

## **MORPHOLOGICAL AND HISTOCHEMICAL STUDY OF ADRENAL GLAND IN LOCAL DOMESTIC PIGEONS ( *Columba livia domestica*) IN BASRAH PROVINCE**

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(Received 30 October 2017 ,Accepted 16 November 2017)

**Keywords:** Adrenal gland , Pigeons , Histomorphological.

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### **ABSTRACT**

The present study was designated to illustrate the morphological , histological and histochemical features of adrenal gland of local domestic pigeons (*coulumba livia domestica*) in Basrah province . Ten adrenal glands used in the study collected from Karrmat Ali Village, Iraq . Immediately after collection the adrenal glands were subjected for morphological histological and histochemical study. The study revealed that the pigeon have paired small glands located in the abdominal cavity at the anterior pole of the kidneys . The gland was elongated in shape and showed creamy or grayish in color. Histologically , the glands was unsheathed with thin fibro – elastic connective tissue capsule containing many blood vessels . The cortical tissues were arranged into two zones; peripheral (sub capsular) and inner (central). The cells of sub capsular are arranged in curved cord , each cord had polyhedral acidophilic cells. On the other hand, the histological examination of the cortex of adrenal glands contains autonomic ganglia associated with glandular capsule ,contains nerve cells and fibers. The inner cortical cells showed straight and curved cords in longitudinal sections, each composed of two types of cells acidophile cells and chromaffin cells .The Histochemical study revealed presence lipids droplets in the gland , in addition to elastic fibers in the capsules and among the cells of glands .

## **INTRODUCTION**

The domestic pigeon was derived from the rock pigeon, that considered the oldest domesticated birds[1] . The adrenal gland considered of a vital organs in

regulating body metabolism like carbohydrate, protein, lipid and electrolyte metabolism [2] .As well as it plays an important role in stress response , immune function and regulates blood pressure, in addition to that removing of the adrenal gland in birds leads to death [3,4] . The adrenal glands of birds are paired Organs , yellow- or orange in color and pear or triangle in shape located near the superior poles of kidneys and embedded in adipose tissue[5] while in chicken located cranio medially and yellowish in color [3].

The adrenal gland is composed of two distinct portions, an outer cortex that derived from mesoderm and an inner medulla that derived from ectodermal neural crest origin [6].The adrenal cortex in domestic mammals forms the bulk of the adrenal gland that subdivide into at least three regions or zones while the medulla forms the center of gland and composed of two types of secretory cells, chromaffin cell and sympathetic ganglion cell[7]. While studies on adrenal glands of birds are unique to domestic mammals , it mentioned the cortical and medullary tissues of the adrenal gland are found always intermingled[8]. Purpose of this study was to designed to study the general morphology, the cellular and sub cellular structures of the adrenal glands in domestic pigeon in Basrah province since there is no studies on this types of birds and this would contribute to understanding of the features of the adrenal gland in birds generally , and in pigeons particularly

## **MATERIAL AND METHODS**

The study was carried out in the college of veterinary medicine, university of Basrah , Iraq in the periods from 1<sup>st</sup> June to 30 June 2017 . Five healthy adult pigeons were used to conduct the current study . The pigeons were obtain from local market in Karrmat Ali Village ,after that the birds was anesthetized by chloroform to study the morphological , histological and histochemical assay . The birds leave for 2-5 minutes to complete anesthesia , after that the birds were euthanized and fixed on anatomy plate to recorded Shape, color and position of the glands .For the histological examination , the adrenal gland was collected immediately after euthanizing pigeons and immersed in fixative 10%formalin for 72 hours. After

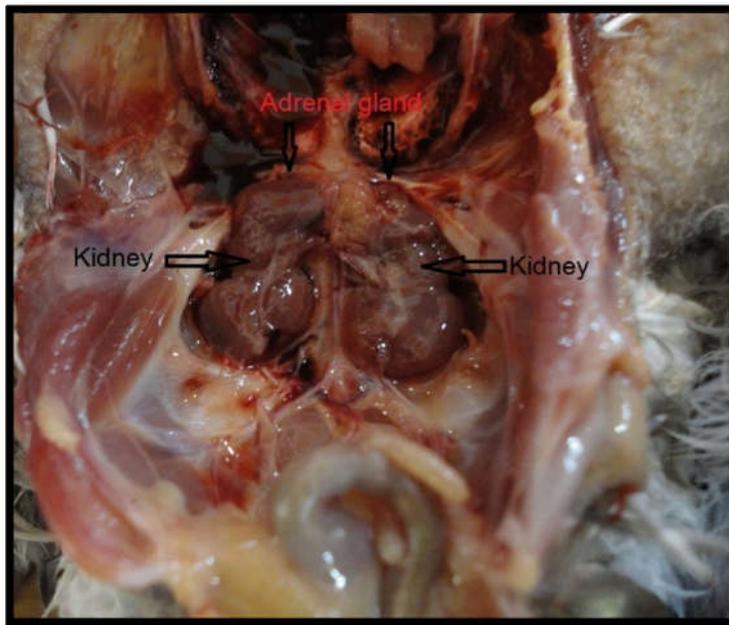
fixation, specimens were washed by tap water and processed using routine histological technique including the following steps: Dehydration, Clearing , embedded and finally cutting and staining by using hematoxylin and eosin for general structures of gland, Periodic acid Schiff(PAS) for detect distributions of lipid droplets in gland and Weigert's saint for detect the elastic fibers in the gland[9] . Finally, histological images of different histological sections were captured using digital camera type [DSC- W350].

## RESULTS

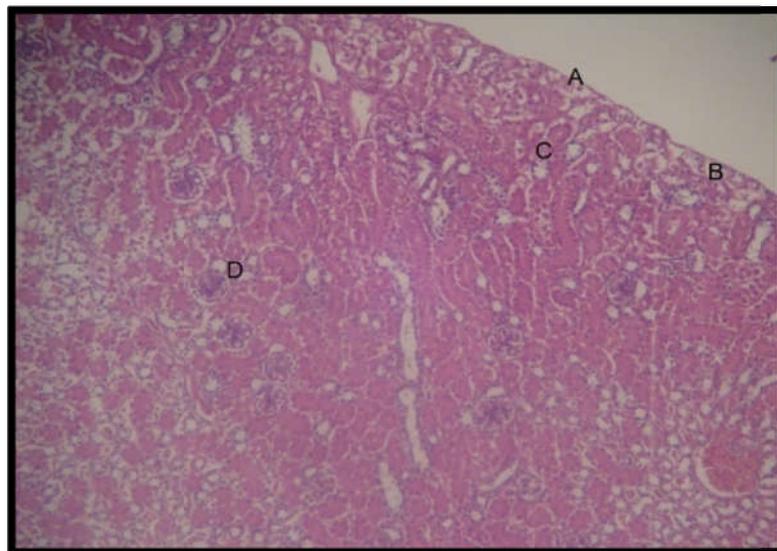
**Morphological examination:** The adrenal gland of pigeons is small, paired organ located in the abdominal cavity at the anterior pole of the kidneys above to it and anterior to bifurcation of caudal vena cava. The left and right glands having small elongated shape that having creamy or grayish color( Fig. 1).

**Histological examination :** The gland was unsheathed with thin dense collagen connective tissue capsule containing many blood vessels . Short thin connective tissue septa penetrate the glandular parenchyma were observed derived from the capsule . The cortical tissues were arranged into two zones; peripheral (sub capsular) and inner (central). The cells of sub capsular were situated under the capsule and arranged in curved cord (Fig. 2). Each cord had polyhedral acidophilic cells containing highly vacuolar cytoplasm and polymorphic nuclei surrounded by basement membrane (Fig. 3). On the other hand, the histological examination of the cortex of adrenal glands contains autonomic ganglia associated with glandular capsule , contains nerve cells and fibers (Fig. 4) . In addition to that, the inner cortical cells showed straight and curved cords in longitudinal sections, each composed of two types of cells acidophic cells and chromaffin cells that contains double rows of columnar cells with basally situated nuclei, a small blood sinuses and few connective tissues were observed between the cortical cords (Fig. 5) .The cortical cells had relatively larger proportion than the medullar ones (Fig. 6).

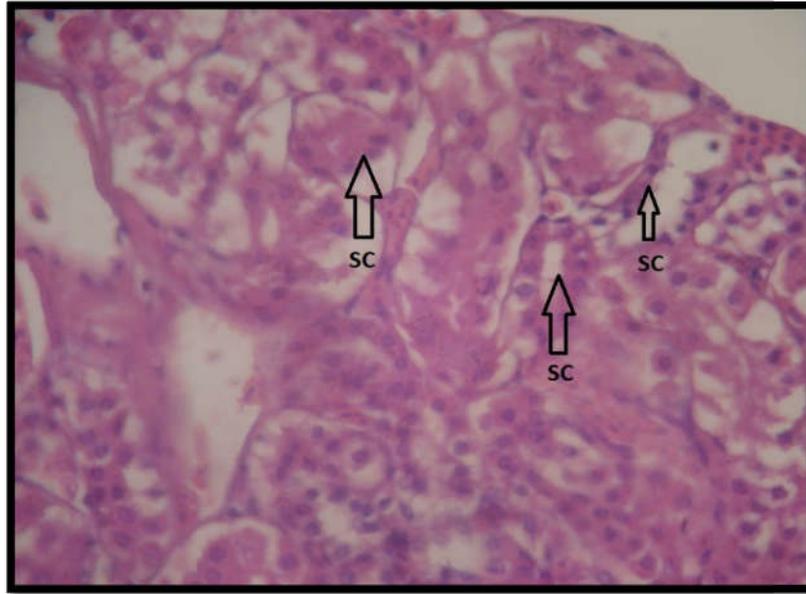
**Histochemical examination :** Histochemical examination to the glands by PAS stains detect presence the lipid droplets in the gland (Fig.7) .On the other hands , the examination to glands by Weigert's saint detects presence of elastic fibers in the capsules and between the cells of glands (Fig.8) .



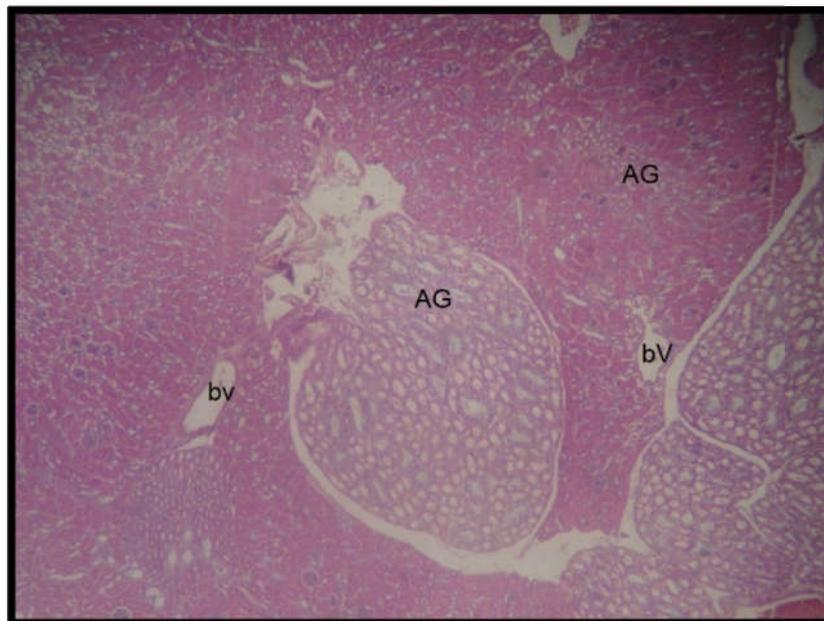
**Fig .1: General morphology of adrenal gland in pigeon appeared longitudinal in shaped located at anterior poles of kidney .**



