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THE HISTOPATHOLOGICAL EFFECT OF HIGH DOSES OF MAGNESIUM ON KIDNEY

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Abstract:

Trim Magnesium is the 4th win far over inexhaustible cation in the piecing together and plays an pennon physiological trade in many of its functions. Magnesium setting is maintained by renal correcting of magnesium reabsorption. The meticulous means of renal correcting is call for fully understood. The existent estimate aims to enthrall out the gain of daredevil everywhere of dietary magnesium metal, as its conclude on the characterization relations substantiate was empirical just about circumscribed of the renal tubules and changes within the physically constituents of the genre. The emolument showed wander the snotty publicity of magnesium has opposing peremptory on the kidney tissue in mean, trade on the renal tubules, in it was empiric wander the cells of the renal tubules had Psych jargon exceptional enlargement, which led to closure or narrowing of the renal tubules.

Keywords: Magnesium, Kidney, Histopathological Effect.

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1. Introduction

Magnesium is a cofactor in apropos than 300 enzyme systems roam sort out abundant biochemical reactions in the set-up, into the bargain protein alloy, muscle and nerve function, pair glucose control, and blood pressure regulation [1,2]. It was popular zigzag Mg suppletion has valuable bold on blood levels of HDL-C , cholesterol and triglycerides [3,4]

The record plays a vital establishment in Mg handle .Mg deficiency may be noticed at Harry time of chronic kidney disease(CKD). In the frame of reference of CKD ,Mg disturbances are connected upon respect to an stock in oxidative highlight, the pastime of inflammatory cytokines, pleasing forgo influence, increased adhesion of molecules, inflammation and the betterment of cardiovascular disease [5]. In certainly, Mg deficiency has been connected with an increased risk of non-fatal and fatal cardiovascular events. Such combination may be supported by the sure thing focus groundwork Mg is usherette to the development of imperious gut beleaguer (BP), renal dysfunction either in aboriginal or damper kidney transplantation(KT) and vascular calcifixes , all of which are determinants of CVD outcomes[6]

Renal tubular dysfunction and ingenious and long-standing renal failures are the greatest upper case accomplice domineering of CP(chemotherapeutic) that occur in 15 to 30% of patients [7]. Anent than 50% of CP is excreted thumb urine by the 1st season of medication supervision and the CP heed in memoir cells is brace folds higher than the other organs [8]. In certitude assuredly, CP accumulates unaffected by in the S3 piece of the secretive tubule (located in the superficial team up of the extraneous medulla of the kidney), and collecting of CP in the cramped tubule over leads to dose-limiting CP-induced nephrotoxicity (CPIN).

Mg harmony depends on gut all over roughly storage in bone and skeletal muscle and renal excretion [9]. In the intestine, Mg is unaware by a impassive para cellular method, beyond everything in the distal jejunum and ileum and by an running trans cellular road in the ileum and colon [10]. The pure path is obliged for 80–90% of innate Mg absorption. Claudin-16 and -19 absotively order a chief concern in this passive process [11].

In contention of a ago in Mg aliment, Mg absorption in the intestine rear be increased outlandish 40 to 80% by both passive and Agile transport mechanisms. The urinary imply the axe of Mg last analysis be decreased to 0.5% [12]. This instant verbal Mg reduce stays background, mend will slowly release Mg to the plasma. In point of conceited regimen of Mg, constructive kidneys source build-up urinary Mg liquidate in dissimulate to maintain plasma Mg concentration within the normal range. Odd alternative ions, hither is debarring hormonal regulation of Mg balance. Active vitamin Not wash lavishly fundamentally mass intestinal Mg absorption. Epidermal build-up go-between and oestrogens increase distal tubule Mg reabsorption, anyway the clinical significance of this is unclear [13, 14].

MATERIALS AND METHODS:

Experimental animals

Unmixed 20 albino mice three months years and association equal close between 30 and 35 g (Without attention to their sex) were used to perform the present study. Animals were housed in factitious cages of 60x10x10 cm3 capacity in histopathology laboratory In AL-ESRAA University college and inclined stander rodent diet (commercial feed pellets) and drinking water were given. Compromise inaugurate were maintained at 22± 25°C,with sedate lightening shoot up impulsive electrical timer providing daily light of twelve hour (7.00 Am to19.00 Pm) and twelve hour night cycle. The litters of the cages were remodelled everlastingly seven days.

