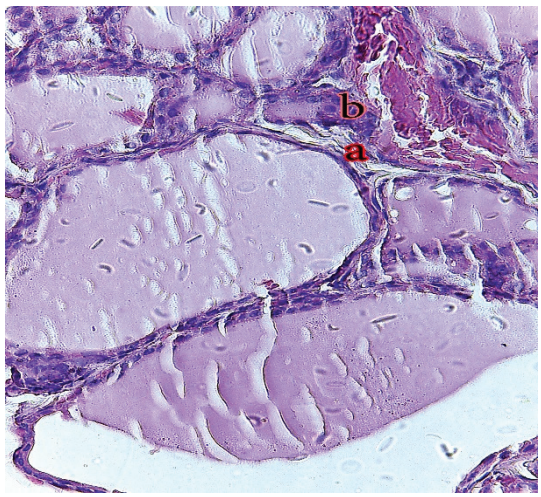


Figure.5. thyroid gland section of rat treated with ($HgcL_2$)showing a: marked disintegration and some connective tissue septal b- congested blood vessels, H&E stain. 40X

Figure.6. thyroid gland section of rat treated with ($HgcL_2$) showing a: increased amount of collagen fibers in between the follicles interrupted follicular wall, b- degeneration of parafollicular, H&E stain.10X

Discussion

It is obvious from the results that the effect of $HgcL_2$on bady weight loss may be resulting from being interrupted of mercury in the absorption and metabolism of feed nutrients essential for heath [13] heavy metal is capable of damaging the organism in many ways because of high affinity to various tissues and its tendency to accumulates [14] the result of the present study shows the effect of mercury on the weight of gland was increasing in the weigh, length and wild comparison with control group (table- 1), these results agree with many other previous studies [15] .In the current work , alteration morphological of thyroid gland in the treated group were further certain by the histological examination of the thyroid tissues which showed Obviously light microscopic , this histological altered of thyroid gland would be illustrated by deficiency of stimulatory effects of thyroid stimulating hormone (TSH), when mercury interacts in synthesis and or secretion of TSH by the pituitary gland or TRH by the hypo thalamus gland, thyroid Producing hormone (TRH) is accountable for regulation the secretion of TSH from the pituitary gland , this result agreed with result that was obtained previously [16-18] In conclusion thy thyroid gland is responsive to $HgcL_2$ exposure. This periphrasis induced morphological and histological changes.

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Conflict of Interest: None to declare.

Ethical Clearance: All experimental protocols were approved under the College of Veterinary Medicine and all experiments were carried out in accordance with approved guidelines.

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