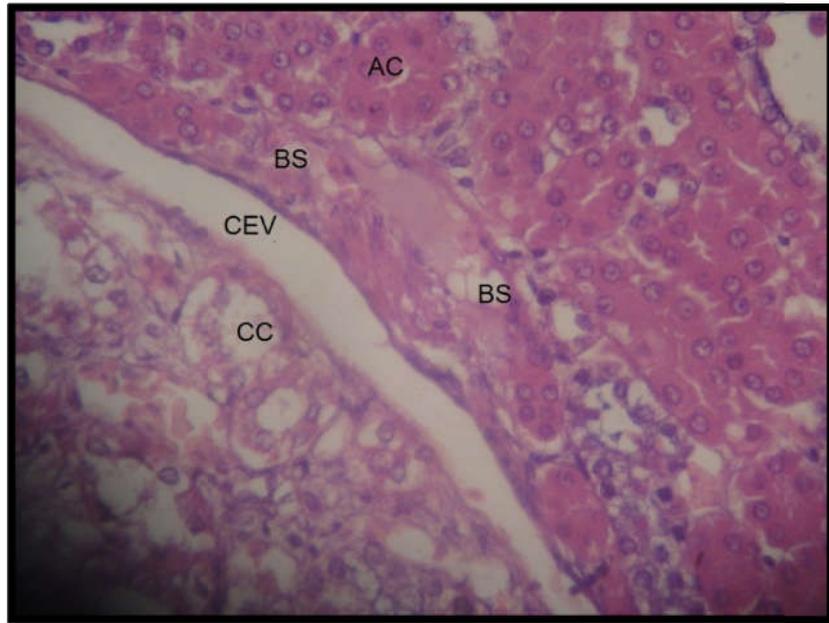
**Fig . 2 : Cross section of adrenal gland of pigeons showing (A) thin capsule , (B) blood vessels , (C) Sub-capsular tissues , (D) Inner (central ) tissues H&E**



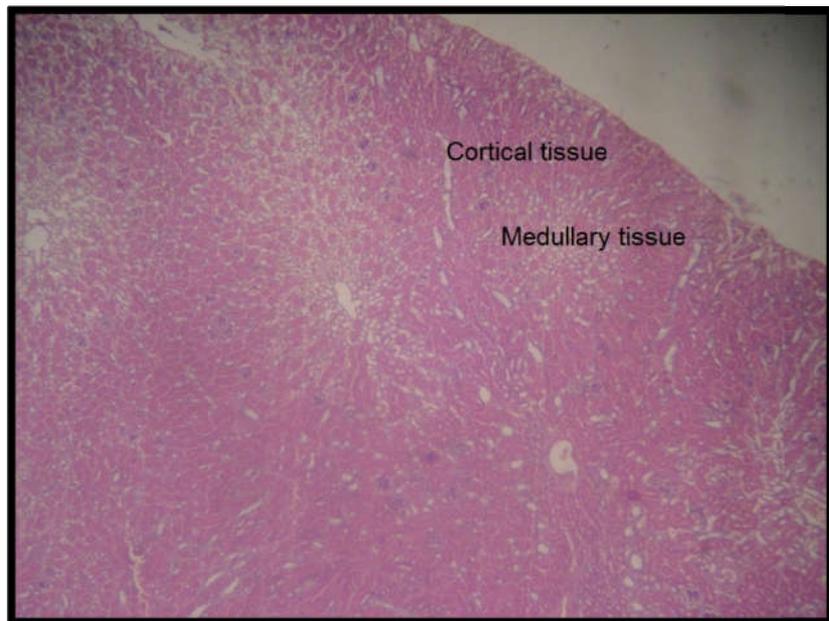
**Fig .3:** Cross section on adrenal gland showing Subcapsular cortical cord (SC) arranged in arch-like manner composed of polyhedral cells with lightly acidophilic vacuolar cytoplasm containing Polymorphic nuclei and surrounded by basement membrane (arrows). H&D X400 .



