

A Macroanatomical and Histological Study of the Uropygial Gland in the White Stork (*Ciconia ciconia*)

Un Estudio Macroanatómico e Histológicos de la Glándula Uropigial de la Cigüeña Blanca (*Ciconia ciconia*)

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SUMMARY: The present study was aimed at the macroanatomical and histological investigation and the demonstration of the structural characteristics of the uropygial gland in the white stork. The uropygial gland of two adult male white storks constituted the material of the study. It was determined that the gland was situated subcutaneously in between the caudal aspect of the lumbosacral bone and the first coccygeal vertebrae. The gland was composed of two lobes, which displayed an oval appearance when viewed from above and resembled a water drop when observed medially. Tuft of feathers were present on the caudal margin of each lobe. The present study revealed that the uropygial gland of the white stork is a simple tubular gland, which discharges its secretion into the lumen by a holocrine mode. Each lobe, possessed centrally located large cavities and a main excretory duct and displayed the presence of externally situated “peripheral tubules” and interiorly situated “central tubules”. These secretory tubules, which composed the parenchyma, were separated by connective tissue septa referred to as “trabeculae”, and released their secretion into a centrally located lumen. The wall of the secretory tubules was comprised of four layers, referred to as the germinative, intermediary, secretory and degenerative layers. The silver-staining procedure demonstrated that the stroma of the uropygial gland did not contain reticulum fibres. The anatomy and histology of the gland has been examined in few avian species. Up to date, this study is the first to describe the histological and anatomical peculiarities of the uropygial gland in white stork. The results acquired hereby will surely contribute to further studies to be conducted on the related area.

KEY WORDS: White stork; Uropygial gland; Anatomy; Histology.

INTRODUCTION

In avian species, the uropygial gland is the only gland associated with the skin. In these species, the secretion of this gland contains antibacterial agents and vitamin D precursors (Harem *et al.*, 2005), preserves feather structure by keeping keratin flexible, and also maintains feather waterproofing (Harem *et al.*; Tas, bas., 1996). It has been reported that the uropygial gland does not exist in the adult ostrich and emu (Johnston, 1988), some pigeons, the majority of parrots and the swan (Gezici, 2002; Johnston). Anatomically, the uropygial gland, which is situated dorsally on the last sacral or first coccygeal vertebra, is a sebaceous organ composed of two lobes, of which the shape and size vary among different avian species (Gezici; Nickel *et al.*, 1977; Tas, bas.,). Although this gland is always present in the embryonic stage, depending on the sex, species and family of the animal, the gland may either exist in a trace form or may completely disappear in some adult birds (Salibian & Montalti, 2009).

Histologically, the gland is enclosed by a capsule and each lobe possesses a central cavity. These cavities collect the secretion of tubules, which are arranged radially in their periphery. The secretion of the gland is transported to the surface of the skin by ducts and is discharged into a narrow papilla, which in general is single in number (Sawad, 2006; Harem *et al.*).

Since the mid-thirteenth century, a multitude of studies have been conducted on the anatomy, histology, secretional composition and functions of the uropygial gland, and significant scientific publications exist, which have dealt with the gland from different viewpoints (Montalti & Salibian, 2000). The aim of the present study was to make a general anatomical and histological evaluation of the uropygial gland, which has not been investigated previously in the stork. In this reason, the information that we have obtained will guide researchers who will conduct studies in this area in the future.

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MATERIAL AND METHOD

Two adult male storks, which had been wounded, were referred to the faculty clinics, but the birds died before were not being able to treat. During necropsy examination it has been revealed that there was no systemic damage to the uropygial gland which would affect the tissue structure. Tissue samples were fixed in 10% formalin for 24 hours for anatomical and histological examination. Following the macroanatomical examination of the structure of the uropygial gland and imaging, tissue samples were subjected to routine histological processing and embedded in paraffin. Finally, 6-micron-thick sections were cut. The general structure of the gland was demonstrated using Mallory’s triple stain (Crossmon, 1937) and the reticulum fibres of the capsule and trabeculae were demonstrated in compliance with the silver method described by Gordon and Sweet (Bancroft & Cook, 1984).

