HISTOLOGICAL STUDY TO THE PROTECTIVE ROLE OF VITAMIN C AGAINST DEXAMETHASONE IN KIDNEY OF ADULT MALE RATS

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ABSTRACT:

Because the anti-inflammatory use of dexamethasone has damaging effects on many organs of the body, and because vitamin C plays as a protective factor to protect against these detrimental effects, the current research was in action to read the amelioration effects of Vitamin C at kidney. Here, 60 rats were randomly split into six groups (Control group (CG), Vitamin C 500 mg/ kg group (C), Dexamethasone 0.3 mg/kg B.W group (D0.3), Dexamethasone 0.5 mg/kg B.W group (D0.5) , Vitamin C and D0.3 mg/kg B.W group (CD0.3) ,Vitamin C and D0.5 mg/kg B.W group (CD0.5). After 30 days, blood and tissue samples were collected from these animals, The histopathological features included damages to the structures of the selected organs when exposed to dexamethasone at both doses; however, these structures had gained normal formations when treated with vitamin C. In conclusion, vitamin C protects against the side effects of dexamethasone, especially at low doses of dexamethasone.

I. INTRODUCTION:

Corticosteroid medications are a form of synthetic steroid hormone developed by the adrenal cortex of apparently people. Glucocorticoids are two types of corticosteroids that are utilized to control a broad list of illnesses and clinical symptoms. Dexamethasone is a kind of steroid that belongs to the corticosteroid family. It’s utilized to cure a variety of illnesses from chronic obstructive pulmonary disorder, extreme allergies, rheumatic disorders, asthma, multiple skin diseases, brain swelling, and tuberculosis while combined with antibiotics (Ramamoorthy and Cidlowski, 2016).

Dexamethasone has a strong anti-inflammatory activity and is often used as a supplementary therapy for viral pneumonia. Dexamethasone's function is similar to that of the compounds generated normally by the body to reduce inflammation. Dexamethasone is around 25 times more potent than other corticosteroid drugs (Ahmed and Hassan, 2020).

Dexamethasone attaches to the cell-membrane based glucocorticoid receptor (GR), translocating the drug to the nucleus. It attaches reversibly to many unique DNA locations, causing a wide range of gene transcription to be stimulated (transactivated) or suppressed (trans-repressed)(Chambial et al., 2013).

Vitamins are crucial for a variety of biochemical and physiological functions in the human body. The fact that certain vitamins cannot be synthesized in the body means that they must be supplemented in the diet. Water and fat soluble vitamins are divided into two categories based on their solubility (A, D, E, K) (Ahmed and Hassan, 2020). Vitamin C is needed for the body's regular physiological functions. It aids in tyrosine, folic acid, and tryptophan synthesis and metabolism, as well as the hydroxylation of proline, glycine, carnitine, lysine, and catecholamine. Which makes cholesterol transfer to bile acids easier, lowering blood cholesterol levels. It also improves iron absorption in the intestine by converting ferric to ferrous. It prevents the organism from the harmful effects of free radicals, contaminants, and contaminants as an antioxidant. Linus Pauling investigated the medicinal impact of vitamin C, but his studies on the therapeutic function of vitamin C sparked more debate. Nevertheless, he was the first to propose the idea of the vitamin C elevated doses for the cure of a variety of disorders ranging from the common cold to cancer. Mega doses of vitamin C have been commonly used in the care and avoidance of a broad range of sicknesses since then, including asthma, atherosclerosis, cataracts, common cold, glaucoma, stroke, macular degeneration, heart failure, cancer, etc (Abdul-Razzak, 2012).
This research designed for exploring histopathological effects of using dexamethasone on rat kidney and to explore the amelioration effects vitamin C supplements against the induced detrimental effects of using dexamethasone.

II. MATERIALS AND METHODS

The experimental design included the use of 60 female rats which are randomly categorized into six groups (Control group (CG), Vitamin C 500 mg/kg group (C), Dexamethasone 0.3 mg/kg B.W group (D0.3), Dexamethasone 0.5 mg/kg B.W group (D0.5), Vitamin C and D0.3 mg/kg B.W group (CD0.3), Vitamin C and D0.5 mg/kg B.W group (CD0.5). All groups were given the dexamethasone with intraperitoneal and it were given vitamin C, after 30 days, blood and tissue samples were collected from these animals. Gaining access to all the organs, they were gathered and processed for histological technique with staining hematoxylin and eosin and examination with the assistance of the light microscope.

