

Anatomical and Histochemical Description of Parathyroid Gland in *Felis catus* (Linnaeus,1758)

Original
Article

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ABSTRACT

Introduction: The parathyroid gland is a small endocrine gland that appears as small oval-shaped bodies with a brown color. It is called the parathyroid gland due to its location closely with the thyroid gland .

Materials and Methods: The study used six adult males of *Felis catus* from the local markets in Baghdad. Formalin (10%) was used to fix the samples for preparing all specimens to conduct histological study. They were passed in an alcohol ascending series 70, 80, 90 and 100% and cleared by xylene. Masson's Trichrome stain (MTc), Haris hematoxlin and Eosin stain (H&E), Periodic Acid Schiff stain (PAS), were used to stain the gained sections.

Results: The current study observed the presence of two pairs of parathyroid glands in *Felis catus* animal, which are in contact with the thyroid gland, occupying an apical peripheral site and a lateral peripheral site, and located within the thyroid gland tissue embedded in its substance. Moreover, the gland appears as lobes consist of 2-4 with oval or irregular in shape and surrounded with a thin capsule. A capsule of connective tissue surrounds the parathyroid gland in *F. catus* is an extension of the capsule of the thyroid gland consisting of collagen, elastic and reticular fibers, nuclei of smooth muscle fibers, blood vessels, and nerves. The septa are extended from the capsule which divides the gland into lobules, the parathyroid gland tissue has three types of cells represented by chief cells, which are the most common cells , while the other two types are Oxiphyl cells and water-clear cells .

Conclusion: The current study *Felis catus*, observed the presence of two pairs of parathyroid glands in *Felis catus* animal, which are in contact with the thyroid gland. Moreover, the gland appears as lobes consist of 2-4 with oval or irregular in shape and surrounded with a thin capsule, and their internal histological structure consists of three cell kinds: chief, Oxphill, and water clear cells.

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Key Words: Chief cells, *felis catus*, histochemical description, parathyroid gland.

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INTRODUCTION

The parathyroid gland is a small endocrine gland that appears as small oval-shaped bodies with a brown color. It is called the parathyroid gland due to its location closely with the thyroid gland in most mammals. These glands are in the dorsal side of the thyroid gland, one in each pole of the thyroid gland. Furthermore, these glands are embedded in the thyroid gland, or embedded in its substance. In mammals, there is one or two pairs of these glands associated with the thyroid gland^[1,2,3,4]. The substance of the parathyroid gland consists of lumps and cords composed of epithelial cells supported by a network of reticular fibers. In most mammals, the gland has principal or main cells and Oxyphil cells^[1,2,5]. The later are the most important cells in the parathyroid gland as they play a key role in the regulating of calcium level in the blood, as they form parathyroid hormone (PTH)^[6,7,8]. In addition, the water-clear cells have been described as a type of the parathyroid gland cells, and this type is rare or not present in normal conditions in humans. The appearance of these cells is linked to parathyroid enlargement and parathyroid adenoma^[9]. The mast cells are another type was found

in the parathyroid gland tissue in normal conditions in humans; the parathyroid gland key function is to secrete parathyroid hormone (PTH). Parathormone (PTH) is a polypeptide hormone of 84 amino acids^[10] Controlling the calcium homeostasis in mammalian blood^[11,12]. It is synthesized exclusively in the parathyroid gland, but in some cases it can be synthesized in the hypothalamus and thymus gland. The structure and secretion of PTH is mutual with the control of the extracellular calcium concentration which calcium receptors mediate in the parathyroid gland^[13]. Biosynthesis of PTH is regulated by the extracellular calcium concentrations and is mediated by calcium receptors in the parathyroid glands^[13]. There are no anatomical and histological studies of the parathyroid gland in mammals in Iraqi except the Iraqi buffalo study^[14], which constituted attention to conduct the current study which may add and enhance the knowledge in this aspect.

MATERIAL AND METHODS

Samples collections

The study used six adult males of *Felis catus* from the local markets in Baghdad. We divided the samples based

on the taxonomic keys in the Natural History Museum in Baghdad.

