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Renalhistomorphometrical Changes in Wister Albino Rats (*Rattus Norvegicus)* Treated With The Amphotericin B And Aloe Vera

Wycliffe Onyango Rajoro[1], Domnic Oduor Marera[1], William Makacha Munyikombo[2], Edwin Uluma Wanjala[1]
Maseno University, Department of Human Anatomy, School of Medicine, P. O Box 333-40105 private bag Maseno Kenya[1]
Maseno University, Department of Medical Physiology, School of Medicine, P. O Box 333-40105 private bag Maseno Kenya[2]
***Corresponding author:** Wycliffe Onyango Rajoro, Orcid Id: Wycliffe Rajoro Onyango (0009-0003-1305-6433) - ORCID, Tell phone number: 0745316231*

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ABSTRACT

Amphotericin B is used in first line management of fungal diseases and despite its clinical effectiveness it has been associated withnephrotoxicity among the population that uses it. The histo-morphological changes within an organ can be used to assess the severity of pathological processes induced by a toxic urgent. Aloe Vera is a herb that is locally available in Kenya and is believed to contain antioxidant and inflammatory effects. To assess histo-morphometry of the kidney after administration of Aloe Vera and Amphotericin B among the Wister Albino rats of *Rattus Norvegicus.* Posttest true experimental design was adopted in this study.Modified resource equation was used to find a sample size of 25. Healthy Wister Albino Rats of *Rattus Norvegicus* species that weighed between 150mg- 250mg/kgbwt were adopted into the study. The animals were divided into experimental and control group and later the randomly separated into Amphotericin B group, HAV, MAV and LAV groups. The control was only fed, Amphotericin group was given feeds plus a once a day intraperitoneal 50mg/kgbwt of amphotericin B. The HAV, MAV and LAV groups were given a constant dose of once a day intraperitoneal 50mg/kgkbwt of amphotericin B plus a daily per oral 800, 400 and 200mg/kgkbwt of Aloe Vera respectively. On the fifteenth day all the animals were sacrificed, kidney excised and prepared histologically. The photomicrographs were taken and examined. The photomicrographs of the control were compared with the amphotericin group and the amphotericin group was further compared with other experiments. The obtained data from the study was reported qualitative and presented using figures. The amphotericin B, MAV and LAV groups presented dilated bowman's capsules, glomerulus space, distal and proximal convoluted tubules and shriked glomerulus capillaries as compared to the control and the HAV group. HAV group presented with the same histological findings as compared with the control, therefore, it demonstrated reno-protective effects of Aloe Vera on Amphotericin B induced nephrotoxicity.

***Key words**: Histomorphometry, Nephroprotection, Amphotericin B and Aloe Vera*

I. BACKGROUND

Histological changes are the microscopic features that can be detected during a pathological mediated process. The kidney has a vast histological field that can be examined to confirm the extend of its toxicity. The normal histology of the kidney can be compared with the one that has been affected to elucidate some changes after a pathological reaction.

The normal histology of the kidney is divided into two parts as follows the inner segment known as the medulla and the outer segment which is the cortex. The renal pyramid is arranged between the cortex and medulla. Nephrons are located within distinct parts of the cortex and medulla (Buys-Gonçalves, Sampaio, Silva, Pereira-Sampaio, & De Souza, 2020).

The cortex consists of renal corpuscles which contain glomerulus space, Bowman 's capsule, glomerulus capillaries, vascular and tubular pole. The bowman's capsules are composed of two layers the inner visceral and outer parietal layer. The parietal layer is lined by the squamous epithelium that is in continuous with the lumen of the proximal convoluted tubule. The visceral layer of the cortex consists of the glomerular capillaries (Edwin, Domnic, & Norman, 2023)

The histological parenchymal cells of the kidney are made up of two parts: the medulla and cortex. Almost the entire part of the parenchymal cells is made up of the urine collecting system called

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nephrons. This nephron drains into the calyces. The cortex part of the renin is dark in color and the medulla looks striped. Within the medulla there are renal pyramids, when the renal pyramids are covered by cortical tissue, they become renal lobe. Each renal lobe is divided into lobules that have a group of nephrons that empty specific places like papilla. The minor calyces empty into the major calyces and then into the renal pelvis. The cortex has a rich supply of blood and contains the renal capsule. The renal capsule contains the glomerular part of the nephron and the tubular system is located at the medulla(Hallgrímsson, Benediktsson, & Vize, 2003)

The glomeruli have three key filtration apparatus; the visceral layer of the renal capsule, endothelium, and the middle basement membrane. The basement membrane is complex and has three layers; lamina rara interna, lamina rara externa, and thick central lamina dense(Denic, Glassock, & Rule, 2021).