III. RESULTS AND DISCUSSION:

The histological examination of the kidney of control group revealed normal Most of the Bowman' capsules and the parts of nephron in shapes and (Fig. 1). The histological results indicated that the exposure to dexamethasone 0.3mg/kg b.w male rats distended Bowman's capsule, distended of capsular spaces there are shrinkages of glomerulus as well as proximal convoluted tubules contraction. The degradation of renal cells and there were not prominent of nuclei with varying shapes and sizes. There was distortion of renal cytoarchitecture and hypercellularity(Fig.2). Cellular propagation of endothelial or mesangial cells and inflammatory cells infiltration could be seen when usage the 0.5mg/kg b.w (Fig.3). Number of these cells appear either invalided or necrosis and another cell debris were founded in the luminal tubules. The tubules with degeneration appeared cells detachment from the basement membrane as well as cellular exudation filling the luminal tubules with vacillations of cytoplasm. Furthermore, nuclei of these cells also effected, where may be occur as karyolysis or pyknotic. The zones of focal hemorrhagic had been detected among renal tubules and there were congestions in the glomerulus and tubules Also, the capillaries among tubules dilated and basement membrane of these capillaries can be inflated. There were increase of degeneration of renal cells and varying in nuclei in shapes and sizes (Fig.4). The protective treatment with vitamin C and dexamethasone 0.3 mg/kg b.w appeared decrease in the histological changes in kidney compare with the administration of dexamethasone in groups (0.3, 0.5mg/kg). More histopathological protection was seen in the animals group treated with vitamin C and 0.5 mg/kg bw of dexamethasone compared to the 0.3 and 0.5 mg/kg bw dexamethasone (Fig.5 and 6). There were no changes in the vitamin C group (Fig 7).

![Figure 1: the kidney of male rat of control group, showed the normal Bowman’s capsule (A) normal, glomerulus and normal spaces of Bowman’s capsule (B), normal proximal convoluted tubules(C) and normal distal convoluted tubules (D) H&E,100x)](https://example.com/image1.png)

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Figure 2: the kidney of male rat with effect D at 0.3 mg/kg, noticed distortion of renal cytoarchitecture, distended Bowman's capsule(A), distended of capsular spaces(B), shrinkages of glomerulus(C), proximal convoluted tubules contraction(D) and hyper cellularity (E) (H&E100X).

Figure 3: the kidney of male rat with effect D at 0.5 mg/kg, noticed the congestions in the glomerulus and tubules (A), Cellular propagation of endothelial (B), shrinkages of glomerulus(C), cell debris in the luminal tubules (D) and zones of focal hemorrhagic (E)
Figure 4: the kidney of male rat with effect D at 0.5 mg/kg, noticed nuclei with varying shapes and sizes, there were areas of necrosis include (pyknotic nuclei (A), karyohexis nuclei (B) and karyolsis nuclei (C) degeneration appeared cells detachment from the basement membrane (D) and destruction of tubular walls (E) (H&E400X).

Figure 5: The kidney with Vitamin C and D at 0.3 mg/kg. b. w showed decrease in the histological changes of kidney compare with the administration of dexamethasone in groups (0.3,0.5mg/kg) decrease of changing Bowmn capsule (A), decrease in distended of bowman capsule space (B) and decrease in effect of distal convoluted tubules (C), decrease in effect of proximal convoluted tubules (D) and less of shrinkage of glomerulus (H&E100X).
Figure 6: the kidney with Vitamin C and D at 0.5 mg/kg. b. w showed decrease in the histological changes of kidney compare with the administration of dexamethasone in groups (0.3, 0.5mg/kg) decrease of changing of Bowman capsule (A), decrease in distended of bowman capsule space (B) and decrease in effect of renal tubules (C), less of shrinkage of glomerulus (D) and less congestion (E) (H&E,100x).

Figure 7: the kidney of male rat of administration with vitamin C 500 mg/kg b.w group, noticed the normal renal corpuscles (A) normal glomerulus and normal spaces of Bowman’s capsule (B) and normal renal tubules(C) (H&E,100x).

Our findings agree with those by (Sekita-Krzak et al., 2004) had revealed that D induce architectural alteration of dilatation of the kidney spaces in renal corpuscles and dilatation of the lumen of the proximal convoluted tubules.

Dexamethasone can stimulate free radical formation. Therefore, it can be claimed with great certainty that Dexamethasone induces oxidative stress. Kidney cells can produce free radicals in glomerular mesangial and
endothelial cells and in tubular epithelial cells. Epithelial cells of proximal tubules are very sensitive to the effects of oxygen free radicals as 50% of cells die after being exposed to the effect of H2O2. These free radicals destroy the glomerular basement membrane, impair the tubular function, degrade the collagen and other components of matrix. Because of potential gentamicin nephrotoxicity (Randjelovic et al., 2012).

Moreover, our results are in line with those by (Ahmed, 2014) has uncovered that vitamin C plays a role in preventing the damaging effects of dexamethasone, in which normal histological architecture of the renal cortex was altered after malathion therapy. It was clear that the glomerular basement membrane had expanded. Tubular lining epithelial vacuolation was extensive, and heterochromatin aggregates in most nuclei had expanded. With the absence of cristae, the mitochondria seemed disordered. When compared to the control, the diameter of renal corpuscles and renal tubules increased, whereas tubular epithelium height fell dramatically. Accompanying vitamin C administration resulted in a moderate enhancement in the prior results.

The present observation was similar to study (Kilany et al., 2020) The numerous studies revealed that vitamin C medications or therapies improved kidney function, reduced renal inflammation. Our study agrees with Acharaya et al (2013) Co-administration of vitamin C along with gentamicin significantly prevented nephrotoxicity by virtue of its antioxidant effect.

REFERENCES: