Study of Histological effect of Silver nanoparticles on Asthma of male mice induced ova albumin

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Abstract. In the current study thirty of male mice weighting (25-30 g) aged (15-17) weeks at the animal house faculty of science / university of Kufa during the period from January 2017 to September 2017. This study included some histological criteria to evaluate the protective role of silver nanoparticles (5 and 10 mg/kg) against asthma that induced by ovalbumin. The animals experimental are divided into three groups (10 animals) for duration of one and two months. The result sowed significant increase (p<0.05) in the serum level of periostin and Galectin-3 and Interleukin-33 in asthma group as compared with control group. The histological study of trachea tissue was sluphing, necrosis and degeneration around the epithelium of bronchioles also, there were congestion and inflammatory cells around bronchioles that treated with ovalbumin (asthma group). Whereas treatment the trachea tissue with silver nanoparticles did not show any histological changes in the trachea tissue except little inflammation.

1. Introduction

Asthma is a chronic inflammatory disorder of the respiratory airway characterized by a multicellular process including eosinophil, neutrophil, mast cell ,T-lymphocyte and CD+4 also the most important features represented by infiltration of eosinophil {1}. The imbalance between T-helper cell (T)-1 and Th2 cytokines in allergic asthma with eosinophil and neutrophil inflammation of airway is considered as relevant of pathophysiology of the asthma disease {2}.

Nanoparticles (NPS) a structures have a range of dimension from 1-100 nm {3}. Silver is the main products among all nanoparticles and used widely in many applications because of its broad spectrum properties, in addition to inflammatory activity the anti-microbial activity used against bacteria ,viruses and fungi {4}. Serum periostin is a multicellular protein of a member of CCN family and α-Carboxylates protein also Vit K –dependent {5}.

The mouse calvariel cell line was the first cloned of periostin therefore its considered as osteoplastic – specific factor {6}. The periostin is a useful biomarkers for bronchial asthma and it has been shown to down regulate of immune responses such as (IL-4) and (IL-13) and it can predict the hypo responsiveness to corticosteroid inhalation in asthma patients {7}.
Galectin-3 are one of the most biomarkers which have functions in variety of biological processes such as allergic pathology and inflammation also, the Galectin-3 belong to the family of B-galactose side binding animal lectins \cite{8}.

IL-33 is a member of cytokines which mostly drive the Th-1 immune responses and have many names including (IL-IF11,NF-HEV) also nuclear factor from endothelial venues and recently described as a member of IL-1 family \cite{9}.

**Aim of the study:** The study was designed to show the role of silver nanoparticles in protect and treatment of asthma induced by ovalbumin by the following criteria:

1- Biochemical markers (periostin, Galectin-3 and IL-33)

3- Histo pathological changes in trachea.

**Induction of Asthma in mice**

Mice were sensitized by three intraperitoneal injection of 0.5 mg/ml of ovalbumin and 20 mg/ml of alum on days 0,7 and 14 at the days 18,19 and 20 the mice will receive ovalbumin and alum by intranasal instillation by micropipette and drop in its nose, mice were challenged at day 21.

**Statistical Analysis:**

The data of present study were articulated as (Mean± Standard Error), the statistical analysis were calculated by using megastat and Graphpad prism, when P value <0.05 was statistically significant \cite{10}

2. **Results**

**Periostin:** this figure showed significant decrease(p<0.05) in the periostin level in the group (T1,T2) (0.398±0.037),(0.106±0.041) for silver nanoparticles compared with asthma, While indicated significant increase (p<0.05) in periostin level in the treated group ( T1) (0.398±0.037) compared with control.

![Figure(1) effect of two concentration of silver nanoparticles on periostin serum level in male rats treated with ovalbumin for 21 days.](image-url)
(T1:5mg/kg silver nanoparticles +ovalbumin for 21 days ,T2: 10mg/kg silver nanoparticles +ovalbumin for 21 days .similar letters indicate non- significant while different letters indicate significant compared treated groups vs control group).

**Galectin-3**

The figure(2) showed significant increase (p<0.05) of galectin-3 level in the asthma group for 21 days (1.690±0.084) compared with control (0.544±0.033) , also showed significant decrease (p<0.05) in galectin level in all protective group( T1,T2) for both duration ,(1.013±0.090),(1.168±0.067) one and two month to silver nanoparticles respectively compared with asthma . this figure showed significant increase (p<0.05) in galectin-3 level in all treated group (T1,T2) ,(1.013±0.090 ,(1.168±0.067) compared with control (0.544±0.033). T2group of silver nanoparticles was significant increase (p<0.05) than other protective group T1.

