



ISSN : 2321-9602

Volume 4, No. 1, March 2016

Indo-American Journal of Agricultural and Veterinary Sciences



www.iajavs.com

editoriajavs@gmail.com or editor@iajavs.com



Research Paper

HISTOLOGICAL STUDIES ON THE ADRENAL GLAND OF HORSE

Prasanth Babu A^{1*}, Jagapathi Ramayya P² and Raj Sekhar U³

*Corresponding Author: **Prasanth Babu A** ✉ prasanthankem@gmail.com

The adrenal gland of horse was covered by a thick capsule. The parenchyma of adrenal gland was distinctly divided into adrenal cortex and medulla. The cortex showed three distinct zones, viz., zona glomerulosa, zona fasciculata and zona reticularis from outside inward. Zona Intermedia layer was also observed between the zona glomerulosa and zonafasciculata. The medulla showed outer darker and inner lighter zone of cells and sympathetic ganglion. A central vein was also noted in the center of the medulla.

Keywords: Adrenal gland of horse, Cortex and medulla

INTRODUCTION

Adrenal glands are located at the superior pole of each kidney, they are critical regulators of metabolism, behavior and stress. The adrenals also produce the catecholamines viz., epinephrine and norepinephrine. These hormones are responsible for the “fight and flight” response when a threat is sensed. Monica Morganti (2010) examined blood serum cortisol a substance primarily produced by the adrenal gland in mares with elevated testosterone levels. According to morganti, the data collected suggested that the adrenal gland could increase both testosterone and cortisol levels in mares, leading to aggressive or stallionlike behavior.

MATERIALS AND METHODS

Adrenal glands were collected from 3 horses dissected at the department of Veterinary

Anatomy, College of Veterinary Science, Tirupati. Adrenal glands were fixed in 10% neutral buffered formalin and were processed. 6 µm thick paraffin sections were stained with haematoxylin and eosin method for general histomorphology (Luna, 1968).

RESULTS AND DISCUSSION

Capsule

The adrenal gland is surrounded by a thick capsule (Figures 1 and 2). It is composed of collagen, elastic and smooth muscle fibres. The capsule comprised of outer and inner collagenous fibrous layer and enclosed a middle smooth muscle layer. Similar findings were also noted in the capsule of adrenal glands of elephant by Krammer *et al.* (1991) and there was no demarcation in the arrangement connective

¹ Assistant Professor, Department of Veterinary Anatomy, College of Veterinary Science, Tirupati, Chittoor District, Andhra Pradesh, India – 517502.

² Professor and University Head, Department of Veterinary Anatomy, College of Veterinary Science, Tirupati, Chittoor District, Andhra Pradesh, India – 517502.

³ Postgraduate Student, Department of Veterinary Anatomy, College of Veterinary Science, Tirupati, Chittoor District, Andhra Pradesh, India – 517502.

Figure 1: Photomicrograph of adrenal gland showing capsule (C), zona glomerulosa (ZG), zona fasciculata (ZF), zona reticularis (ZR) and medulla (M) H&E X 100