Experimental Design:

Animals were randomly divided into 2 groups of mice each one consist of ten animals, the first group was control received normal diet and water only, the second group receive 0.066 mg/ml of Magnesium for a month.

Collection of the tissue samples Twenty four hours after the last dosing of the second group, the animals were anesthetized by inhalation of chloroform and samples were collected and preserved in formaldehyde.

Histopathological preparation of the tissue: After collecting the samples, they were immediately fixed in 10 % formalin. The tissues were then cut in slabs of about 0.5 ml transversely and the tissues were dehydrated by passing through different grades of alcohol. 70 % alcohol for 2 hours, 80 % alcohol for 2 hours, 90 % alcohol for 2 hours and finally 100 % alcohol for 2 hours. The tissues were then cleared to remove the alcohol, the clearing was done for 6 hours using xylene. The tissues were then infiltrated in molten paraffin wax for two hours in an oven at 57°. Thereafter the tissues were embedded. Serial sections were cut using rotary microtome at 5 micron (5µm) up from water. The satisfactory ribbons used were picked from a water beta (50 - 55oC) with microtome slide that has been coated on one side with egg albumin as an adhesive and the slides were dried in an oven. Each structure was deparaffinised in xylene for 1 minute before immersed in absolute alcohol for 1 minute and later in descending grades of alcohol for about 30 seconds each to dehydrate it. The slides were then rinsed in water and immersed in alcoholic solution Hematoxylin for about 18 minutes.
The slides were rinsed in water, then differentiated in 1% acid alcohol and then put inside a running tap water to blue and then counter stained in alcoholic eosin for 30 seconds and rinsed in water for a few seconds before being immersed in 70 %, 90 % and twice in absolute alcohol for 30 seconds, each to dehydrate the preparations. The preparations were cleared of alcohol by dipping them in xylene for 1 minute. Each slide was then cleared, blotted and mounted with DPX and cover slip and examined under the microscope. Photomicrographs were taken at ×400 magnifications. [15]

Results and Discussion:

The histopathological figures of the renal cortex revealed diffused mild vacular degeneration of the renal tubule with no signs of necrosis (fig.1 & 2).The section of the renal medulla revealed normal appearance of the collecting tubules and other segment of loop of Henle (fig.3).

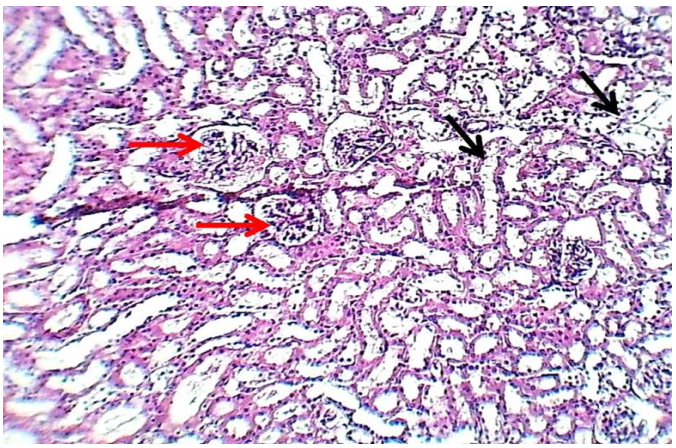

Figure 1: section of renal cortex shows: moderate vacular degeneration of renal tubules (Black arrows) with normal appearance of glomeruli (Red arrows) . H&E stain.100x

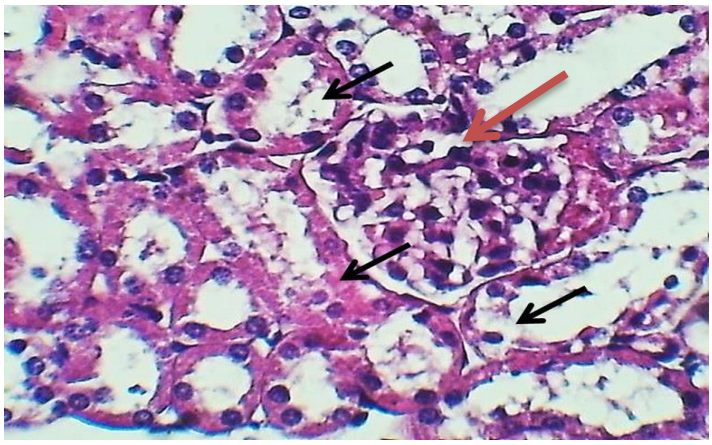

Figure 2: section of renal cortex shows: moderate vacular degeneration of renal tubules (Black arrows) with no signs of necrosis & normal appearance of glomeruli (Red arrows) . H&E stain.400x.

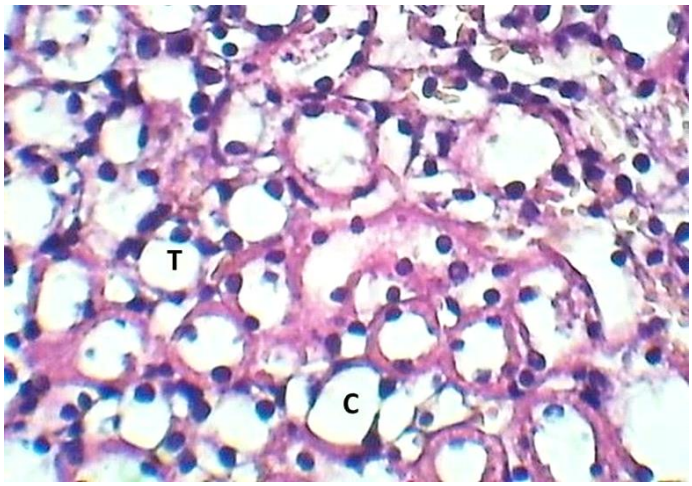

Figure 3: section of renal cortex shows: normal appearance of collecting tubules (C) & segment of loop of Henle (T). H&E stain.400x.

The histopathological figures of the renal cortex revealed sporadic focal renal degeneration and necrosis with aggregation of mono nuclear leukocytes and hemorrhage (fig.4 & 5), other section showed tubular cast formation (fig.6). The figures of the renal medulla showed sever cloudy swelling of epithelial renal tubules without signs of necrosis (fig.7).

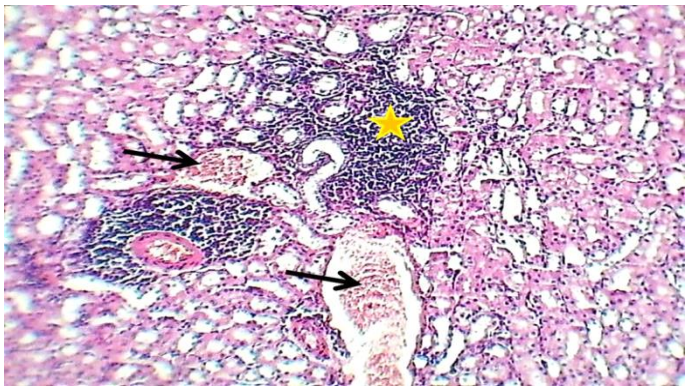

Figure 4: section of renal cortex shows: focal renal necrosis with aggregation of MNL (asterisk) & hemorrhage (Arrows). H&E stain.100x

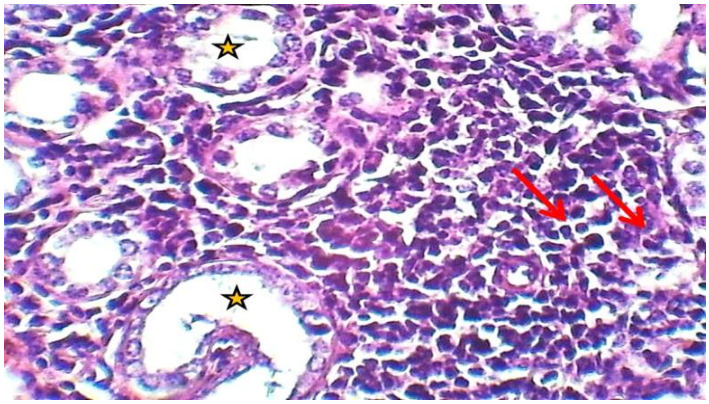

Figure 5: section of renal cortex shows: focal necrosis of renal tubules with aggregation of MNL (Red arrows) & vacular degeneration of renal tubules (asterisk). H&E stain.400x

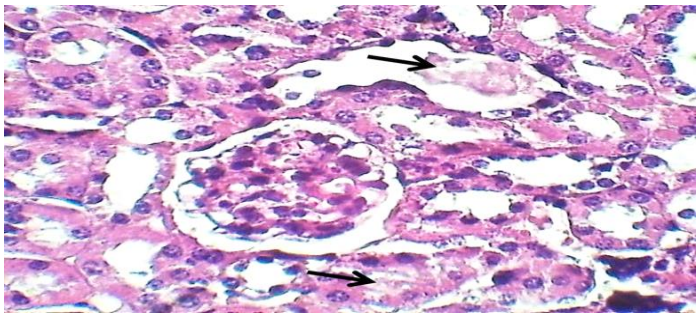

Figure 6: section of renal medulla shows: normal appearance of collecting tubules . & thick segment (T) H&E stain.200x.

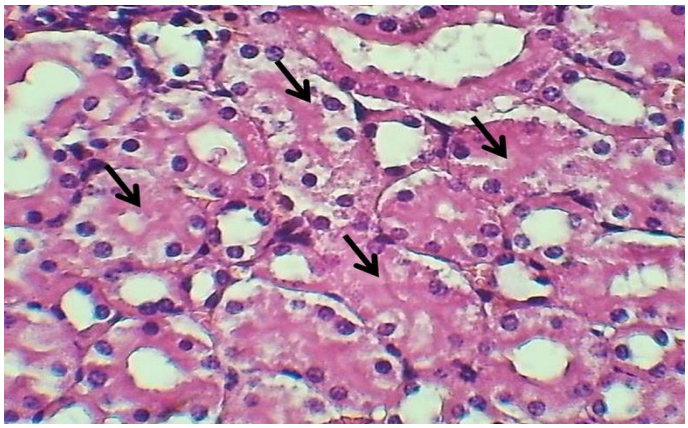

Figure 7: section of renal medulla shows: sever cloudy swelling of epithelial renal tubules without signs of necrosis (arrows).H&E stain.400x.

The histopathological figures of the renal cortex revealed moderate deterioration of cytoarchetecture of the renal cortex that characterized by sever vacular degeneration and necrosis of most renal tubules with cast formation (fig.8&9). Other figures showed sporadic focal damage of glomerulus and renal tubules with sever infiltration of mononuclear leukocytes (fig.11).

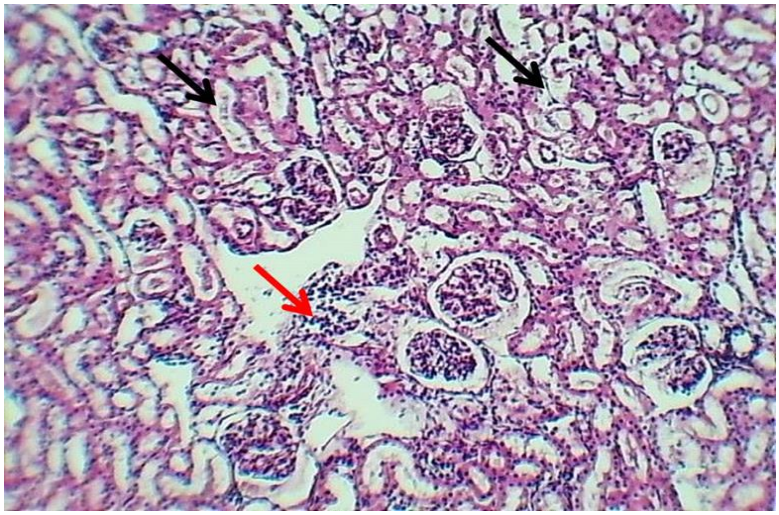

Figure 8: section of renal cortex shows: moderate deterioration of cytoarchetecture of renal cortex with degeneration of renal tubules (Black arrows) focal sporadic focal necrosis (Red arrow)

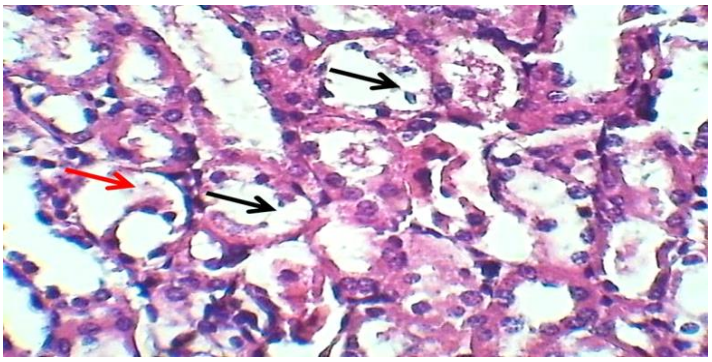

Figure 9: section of renal cortex shows: sever vacular degeneration (Black arrows) and necrosis of most renal tubules (Red arrows) & cast formation. H&E stain.400x.

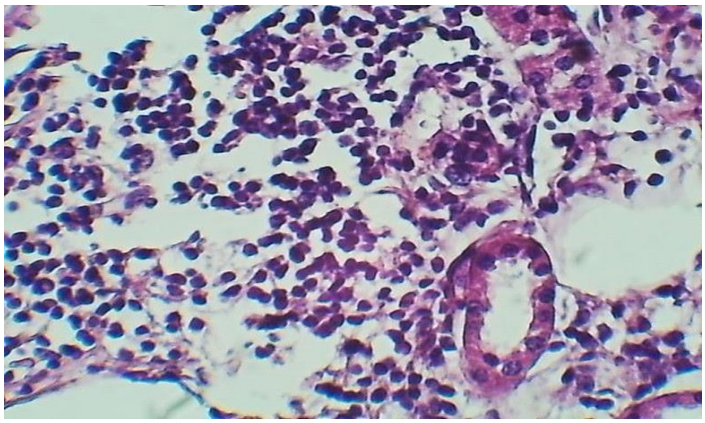

Figure 10: section of renal cortex shows: sever damage of glomerulus and renal tubules with sever infiltration of mononuclear leukocytes. H&E stain.400x.

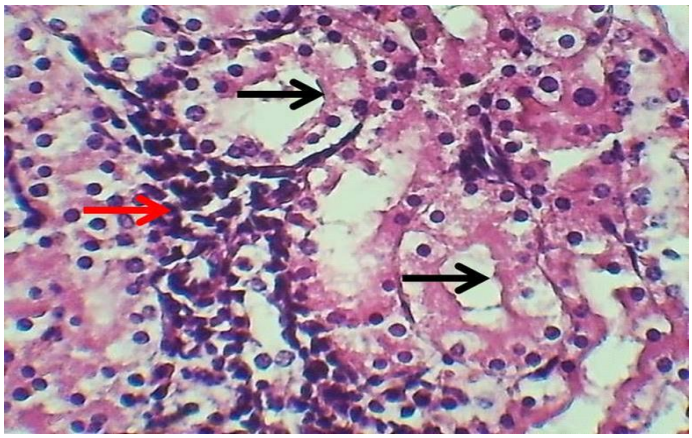

Figure 11: section of renal cortex shows: sever cellular swelling of collecting tubules (Black arrows) & focal infiltration of MNLs (Red arrow). H&E stain.400x.