![Figure 2](image)

**Figure(2)** effect of two concentration of silver nanoparticles on Galectin serum level in male rats treated with ovalbumin (protective groups for 21 days.

(T1:5mg/kg silver nanoparticles +ovalbumin for 21 days ,T2: 10mg/kg silver nanoparticles +ovalbumin for 21 days .similar letters indicate non- significant while different letters indicate significant compared treated groups vs control group).

**Interleukin -33**

The figure(3) showed significant increase (p<0.05) in the interleukin-33 level in the asthma group 21 days( 1622.78± 147.42) compared with control ( 461.331± 91. 894) also ,this figure showed significant decrease (p<0.05) in interleukin- 33 level in the treated group (T1,T2) (711.404± 144.165) .( 898.77± 249.38) compared with asthma .the figure showed no significant differences (p<0.05) in the interleukin level in the treated group (T1) compared with control ,while occurs significant increase (p<0.05) in the interleukin level in other treated group (T2)compared with control .
Figure (3) effect of two concentration of silver nanoparticles on interleukin 33 serum level in male rats treated with ovalbumin for 21 days.

(T1: 5mg/kg silver nanoparticles + ovalbumin for 21 days, T2: 10mg/kg silver nanoparticles + ovalbumin for 21 days. Similar letters indicate non-significant while different letters indicate significant compared to treated groups vs control group)

Histological results

Histological section of male mice tracheae (control) showed normal structure of bronchiole (Br.) (image 4-1). Histological section of male mice trachea (asthma) showed sloughing (Slu) epithelium of bronchiole and necrosis (Nec.) and degeneration (Deg.) in the epithelium of bronchiole (image 4-2). Image (4-3) histological section of tracheae treated with ovalbumin and silver nanoparticles (5mg/kg) for one month showed inflammatory cells (Inf.c) around bronchioles and normal blood vessel (B.V).

Image (4-1) histological section of male mice trachea (control) showed normal structure of bronchiole (Br.) and normal epithelium (Epi.) and normal cartilage (Cart). PAS stain 400X

Image (4-2) histological section of male mice trachea (asthma) showed sloughing epithelium of bronchiole (Slu.) and degeneration (Deg.) and (Nec.) in the epithelium of bronchiole

Image (4-3) histological section of male mice trachea treated with ovalbumin and silver nanoparticles (5mg/kg) for one month showed normal blood vessel (B.V.) and inflammatory cells (Inf.c) around bronchioles. PAS stain 200X.
3. Discussion:

Serum level of periostin may reflect the level of periostin in inflamed lesions that induced by Th2 type immune response. In a study on mice have found that postn +1+ mice had a higher airway responses than postn -1- [11].

The current results of figure (4-1) indicated a significant decrease (p<0.05) in periostin level in treated groups of silver nanoparticles compared with asthma groups. No previous studies deals with the effect of silver nanoparticles on periostin level in asthma and other disease. The results may be discussed the decrement in periostin level by the relation between eosinophil and periostin. So the present study proved that after administration of silver nanoparticles at different concentration and periods were led to significant decrease in eosinophil and these cells produce periostin therefore the decrement in eosinophil count may reflects the decline in periostin level in serum of treated.

In the figure (4-2) showed a significant increase (p<0.05) in the Galectin level in serum of asthma group in compare with control group. The study accordance with various studies that evident to play role of Galectin -1,3and 9 in various inflammation also, that are expressed by eosinophil or others cells interfere with eosinophil recruitment in allergic asthma [12].

In a study on wild type mice expired to acute allergen have been showed increase in Galectin -3 level also, expressed inflammatory cell such as (macrophage ,eosinophil ) the broncho alveolar lavage in wild type mice [13]. In laboratory study have postulated that Galectin-3 expressed with high level on the eosinophil of allergic subject [14].

The figure (4-3) showed a significant decrease (p<0.05) in the level of IL-33 in asthma groups in compare with control groups. A recent study of has postulated that IL-33 induce of allergic asthma because the Th2 inflammation was dependent on FCYRIII and IL-33 enhance a secondary response ligation FCYRIII on antigen presenting cells to develop Th2 – mediated response in the lung some other studies have documented that a signaling of IL-33 is required for eosinophil and production of IL-5 and IL-13 from innate lymphocytes (ILC25) therefore it considered as an essential factors for severe asthma in mice[16]. Research of several studies have reported that IL-33 modulate a mast cell through a pathway signaling /and activated mast cell and basophil to enhance of maturation ,migration ,survival ,adhesion and production of several cytokines as pro inflammatory in air way of asthma [17].previous study has demonstrated that IL-13 in eosinophil and in vivo IL-33 have a crucial roles in eosinophil homeostasis and allergic inflammation ( Poole et al ,2014).

4. References

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