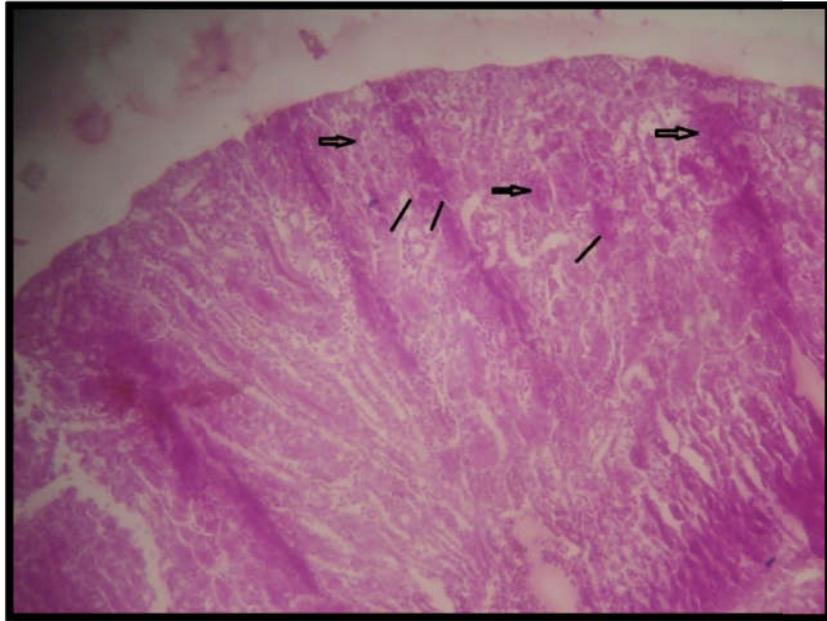
**Fig .4:** Section on adrenal glands of pigeons for cortex appeared (AG) Autonomic ganglia , (bv) blood vessels . H&E stain, X100 .



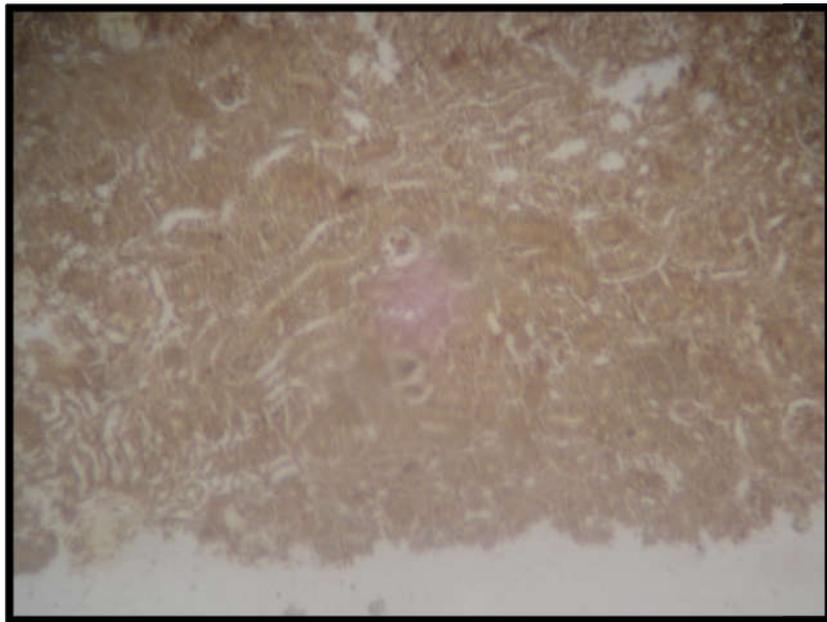
**Fig .5: Longitudinal section on pigeon adrenal gland for the inner zones appeared , (AC) acidophilic cells and (cc) chromaffin cells with (BS) blood sinusoids, Note the central vein (CEV) that separates the two types of cells . H&E stain, X400.**