The tubular part is made up of three parts nephron loop, proximal, and distal tubes. The proximal tube consists of straight segments, its convoluted part is found within the renal cortex and all are covered by the simple cuboidal epithelium. The loop of Henle is covered by the simple squamous epithelium with no microvilli (McBride, 2016).

In a rat model induced with amphotericin B nephrotoxicity demonstrated microscopic features such as presence of necrotic area in the cortical region such as dilatation degeneration of proximal and distal convoluted tubules. The simple cuboidal epithelium had abundant hyperchromatic nuclei clearly seen. The medullary was not involved. The renal corpuscles were also affected (Parker et al., 2016).

This study aimed at solving kidney failure coursed by amphotericin B induced by nephrotoxicity among the population uses it.

II. METHODOLOGY

This study was conducted in one of the University in Western part of Kenya and acquired the necessary ethical approval before its commencement. The experimental only true posttestdesign was used in this study. The study adopted Wister albino rats of *Rattus Norgevicus* species as study subjects because of their long standing history involvement in drug exposed experimentalstudies and also share 80% of the genome with human beings. Modified resource equation was used to calculate the sample size of 25 from a sample of 250 Wister albino rats of*Rattus Norgevicus*.Healthy Wister albino rats of *Rattus Norgevicus* since initiation to carbonated cages and that also weighed 150- 250mg were introduced into the study. The 25 animals earlier divided into control and experimental groups. Later the experimental groups were further randomly separated into four groups of five animals each and labeled per group as amphotericin B, HAV high dose of aloe Vera, MAV –Medium dose of aloe Vera and LAV low dose of aloe Vera. The control group was only given feeds, and water *adlibitum.* The amphotericin B group was only given intra-peritoneal once a day dose of 50mg/kgbwt of amphotericin B per animal for 14 days. The HAV, MAV and LAV low dose of Aloe Vera groups were also given a constant dose of intra-peritoneal once a day dose of 50mg/kgbwt of amphotericin B per animal and followed by per oral 200, 400, 800mg/kgkbwt of Aloe Vera per animal respectively. The animals were sacrificed on the fifteenth day of the experimental. The excised kidneys were further fixed in formaldehyde, dehydrated in ascending percentage of alcohol, cleared, sectioned , embedded in a paraffin oil for sectioning , stained with hematoxylin and eosin. The prepared kidney slides were visualized using the Olympus Microscope focusing on the cortical region of the kidney and the renal corpuscles, proximal and distal convoluted tubules were observed. The photomicrographs were taken randomly separated per group. The photomicrographs were compared among the groups and reported qualitatively. Data were presented using figures.

III. RESULTS

The photomicrographs that had been taken were separated as per the groups. The glomerulus capillaries, glomerulus space, proximal and distal convoluted tubules, interstitial and vascular parts of the kidneys were examined and compared among the groups.

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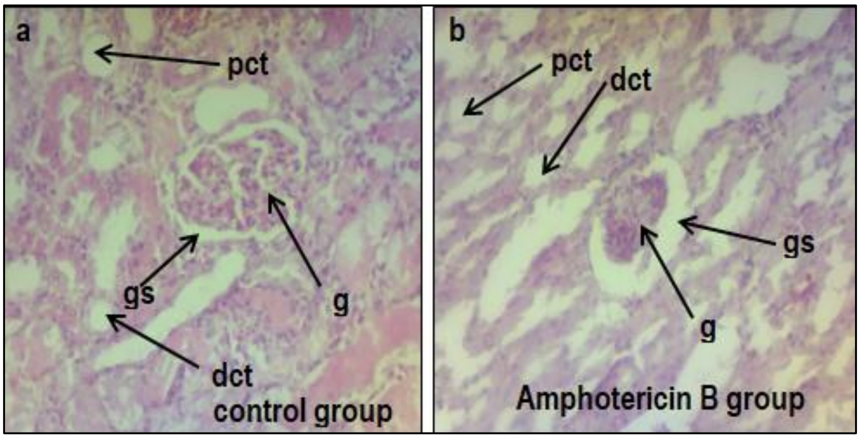

Figure 1: Photomicrograph of the kidney of control and Amphotericin B group × 100

Key: *Amphotericin B group was only given (50mg), Control group was only fed with water adlibitum*

The control group had normal histological findings of the kidney. Amphotericin B group portrayed histological changes such as shrinkage of the glomerulus, increase in the glomerulus space, dilated proximal and distal convoluted tubule (Figure 1).

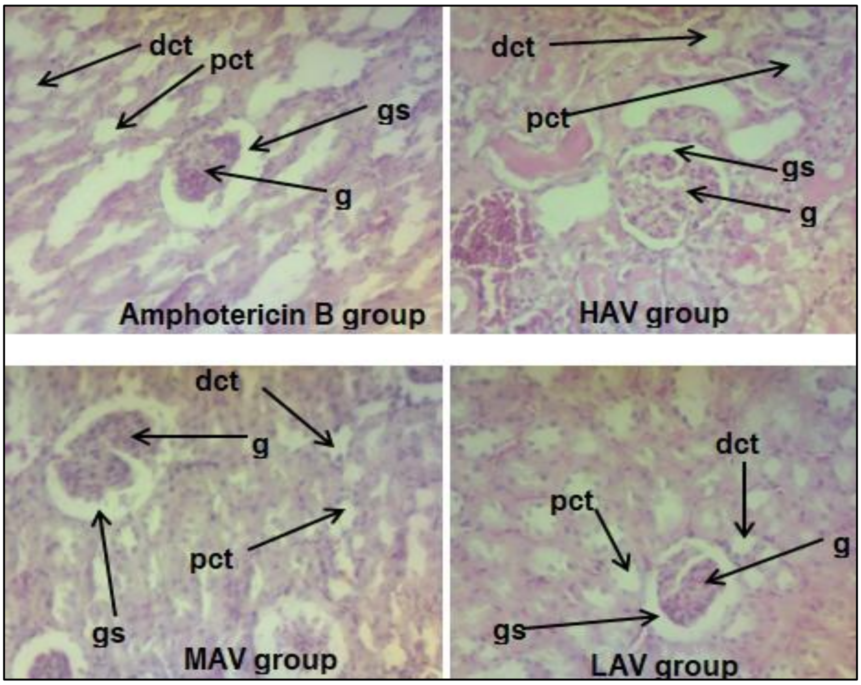

Figure 2: Photomicrograph of the kidney of Amphotericin B, HAV group, MAV group and LAV group
Key: *HAV- High dose of Alovera (800mg/k/bwt) + Amphotericin B group (50mg/k/bwt), MAV-Medium dose of Alovera (400mg/k/bwt) + Amphotericin B group (50mg/k/bwt) and LAV dose of Alovera (200mg/k/bwt) + Amphotericin B group (50mg/k/bwt)*

The medium dose group and the low dose group of the Aloe Vera displayed soame histological features as compared to the Amphotericin B group. They had dilated proximal and distal convoluted tubules, shrinkage of the glomerulus and increased glomerulus space. High dose group showed normal Histological findings (Figure 2) .

IV. DISCUSSION

Histomorphometry has been used by many researchers to elucidate the toxicity effects of a substance on an targeted organ (Wilson, Johnson, Magee, & Hoerr, 2018). This study focused on the cortical part of the kidney as per the groups and examined the histological architectural changes following administration of Amphotericin B and Aloe Vera. The control had only been feed *adlibitum* and was compared with the amphotericin group for confirmation of the kidney toxicity. Amphotericin B group was further compared with other treatment group to demonstrate nephroprotection.

The control group demonstrated normal histological findings; the amphotericin B group reported dilated glomerulus space, proximal and distal convoluted tubule, shrinked glomerulus capillaries as compared to the control group. Both the amphotericin B and control group had normal interstitial and vascular of the kidney histology (Figure1). The findings were in tandem with (Edwin et al., 2023)who also reported similar findings when he conducted a study on cisplatin induced nephrotoxicity and this suggested nephrotoxicity. The same study findings differed with the other authors such as (Ghadha, 2021)who reported inclusion of the hypotrophy of the kidney parenchyma cells and fat deposits with the interstitial part in doxorubicin induced nephrotoxicity. This could be attributed by the different points of stress target during metabolism of the drugs.

The study also reported that the MAV and LAV group demonstrated similar histological findings when compared with the amphotericin B group. This could be implying that the medium dose and the low dose (400,200mg/kbwt) respectively were unable to protect the kidney from amphotericin B nephrotoxicity(Figure 2). The study findings intermarried with the other literatures such as (Allan, Oyugi, & Nyabola, 2023)when he did a study on nephron-protection effects curcuma on sildenafil induced nephrotoxicity. This could be associated with the low concentration of the antioxidative agents MAV and LAV group to protect the kidney from the amphotericin B induced nephrotoxicity.

The study reported that the HAV among the treatment group had normal histological findings and was similar to the control group as compared to the amphotericin B group. Had normal glomerulus capillaries, glomerulus space, proximal and distal convoluted tubule, interstitial and vascular part. These study findings concurred with (Waswa, Korir, Masoni, & Khisa, 2024) when he conducted a study on *Rosmarinus Officinalis* nephroprotective effects on gentamycin induced nephrotoxicity. The study findings suggested nephroprotection.

V. Conclusion

Histomorphological changes were able to demonstrated the renoprotectiveness of the Aloe Vera on Amphotericin B induced nephrotoxicity.

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