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The effect of different doses levels of silver nanoparticles (AgNPs) on the seminal vesicles and prostate in Albino male Rat. Histopathological study.

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Summary: The present study was conducted on eighteen adult male albino rats were divided into three groups, each group was included six animals. The first group was represented control group, the second group was intravenous injection (I/V) in the tail region at dose (0.4mg/kg. Body weight) of silver nanoparticles (AgNPs), the third group was intravenous injection of (AgNPs) at dose (0.6mg/kg. Body weight) in the tail region. The histological findings was revealed increase in the epithelial lining folds and large amount of alveolar secretions of seminal vesicle in the second treated group, from another hand, the alveoli of prostate were enlarged. While the seminal vesicles of the third treated group was appeared shortening in alveoli folds, connective tissue hyperplasia, and the seminal vesicle alveoli was enlarged, the prostatic tissue was revealed distraction in the epithelial lining of some prostatic alveoli, beside, some prostatic alveoli were enlarged and oozing of prostatic alveoli secretion into interstitial tissue.

Key word: Silver nanoparticles, Male rat Reproductive system.

INTRODUCTION

Metal nanoparticles such as titanium, silver, and platinum have potentially useful applications in many industrial fields. Among these metal nanoparticles, platinum nanoparticles (PNPs) have been widely used as a catalyst due to their high conductance and reactivity [1,2].

Among nanomaterials, the commercial application of silver nanoparticles is the most widespread, where their antimicrobial activity has been applied to bedding, washing machines, water purification, toothpaste, shampoo and rinse, nipples and nursing bottles, fabrics, deodorants, filters, kitchen utensils, toys, and humidifiers [3]. Silver nanoparticles have also been added to medical products, including wound dressings, contraceptives, surgical instruments, bone prostheses, and cardiac catheters [4,5]. Nanomaterials have always been released into air by various natural phenomena, e.g. volcano ashes or wild fi res, and this is how they unintentionally come into contact with humans, animals, and the environment. Besides, anthropogenic NMs set free by diesel engine exhaust, combustions, welding or cigarette fume are part of the plausible exposure to nano-sized particles [6].

Nanomaterials are part of an industrial revolution to develop lightweight but strong materials for a variety of purposes [7]. Due to the novel physical and chemical properties of nanoscale materials, nanomaterials have been used to create new consumer products as well as applications for life sciences and biotechnology. Chemically, the nanoparticles are very diverse. It is estimated that of all the nanomaterials used in consumer products, silver nanoparticles (AgNPs) currently have the highest degree of commercialization [8], so they are more likely to be exposed to humans and to the environment at large. The toxic effects of nanoparticles have been evaluated in a variety of studies; however the potential health and environmental impacts on plants have yet to be thoroughly examined. Exposure to nanoparticles can occur via water, food, cosmetics, drugs, and drug delivery devices, and can lead to a wide variety of toxicological effects [9]. Silver nanoparticles (AgNPs) have been rapidly employed in the manufacturing of many products such as healthcare items, room-sprays, pipelines, and washing machines due to its long-standing antibacterial properties [10,11]. It has been termed as a broad-spectrum biocide due to its ability to target a wide array of bacteria [12]. Silver impregnated catheters and wound dressings are used in therapeutic applications. In spite of the wide usage of AgNP in wound dressings, which can cause easy entry into the cells, very few reports on the toxicity of AgNPs are available. Several recently published reports state that despite the many promises of AgNPs, there are many unknown risks which have not been properly assessed prior to their high industrialized usage. Silver (Ag) is classified as an environmental hazard by the EPA because it is more toxic to aquatic plants and animals than any other metal except for mercury. Even if a nanoparticle itself is not especially toxic, silver nanoparticles increase the effectiveness of delivering toxic silver ions to locations where they can cause toxicity. In the near future there is a risk of enhanced bioavailability of the nanoparticles in the environment [13].

In recent years, nanoparticles have been increasingly used in several industrial, consumer and medical applications because of their unique physico-chemical properties. However, *in vitro* and *in vivo* studies have demonstrated that these properties are also closely associated with detrimental health effects. There is a serious lack of information on the potential nanoparticle hazard to human health, particularly on their possible toxic effects on the endocrine system. This topic is of primary importance since the disruption of endocrine functions is associated with severe adverse effects on human health[14].

Materials and Methods

Ag NPs have been obtained from school of Applied Sciences, University of Technology, Iraq. Eighteen male albino rats were used by dividing them into three groups, each group comprise 6 rats. First group(control group) given food and water like other groups by liberty. Second group was tail injected by (AgNPs) at concentration at dose of (0.4 mg/kg. body weight/day). Third group was injected by (AgNPs) at concentration at dose of (0.6 mg/kg. body weight/day) for 15 days. All animals were sacrificed at the end of experiment The average weight of animals was ranged (170-200) gm; the age of mature male rats was four months.. The environmental conditions were strictly controlled with a temperature of 23±1Cº, and a 12h light/ dark cycle.