The Histological preparations

Formalin (10%) was used to fix the samples for preparing all specimens to conduct histological study. They were passed in an alcohol ascending series 70, 80, 90 and 100% and cleared by xylene. Also, they are embedded in paraffin wax blocks to be cut by microtome for the section production with 6 mm in thickness. Masson's Trichrome stain (MTc), Haris hematoxlin, Periodic Acid Schiff stain (PAS), Eosin stain (H&E)^[15,16] were used to stain the gained sections.

RESULTS

Anatomical Description of Parathyroid Gland

The results showed that there are two pairs of parathyroid glands in *F. catus* linked with the thyroid glands and occupying different places within the thyroid tissue. It may take an apical peripheral site, lateral peripheral site and a site within the tissue of the thyroid gland and embedded in its substance (Figure 1 a,b). The gland appears in the form of lobes (2-4) which are oval or irregular in shape (Figure 2 a,b) which is surrounded by thin capsule from which septa arises and divides the glands into lobules. In addition, the parathyroid gland cannot be distinguished from the thyroid gland, as their sites were detected through the histological thyroid gland sections due to the difficulty of distinguishing the parathyroid and separating it with a dissecting microscope due to its small size.

The Histological Description of Parathyroid Gland

Histologically results showed that The capsule surrounds the parathyroid gland in *F. catus* is formed of connective tissue extended from the capsule of the thyroid gland which is formed from collagen, elastic and a few reticular fibers, nuclei of smooth muscle fibers, blood vessels, and nerves (Figure 3). This is observed in the apical and lateral terminal gland sites surrounding the parathyroid gland and separating it from the surrounding thyroid tissue. Moreover, the septa extends from the capsule of the parathyroid gland to the internal part of the glands separate it into lobules (Figure 4). The collagen fibers in the capsule and septa are stained with blue color using Masson trichrome stain (Figure 5).

The Parathyroid tissue in *F. catus* consists of three types of cells represented by chief cells, which are the most common cells, and the other two types are oxyphil cells and water-clear cells. The chief cells are polygonal with dark color vesicular nuclei, and the cytoplasm appears containing granules are that able to colored with the dyes

used in the current study (PAS, MTc) (Figures 6,7) the chief cells also are more widespread in the parathyroid tissue (Figure 8). The second type of cells are oxyphil cells that are polygonal in shape, their nuclei are vesicular and light-colored, and the cytoplasm contains granules that color with the dyes that were used in this study (Figures 6,7). The third type of cells is the water-clear cells, which have polygonal shape and large size, and the nuclei are oval in shape, while the cytoplasm is transparent and does not contain granules. These cells are widespread in the gland tissue directly under the capsule and are less numerous than the previous two types of cells (Fig.5, 8). In addition, blood vessels are present in the parathyroid gland tissue (Figure 3).

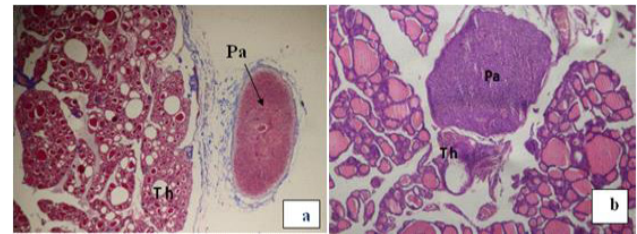


Fig. 1: a,b. A photomicrograph of Parathyroid gland in *Felis catus* showing (Pa) Parathyroid gland and (Th) thyroid gland (MTC, PAS stain 40X).

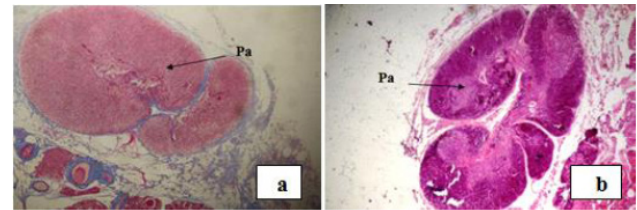


Fig. 2: A photomicrograph of Parathyroid gland in *Felis catus* showing (Pa) Parathyroid gland and its lobes (2-4) (MTC, PAS stain 40X)