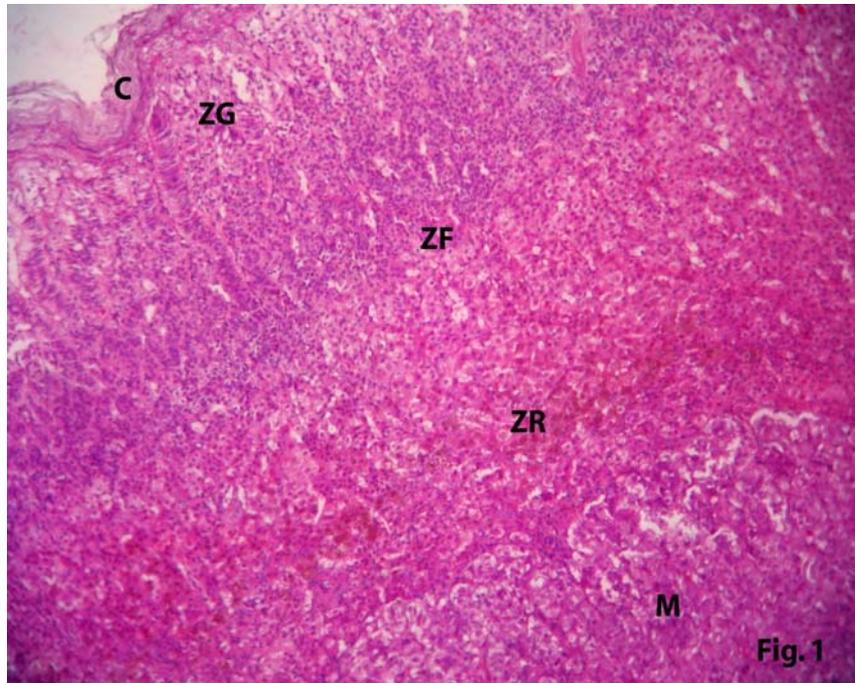
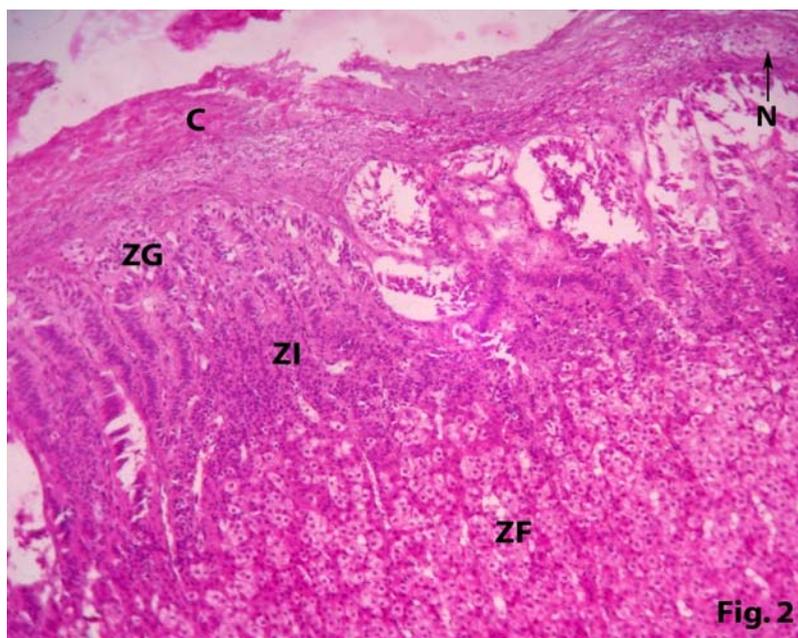


Figure 2: Photomicrograph of adrenal gland showing capsule (C), cellular nodule (N), zona glomerulosa (ZG), zona intermedia (ZI) and zona fasciculata (ZF) H&E X 100



tissue in capsule of buffalo and pig as reported by Sohal and Chaturvedi (1962) and Prasanth *et al.* (2008) respectively. Numerous fibrous trabeculae entered at right angles from the capsule through the cortex towards the medulla. Bundles of collagen fibers forming thin septa arise from the trabeculae and ramify between the secretory cells. Similar observations were also noted by Vukovic *et al.* (2009) in dolphins, Krammer *et al.* (1991) in elephants and Prasanth *et al.* (2008) in pigs.

In the capsule cellular nodules were observed, these are surrounded by thin connective tissue capsule (Figure 2). Dyce *et al.* (1996) reported that in domestic animals accessory aggregation of the cortical tissue can be incorporated within the several organs, but they most frequently tied to the adrenal gland capsule. But in our study these cells resembles the inner zone cells of medulla can be considered as accessory adrenal tissue. Similar results were observed by Vukovic *et al.* (2009) in dolphins.

ADRENAL PARENCHYMA

The parenchyma of adrenal gland was distinctly divided into adrenal cortex and medulla. The cortex showed three distinct zones viz., zona glomerulosa, zona fasciculata and zona reticularis (Figure 2).

ZONA GLOMERULOSA

Zona glomerulosa is present beneath the capsule and cells were arranged as arcades and curved clusters (Figure 2). These clusters are separated by distinct trabeculae. Cells were high cuboidal to columnar cells with eosinophilic cytoplasm and consist of elongated basophilic vacuolated nuclei. Blood capillaries could be found between the clusters (Figure 2). Similar observations were also noted by Trautmann and Fiebiger (1957) and Dellmann (1993) in equines and Krammer *et al.* (1991) in elephants.

In the present study between the zona glomerulosa and zona fasciculata smaller and

more intensely stained eosinophilic cells arranged as clusters or rosette shaped. Some authors named this zone as zona Intermedia as reported by Dellmann (1993) in cow, sheep and goat and Nicander (1952) in horse, cow and rabbit.