Histopathology

Seminal vesicles and prostate were collected and fixed with 10% formalin, processed by paraffin method, cut at six micrometers in thickness by using rotary microtome and stained with Hematoxylin and Eosin (H&E) [15]. Section were examind by histopathologist with olumpis Microscope (japan). Pholos were taken by digital camera (sony-japa 14 Migapixill).

Results

Histopathological changes of seminal vesicles and prostat are follow: For control group: seminal vesicle sections showed the alveoli was lined by simple columnar epithelium (Figure 1). The prostat sections showed alveoli lined by simple cuboidal epithelium, and filled with secretion (Figure 2). Second treated group with AgNPs (0.4 mg/kg.body weight/day: seminal vesicales sections showed increase in the gland folds, and increase in the height of glandular epithelial linings and increase in the alveolar secretions (Figure 3).Prostat sections appear hyperplasia of epithelial lining of glandular alveoli and enlargement of prostatic alveoli, and flattened of alveoli epithelial linings (Figure 4). Third treated group with AgNPs (0.6 mg/kg body weight/day) seminal vesicle section was noticed connective tissue hyperplasia, enlargement in the alveoli and shortening in the alveoli folds (Figure 5). Prostat sections showed damage in the epithelial linings of some prostatic alveoli, enlargement of some prostatic alveoli, Oozing of prostatic secretions into interstitial connective tissue (Figure 6).

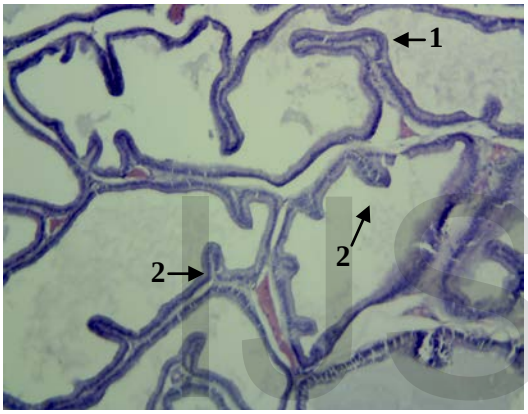

Figure 1: Control Rat seminal vesicle, consist of alveoli was lined by simple columnar epithelium (1). From epithelium linings was projected many folds (2).H&E.400X

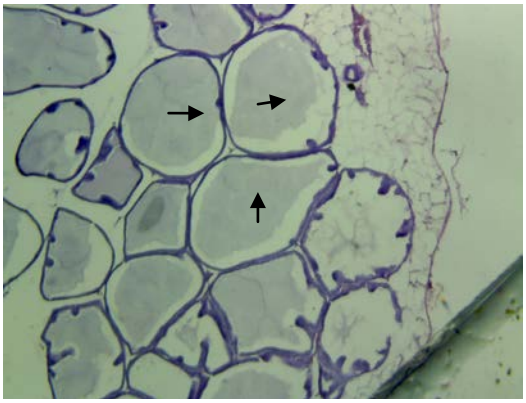

Figure 2: Control rat prostate was showed some alveoli, lined by simple cuboidal epithelium. The alveoli were filled with acidophilic secretion. H&E. 100X.

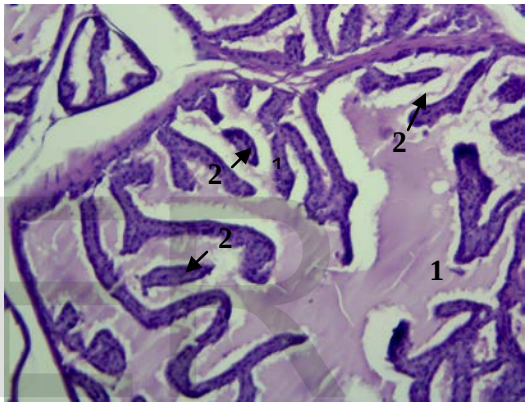

Figure 3: Second treated group. Rat seminal vesicle was injected I/M (0.4)mg/kg.B.W. of silver nanoparticles, was observed, the alveoli were enlarged (1), and desequamation of folds(2). H&E.400X.