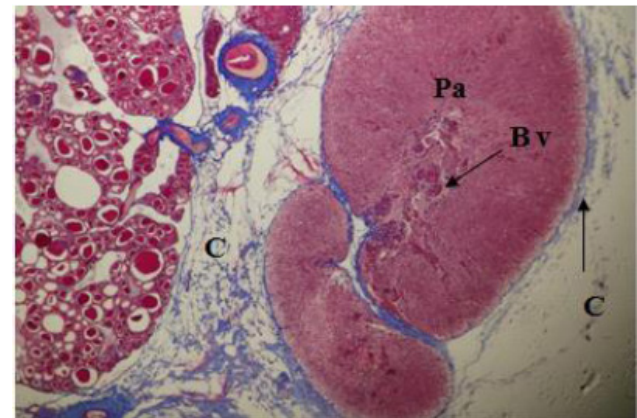


Fig. 3: A photomicrograph of Parathyroid gland in *Felis catus* showing (C) Capsule, (Bv) blood vessel (MTC stain, 40X)

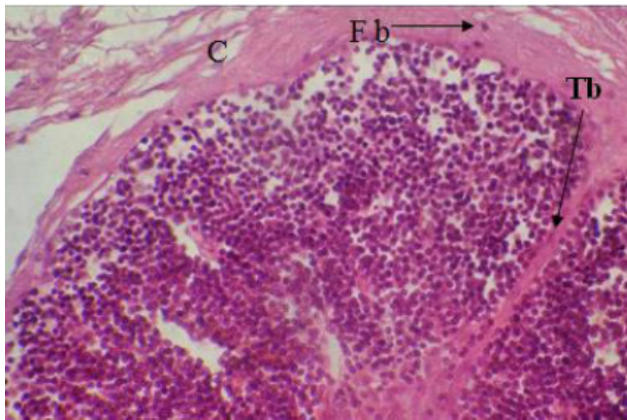


Fig. 4: A photomicrograph of Parathyroid gland in *Felis catus* showing (C) Capsule, (Fb) Fibroblast, (Tb) trabecula (H&E stain, 100X)

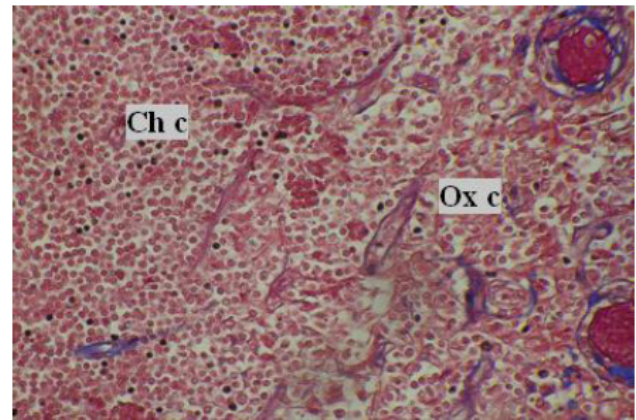


Fig. 7: A photomicrograph of Parathyroid gland in *Felis catus* showing (Chc) Chief cells, (Oxc) Oxyphil cells, (MTC stain, 400X)

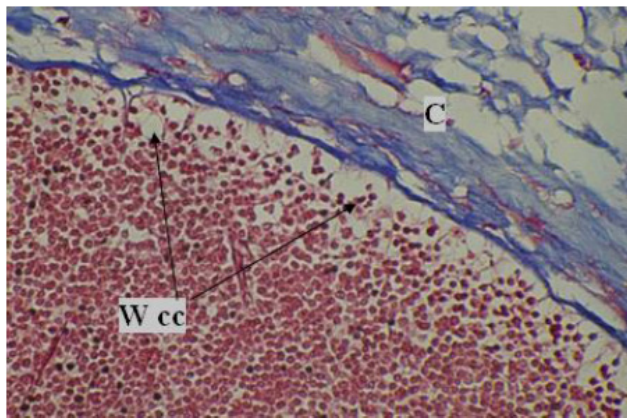


Fig. 5: A photomicrograph of Parathyroid gland in *Felis catus* showing (C) Capsule, (Wcc) Water clear cells (MTC stain, 400X)