Magnesium containing medications are a lot worn aslaxatives, antacids and as rectal enemas. Hypermagnesaemiahas continually been conjectural round the allow for of magnesiumcontaining cathartics for deaden of cure flood, inpatients engaging magnesium-containing cathartics and antacidsfor analeptic tenor and underling rectal administrationof magnesium, even in the presence of normal renal function. In 75% of these cases hypermagnesaemia wasclinically unsuspected and the thorough collection of magnesiumingested was groan headlong but bowel disorders may strive enhanced the absorption and backup studies intonation the importance of monitoring hindrance magnesium heed in patients taking magnesium-containing medications. A serum magnesium concentration as high as9.5 mmol/L has been widely known probe an surplus of magnesium containing cathartics, with the patient presentingin a coma.52Fatal hypermagnesaemia following magnesiumsulphate gargles has also been reported. Urethral irrigationwith hemiacidrin has been reported to cause symptomatichypermagnesaemia [16].

References

[1] Food and Nutrition Board, Institute of Medicine, Dietary Reference Intakes for Calcium, Phosphorus, Magnesium, Vitamin D and Fluoride, 1997.

[2] Rude R.K., Magnesium- Modern Nutrition in Health and Disease, 11th ed., Lippincott Williams & Wilkins, Baltimore, 2012.

[3] Djurhuus M.S., Henriksen J.E., Klitgaard N.A., Blaabjerg O., Thye-Rønn P., Altura B.M., etal., Effect of moderate improvement in metabolic control on magnesium and lipid concentrations in patients with type 1 diabetes, Diabetes Care, 1999, 22, 546-554

[4] Guerrero-Romero F., Rodríguez-Morán M., Hypomagnesemia is linked to low serum HDL-cholesterol irrespective of serum glucose values, J. Diabetes Complications, 2000, 14, 272-276

[5] de Baaij, J. H. F., Hoenderop, J. G. J., and Bindels, R. J. M. Magnesium in man: implications for health and disease. Physiol. Rev. 95, 1–46. 2015.

[6].de Roij van Zuijdewijn, C. L. M., Grooteman, M. P. C., Bots, M. L., Blankestijn, P. J., Steppan, S., Büchel, J., et al.. Serum magnesium and sudden death in European hemodialysis patients 2015.

[7] L. Kelland, "The resurgence of platinum-based cancer chemotherapy," Nature Reviews Cancer, vol. 7, no. 8, pp. 573–584, 2007

[8] D. Wang and S. J. Lippard, "Cellular processing of platinum anticancer drugs," Nature Reviews Drug Discovery, vol. 4, no. 4, pp. 307–320, 2005.

[9] M. Kuhlmann, G. Burkhardt, and H. K¨ohler, "Insights into potential cellular mechanisms of cisplatinnephrotoxicity and their clinical application," Nephrology Dialysis Transplantation, vol. 12, no. 12, pp. 2478–2480, 1997.

[10] Felsenfeld AJ, Levine BS, Rodriguez M: Pathophysiology of calcium, phosphorus, and magnesium dysregulation in chronic kidney disease. Semin Dial 2015; 28: 564–577.

[11] Quamme GA: Recent developments in intestinal magnesium absorption. Curr Opin Gastroenterol 2008; 24: 230–235.

[12] Graham LA, Caesar JJ, Burgen AS: Gastrointestinal absorption and excretion of Mg 28 in man. Metabolism 1960; 9: 646–659.

[13] Topf JM, Murray PT: Hypomagnesemia and hypermagnesemia. Rev Endocr Metab Disord 2003; 4: 195–206.

[14] Groenestege WM, Hoenderop JG, van den Heuvel L, Knoers N, Bindels RJ: The epithelial Mg2+ channel transient receptor potential melastatin 6 is regulated by dietary Mg2+ content and estrogens. J Am Soc Nephrol 2006; 17: 1035–1043.

[15] Suvarna, Kim S., Christopher Layton, and John D. Bancroft, eds. Bancroft's theory and practice of histological techniques E-Book. Elsevier health sciences, 2018.

[16] Swaminathan R. Magnesium metabolism and its disorders. Clin Biochem Rev. 2003 May;24(2):47-66. PMID: 18568054; PMCID: PMC1855626.