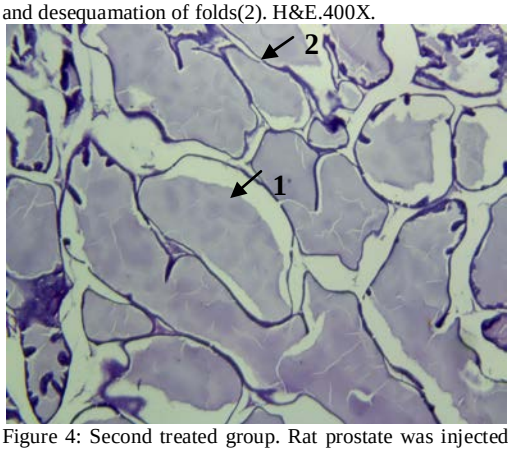

Figure 4: Second treated group. Rat prostate was injected I/M (0.4) mg/kg. B.W.,of silver nanoparticles. The figure was revealed enlargement of prostatic alveoli (1), and flattened of alveoli epithelial linings (2). H&E. 100X

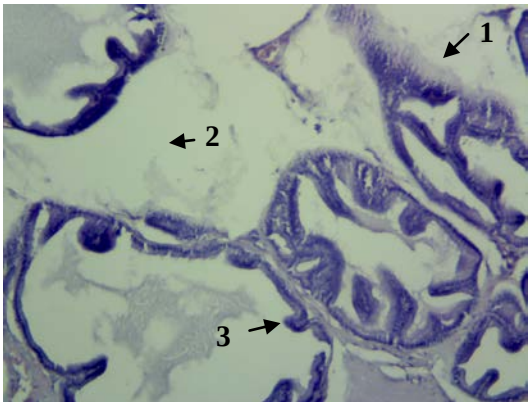

Figure 5: Third treated group. Rat was injected (0.6) mg/kg. B.W. silver nanoparticles, the rat seminal vesicle was noticed hyperplasia (1). Enlargment in the alveoli (2), shortening in the alveoli folds (3). H&E.400X.

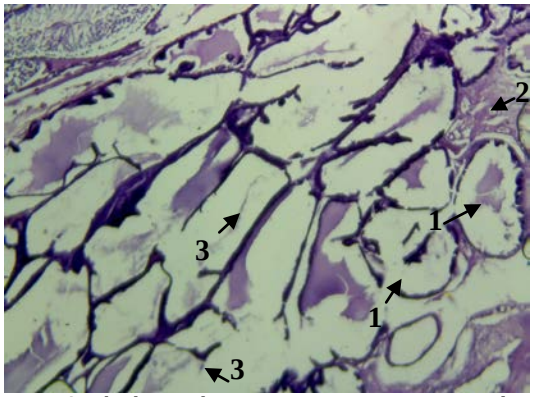

Figure 6: Third treated group. Rat prostate was injected I/M (0.6) mg/kg. B.W. of silver nanoparticles, showed damage in the epithelial linings of some prostatic alveoli(1). Oozing of prostatic secretions into interstitial C.T. (2). Enlargement of some prostatic alveoli (3). H&E.100X.

Discussion

The effect of silver nanoparticles (AgNPs) on the accessory male glands in the mammals need more future studies. This present study was designed to determine the effect of silver nanoparticles on the rat seminal vesicle and prostat glands due to alittle litttreture reviews. The previous studies were mentioned the silver nanoparticules had ablity to penetrate into for reproductive cells and causes reduce sperm motility and led to dysfunction of spermatozoa[16]. Our observations about the effect of silver nanoparticle on the prostat gland of rat was led to dilation of prostatic alveoli and flattened of the cuboidal epithelial cells linings at dose (0.4)mg/kg.bw was injected intramuscular in the thigh region, while the prostatic alveoli at (0.6)mg/kg.bw were revealed distruction and oozing of prostatic secretions into interstitial connective tissue. The current studies [17,18] were identical to our findings, they mentioned, the toxic effects of silver nanoparticles on the spermatogenesis, these workers were administrated silver nanoparticles intravenously in the male rats, they noticed decreased of epididymal spermatozoa count and increased levels of deoxyribonucleic acid damage in germ cells and change in the morphometric measurements in the seminiferous tubules. The present study was showed hazard effect of silver nanoparticles at dose (0.4mg/kg.bw) on the rat seminal vesicle, this cytotoxic effect was involved, enlargement of seminal vesicle alveoli, and desquamation of epithelial lining. While the dose (0.6mg/kg.bw) injected intramuscular led to shortening of epithelial lining folds of rats seminal vesicle, hyperplasia in the interstitial connective tissue and enlargement of alveoli, these observations was corresponding with current studies [19] were carried out on the male reproductive system due to effect of silver nanoparticles (20nm and 200nm) led to apoptosis, necrosis and decline in proliferation of human testicular cells.

Recommendation

Further studies for the AgNPs on testosterone, and blood parameters.

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