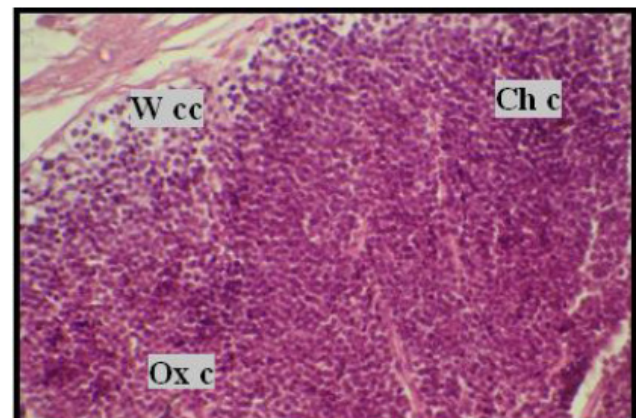


Fig. 8: A photomicrograph of Parathyroid gland in *Felis catus* showing (Chc) Chief cells, (Oxc) Oxyphil cells, (Wcc) Water clear cells (H&E stain, 400X)

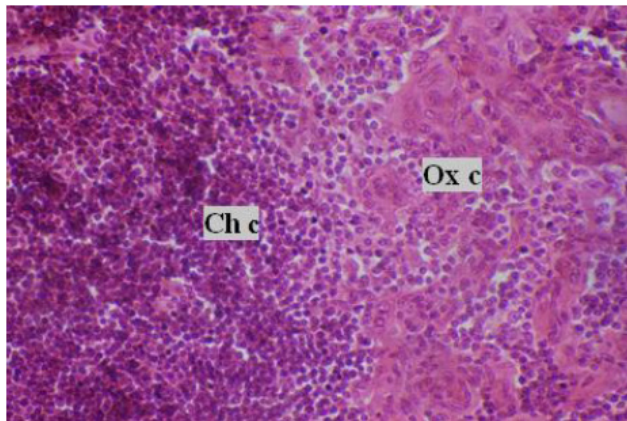


Fig. 6: A photomicrograph of Parathyroid gland in *Felis catus* showing (Chc) Chief cells, (Oxc) Oxyphil cells, (PAS stain, 400X)

DISCUSSION

Anatomical Description of Parathyroid Gland

The anatomical examination revealed that parathyroid glands in *F. catus* linked with the thyroid glands and occupying different places within the thyroid tissue. It may take an apical peripheral site, lateral peripheral site and a site within the tissue of the thyroid gland and embedded in its substance. This results agree with results of several previous studies^[1,2,3,12], and the similarity of results probably due to the interaction and coordination between thyroid and parathyroid gland in their functions. The gland appears in the form of lobes (2-4) Which are oval or irregular in shaped. The number of parathyroid gland lobes are different in mammals, there is one pair or two

pairs of glands linked to the thyroid glands, while there is one pair of parathyroid glands in mice^[12,17]. The findings of the present study agreed with the parathyroid gland in *H. javanicus* and *H. auritus*, as it is located within the tissue of the thyroid gland; furthermore, it appears in the hedgehog in the form of lobes (2-4) oval or circular surrounded by a thin capsule separating it from the thyroid follicles^[18,19]. Yet, no reports indicate that these results match other studies which may be because there are no parathyroid gland studies in the species under consideration.

The Histological Description of Parathyroid Gland

The findings of the Histologically structure showed that parathyroid gland in *F. catus* is embedded within thyroid gland tissue and surrounded by thin connective tissue capsule, the septa extends from the capsule of the parathyroid gland to the internal part of the glands separate it into lobules. This result revealed an agreement with previous results recorded by^[1,14,20,21]. Results of this study recognized three types of cells within the gland tissue represented by chief cells, oxyphil cells, and water-clear cells. The past studies revealed that there was a variation in the types of cells in the parathyroid gland in different mammals; it was found that there was one type of cell in Virginia deer represented by the key cells confirming the type of cells of the parathyroid gland in the guinea pig^[22]. Furthermore, the researchers observed chief cells in humans, and oxyphil cells appear with them sometimes^[23], whereas there is one type represented by chief cells in hamsters^[8]. Many studies also found that two cells in the parathyroid gland in different mammals and have been called by different names, as two types of cells were found within the parathyroid gland tissue in Cadaveric Em balmed specimens represented by chief and oxyphil^[24], and in camel (*Camelus dromadirus*)^[25]. On the other hand, it was found that there are two types of cells in the brown bat (*Myotis lucifugus lucifugus*)^[26], the chief and the water-clear. Additionally, both were found in the parathyroid gland tissue in dogs, represented by the chief cells and Multisyncytial cells^[27], while it was detected that the parathyroid gland in the Iraqi buffalo consists of four types of cells represented by light principle cells, dark principle cells, syncytial cells, and water-clear cells^[15]. Whereas the study of Al-Aamery and Dauod^[18,19,28,29] in *H. javanicus* and *H. auritus* animals was found that the thyroid gland has three types of cells: the chief cells, oxyphil cells, and water-clear cells, and this confirmed the results of the present study for *F. catus*. The agreement may be due to the fact that parathyroid glands of mammals are analogous structure, while the differences in the names of cells perhaps related with the concentration of the secretion.