**Fig .6: Longitudinal section on pigeon adrenal gland shows that the proportions of cortical zone relatively larger than medullary zone . H&E stain, X100.**



**Fig .7 : Cross section on adrenal glands of pigeons detect lipid droplets in gland (↷) and the sing (↶) refers absence of lipid droplets PAS stains X400.**



**Fig (8) Cross section on adrenal gland of pigeons refers to presence of elastic fibers in the capsule and between the cells of the gland, Note the black color that refers to presence of elastic fibers, Weigert's saint X100**

## DISCUSSION

In the current study, the adrenal gland of pigeons appeared as paired gland one in each sides . This results was, compatible with most birds[10] . The position of gland , at the abdominal cavity at the anterior pole of the kidneys and above it and anterior to bifurcation of caudal vena cava. The left and right adrenal glands are very small and elongated in shape and showed creamy or grayish color. These results are the same as reported by[11,12] in the duck, that have creamy or yellowish adrenal glands located above the anterior poles of the kidney , but having some variations in the shapes of the glands , the left is flat to irregular triangular while, the right gland pyramidal.

The adrenal glands of chicken was triangular in shape , located cranio-medially from the kidney and yellowish in color[3,10,13] while Iraqi black Partridge *Francolinus francolinus* was small, ovoid , and yellowish in color lying just cranial to kidney[14], these birds was varies in contrast with pigeons . The reasons of variations may be related to variations in size of birds between pigeons and these birds.

Histologically the adrenal glands of pigeons was unsheathed with a thin fibro- elastic connective tissue capsule containing many blood vessels . Short thin connective tissue septa derived from the capsule penetrate the glandular parenchyma. On the other hand, the histological examination of the cortex of adrenal glands observed autonomic ganglia associated with glandular capsule that contains nerve cells and fibers . These results in agreement with that [11] in duck and [14] in Iraqi black Partridge *Francolinus francolinus* . In the same times , the present results differs with [10] in chicken and [15] in geese , the adrenal gland was surrounded from outside by connective tissue capsule that contained collagen fibers and reticular fibers, with very few elastic elements, blood vessels and fibroblasts .

The adrenal glands of pigeons parenchyma composed from an internal cortical tissues intermingled with medullary (chromaffin) cells , these finding was the same was observed from[10] in chicken, [11] in duck , [15] in geese and [16] in African ostrich chicks , they observed that the glandular parenchyma of adrenal glands was composed of intermingled cortical (inter renal), medullary (chromaffin) tissues and numerous blood sinusoids with no definite cortex and medulla as showed in mammals that composed from an outer cortex and an inner medulla like that

described by [17] in rabbit and [18] in Dolphin. The reasons of histological variations may be related to differences in size of organisms in mammals that needed more specialization in structures of adrenal gland for regulate several vital physiological functions.

The light microscopic examination of all sections prepared from adrenal gland of pigeons under study revealed higher proportion of cortical tissues in contrast to expense of chromaffin (medullary) tissues and this in agreement with [10] that notice through examination sections prepared from adrenal gland of chickens a higher proportion of cortical tissues on the expense of chromaffin (medullary) tissues , and this may be related to increased production of adrenal cortical hormones (glucocorticoids and mineralo -corticoids) in the chicken and pigeons that lives in areas which water conservation is important [19] .