ZONAFASCICULATA

Zona fasciculata is the largest zone among the different zones of cortex. It is composed of radially oriented cords of cells (Figure 2). The cords are usually two cell layer thick. These cells were large and polygonal shaped with centrally located nucleus. The cytoplasm of the cells is spongy due to the presence of lipid droplets. In between the cords of cells sinusoids are present. Prasad and Yadav (1973) and Sohal and Chaturvedi (1962) in buffalo and Prasanth *et al.* (2008) in pigs recorded columnar type of cells. Whereas Vukovic *et al.* (2009) in dolphins, Krammer *et al.* (1991) in elephants reported cuboidal to polyhedral cells in zona fasciculata.

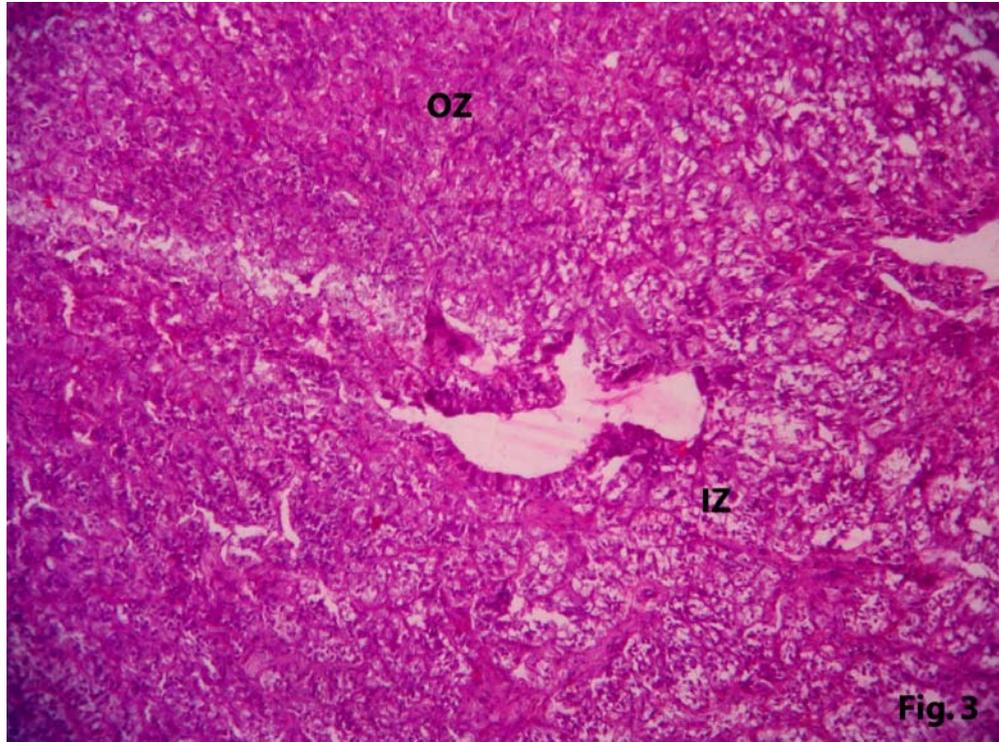
ZONA RETICULARIS

Zona reticularis is the deepest layer of adrenal cortex. Zona reticularis forms an irregular network of anastomosing cell cords. Cells of cords are large polyhedral cells with dark nuclei. Cells are more eosinophilic with fewer lipid droplets unlike the cells of zonafasciculata. Between the cords of cells dilated capillaries are appeared (Figure 2). Similar observations were also reported by Pawar (1998) in donkeys Vukovic *et al.* (2009) in dolphins, Krammer *et al.* (1991) in elephants and Prasanth *et al.* (2008) in pigs.

MEDULLA

The junction between the cortex and medulla is irregular and well defined (Figure 2). The medulla contained outer darker zone and inner lighter zone of cells with central vein in the middle (Figure 3). These cells are often referred to as chromaffin cell, since these cells are showing affinity towards the chromium salts of fixatives.

Figure 3: Photomicrograph of medulla of adrenal gland showing outer zone (OZ) and inner zone (IZ) H&E X 100



The outer zone is comprised of large, dark stained polygonal cells with somewhat eccentrically located nucleus. Connective tissue fibers are not abundant in this region. The inner part is composed of cluster of cells surrounded by clearly visible connective tissue fibers. The cells showed translucent cytoplasm and dark nuclei. In both the regions of medulla large blood vessels and numerous sinusoids are present. However Dellmann (1993) was described that in horse, cow, sheep and pigs the medulla was divided into two areas, the outer area of the more intensely stained epinephrine secreting cells, the inner area built of weakly stained norepinephrine secreting cells. Such arrangement of cells was also observed by Prasanth *et al.* (2008) in pigs, Prasad and Yadav (1973) in buffaloes and Krammer *et al.* (1991) in elephants. Dense network of preganglionic sympathetic nerve fibers are observed at

different places of medulla. Sympathetic ganglions were also observed between the chromaffin cells as reported by Dellmann (1993) in domestic animals.