CONCLUSIONS

This study concluded that the two pairs of parathyroid glands in *Felis catus*, which are in contact with the thyroid gland, occupying an apical peripheral site and a lateral peripheral site, and located within the thyroid gland tissue embedded in its substance. A connective tissue

capsule surrounds parathyroid glands, and their internal histological structure consists of three types of cells: chief, Oxyphil, and water clear cells.

CONFLICT OF INTERESTS

There are no conflicts of interest.

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الملخص العربي

الوصف التشريحي والكيمونسجي للغدة جار الدرقية في القط *Felis catus* (Linnaeus, 1758)

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لمقدمة: الغدة جار الدرقية هي اصغر الغدد الصم وتظهر بشكل جسيمات بيضوية صغيرة الحجم بنية اللون. يطلق عليها اسم الغدة جار الدرقية نسبة لموقعها الذي يكون بتماس مع الغدة الدرقية.

مواد وطرائق العمل: استخدم في الدراسة الحالية (٦) ذكور بالغة من حيوان *Felis catus* والتي تم الحصول عليها من الاسواق المحلية في محافظة بغداد, تم استخدام الفورمالين (١٠٪) لتثبيت العينات ولتحضيرها لإجراء الدراسة النسيجية. ومررت بسلسلة كحولات تصاعدية (٧٠، ٨٠، ٩٠ و ١٠٠٪) وروقت العينات بأستعمال الزايلين. لونت العينات بأستعمال ملون ماسون الثلاثي الكروم MTC، ملون حامض الشيف الدوري PAS وملون الهيماتوكسولين والايوسين (H&E).

النتائج: اظهرت نتائج الدراسة الحالية وجود زوجين من الغدة جار الدرقية في حيوان *Felis catus*، والتي تقع بتماس مع الغدة الدرقية، تحتل موقع طرفي قمي وموقع طرفي جانبي، حيث تظهر منغرسه ضمن نسيج الغدة الدرقية. فضلا عن ان الغدة تتألف من ٢- ٤ فصيصات بيضوية غير منتظمة الشكل ومحاطة بمحفظة رقيقة. تحاط الغدة جار الدرقية بمحفظة من نسيج ضام في *Felis catus* هي امتداد لمحفظة الغدة الدرقية والتي تتألف من الياف كولاجينية، الياف مرنة والياف شبكية، انوية لالياف عضلية ملساء، اوعية دموية واعصاب. وتمتد من المحفظة حويجزات الى النسيج الداخلي للغدة تقسمها الى فصيصات، يتألف نسيج الغدة جار الدرقية من ثلاثة انواع من الخلايا تتمثل بالخلايا الرئيسية وهي الاكثر انتشارا، بينما النوعين الاخرين هما الخلايا الحمضة Oxiphyl cells وخلايا الماء الشفافة water clear cells.

الاستنتاج: اظهرت نتائج الدراسة الحالية في *Felis catus* وجود زوجين من الغدة جار الدرقية تقع بتماس مع الغدة الدرقية، فضلا عن ان الغدة تتألف من ٢- ٤ فصيصات بيضوية غير منتظمة الشكل ومحاطة بمحفظة رقيقة، اما التركيب النسيجي الداخلي فهي مؤلفة من ثلاث انواع من الخلايا : الخلايا الرئيسية cells chief، الخلايا الحمضة Oxiphyl cells وخلايا الماء الشفافة water clear cells.