The present study showed that , the cortical tissues were organized into two zones; peripheral (sub capsular) and inner (central). The cells of sub capsular were situated under the capsule and arranged in curved cord . Each cord had polyhedral acidophilic cells containing highly vacuolar cytoplasm and polymorphic nuclei surrounded by basement membrane . In addition to that , the inner cortical cells showed straight and curved cords in longitudinal sections, each composed of two types of cells acidophilic cells and chromaffin cells that contains double rows of columnar cells with basally situated nuclei , a small blood sinuses and few connective tissues were observed between the cortical cords. These finding in agreement with[11] in duck , [14] in Black Iraqi Partridge *Francolinus francolinus* and[15] in chickens , French geese (*Anser anser*), African ostrich chicks and Egyptian geese (*Alopochen aegyptiacus*).

Histochemically , the secretary cells of glands when stained by PAS stain arranged in cords, often one cell thick, surrounded by fine strands of supporting tissue. The nuclei of these cells stain strongly, and the cytoplasm looks pale due to the presence of lipid droplets. Some cells of this layer have no lipid droplet, characterized by dark nuclei, and condense their cellular. These results in agreement with [14] in Black Iraqi Partridge *F francolinus* ,  
On the other hands, the examination of gland by Weigert's saint detects presence of elastic fibers in the capsules and between the cells of glands and this will discuss when explained the structures of glands capsules.

## دراسة مظهرية وكيمونسيجية للغدة الكظرية في الحمام المحلي في محافظة البصرة

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### الخلاصة

الهدف من الدراسة الحالية توضيح ملامح الغدة الكظرية للحمام المحلي في محافظة البصرة عن طريق الفحوصات المظهرية والنسيجية والكيمياء النسيجية اذ لا توجد دراسة عن هذا النوع من الطيور. عشرة نماذج من الغدد الكظرية استخدمت في الدراسة من خمسة طيور تم جمعها من كرمة لأجراء الفحوصات المظهرية والكيمونسيجية. شملت الدراسة المظهرية دراسة لون وشكل الغدة بعد تثبيت الغدة على لوحات التشريخية. تم إجراء دراسة النسيجية والكيمونسيجية للغدد الكظرية عن طريق (تثبيتها في ١٠٪ من الفورمالين بعد ذلك تصبيغها بالصبغات النسيجية العادية هيماتوكسيلين ايوسين ، صبغة بيريوك اسد شف وصبغة رايت . كشفت الدراسة المظهرية أن الغدة الكظرية في الحمام صغيرة بالحجم ، زوجية تتموضع في تجويف البطن في القطب الأمامي من الكلى، طولية في الشكل كما بينت الدراسة ان لون الغدة كرمي او رمادي . بينت الدراسة النسيجية أن الغدة تحاط بمحفظة ليفية رقيقة – مرنة من النسيج الضام تحتوي على العديد من الأوعية الدموية. تم ترتيب الأنسجة القشرية في منطقتين. الطرفية (تحت المحفظة) والداخلية (المركزية). يتم ترتيب خلايا تحت المحفظة في صفوف منحنية ، وكان كل صف من يحتوي خلايا حمضة متعدد السطوح تحتوي على ساتوبلازم شديد الفجوات ونوى متعددة الأشكال محاطة بالغشاء القاعدي. من ناحية أخرى، فإن الفحص النسيجي لقشرة الغدد الكظرية يحتوي على العقد اللاإرادي المرتبطة بكبسولة الغدة، ويحتوي على الخلايا العصبية والألياف. أظهرت الخلايا القشرية الداخلية الحبال المستقيمة والمنحنية في المقاطع الطولية، كل منها مكون من نوعين من خلايا خلايا الحامضية وخلايا الكروموفين . كشفت الدراسة الهستوآيائية وجود قطرات دهنية في الغدة، بالإضافة إلى ألياف مرنة في الكبسولات وبين خلايا الغدد.

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