CONCLUSION

The adrenal gland of horse was covered by a thick capsule it was comprised of outer and inner collagenous fibrous layer and enclosed a middle smooth muscle layer. The parenchyma of adrenal gland was distinctly divided into adrenal cortex and medulla. The cortex showed three distinct zones viz., zona glomerulosa, zona fasciculata and zona reticularis from outside inward. Zona glomerulosa was arranged as arcades and curved clusters contained high cuboidal to columnar cells with eosinophilic cytoplasm and consist of elongated basophilic vacuolated nuclei. Zona Inter media layer was also observed between the zona glomerulosa and

Zona fasciculata. Zona fasciculata was composed of radially oriented cords of two cells thick contained large polygonal shaped cells with centrally located nucleus. Zona reticularis forms an irregular network of anastomosing cell cords. Cells of cords are large polyhedral cells with dark nuclei. The medulla showed outer darker and inner lighter zone of cells, sympathetic ganglion. The outer zone was comprised of large, dark stained polygonal cells with somewhat eccentrically located nucleus and the inner part was composed of cluster of cells surrounded by clearly visible connective tissue fibers. The cells showed translucent cytoplasm and dark nuclei. A central vein was also noted in the center of the medulla.

REFERENCES

1. Dellmann H D (1993) "Text book of Veterinary Histology", 4th Ed. Lea and Febiger, Philadelphia.
2. Dyce K M, Sack W O and Wensing C J G (1996), "Veterinary Anatomy", Philadelphia, London, New York, St. Louis, Sydney, Toronto: W B Saunders Company, pp. 541-542.
3. Krammer B, Teixeira M and Hattingh J (1991), "The histology of the adrenal gland of the African Elephant (*Loxodonta africana*)", *South African Journal of Zoology*, Vol. 26, No. 4, pp. 193-198.
4. Luna L G (1968), *Manual of Histological Staining of the Armed Forces Institute of Pathology*, 3rd Edn. New York, McGraw Hill book company.
5. Monica M. (2010) "Stallionlike Behavior in the Mares: The Role of Adrenal Gland", *American Association of Equine Practitioners summit*, Dec 4-8, Baltimore.
6. Nicander L (1952), "Histological and Histochemical studies on the adrenal cortex of domestic and laboratory animals", S. Karger, New York.
7. Pawar (1998), "Histological and Histochemical Studies on the Endocrine Glands of Indian Donkey", Ph.D. thesis submitted to the University of Agricultural Sciences, Dharwad.
8. Prasad G and Yadav R C P (1973), "Histological observations on the adrenal medulla of the Indian buffalo", *Indian Journal of Animal Science*, Vol. 43, No. 2, pp. 125-128.
9. PrasanthBabu A, Gautam A K, Ananda Rao K, JagapathiRamayya P, Chandrasekhara-rao T S and Rajendranath N (2008), "Histological Studies on the Adrenal Gland of Pig (*Susdomesticus*)", *Indian Journal of Veterinary Anatomy*, Vol. 20, No. 1, pp. 55-57.
10. Sohal H S and Chaturvedi R P (1962), "Adrenal glands of Indian Buffalo", *Journal of Anatomical Society of India*, Vol.11, pp. 46-48.
11. Trautmann A and Fiebiger J (1957), *Fundamentals of the histology of domestic animals*, Comstock Publishing Associates, Ithaca, New York, pp. 142-145.
12. Vukovic S, Lucic H, Zivkovic A, DurasGomercic M, Gomercic T and Galov A (2010), "Histological Structure of the Adrenal Gland of the Bottlenose Dolphin (*Tursiops truncatus*) and the Striped Dolphin (*Stenellacoeruleoalba*) from the Adriatic Sea", *Anatomia Histologia Embryologia*, Vol. 39, pp. 59-66.



Indo American Journal of Agricultural and Veterinary Sciences

Hyderabad, INDIA. Ph: +91-09441351700, 09059645577

E-mail: editoriajavs@gmail.com or editor@iajavs.com

Website: www.iajavs.com