RESULTS

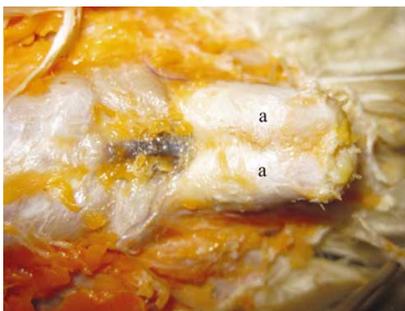


Fig. 1. Lobes of the uropygial gland in the White stork (dorsal view).



Fig. 2. Lobes of the uropygial gland in the White stork (medial view).



Fig. 3. The uropygial gland in the White stork (caudal view). Arrow: follicle of the feather.

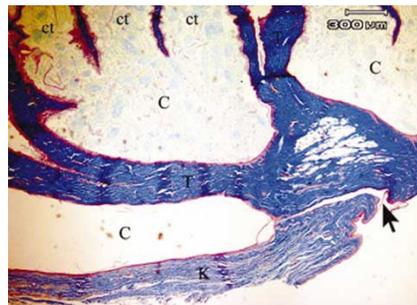


Fig. 4. The central tubules (ct), cavities (C), the main excretory duct (arrow) and capsule (K) of gl. uropygialis in white stork, Triple.

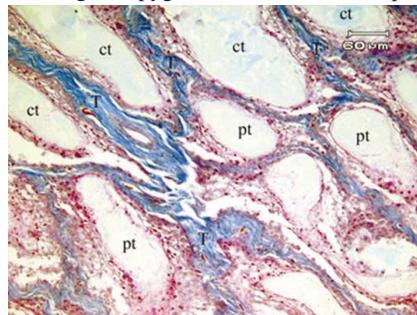


Fig. 5. Peripheral tubules region of the Uropygial gland in the white stork. pt; peripheral tubules, ct; central tubules, T; trabeculae. Triple.

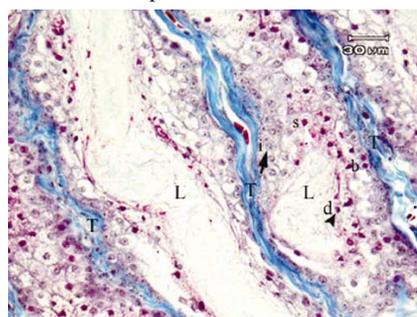


Fig. 6. A histological appearance of the Uropygial gland in the white stork. T; trabeculae, L; lumen, b; basal cell, i; intermediary cell, s; secretory cell, d; degenerative cell, Triple.

Anatomically, it was determined that the gland was situated subcutaneously in between the caudal aspect of the lumbosacral bone and the first coccygeal vertebrae. The gland was composed of two lobes, and both lobes resembled an oval bean when viewed from above (Fig. 1), and a water drop when observed medially (Fig. 2). An inconspicuous flat papilla with tuft of feathers was observed on the dorsocaudal aspect of the gland (Fig. 3).

It was ascertained that the uropygial gland of the white stork was a simple tubular gland that discharged its secretion into the lumen by a holocrine mode. Each lobe, which was enclosed by a connective tissue capsule, possessed a main excretory duct (Fig. 4, arrow). It was observed that the secretion of the gland (Fig. 3) was transferred to the caudal surface of the lobes in these excretory ducts. Each lobe was composed of “peripheral tubules” in the exterior region and “central tubules” in the interior region (Fig. 5). These secretory tubules, which composed the parenchyma, were separated by connective tissue septa referred to as trabeculae, and discharged their secretion into the central cavity (Fig. 4). The wall of the secretory tubules was comprised of four layers, namely, the germinative (basal), intermediary, secretory and degenerative layers (Fig. 6). Furthermore, it was observed that the trabeculae separating the secretory tubules contained fibroblasts, smooth muscle cells and blood vessels. The number of smooth muscle cells was particularly greater in the trabeculae surrounding the central cavity. The silver staining procedure demonstrated that the stroma of the uropygial gland lacked reticulum fibres.

DISCUSSION

It has been reported in previously conducted studies that the uropygial gland is composed of two lobes and that the size and shape of the gland vary among different species (Gezici; Salibian & Montalti; Tasbas,). It has been indicated that the gland resembles an oval-shaped bean in chickens and the letter "V" in waterfowl (Gezici) and that it is of the size and shape of a small nut in ducks, geese and pigeons (Gezici; Nickel *et al.*, 1977). Furthermore, it has been reported that the gland is situated dorsally to the last sacral or first coccygeal vertebra (Gezici, 2002; Nickel *et al.*, 1977; Tasbas, 1996). The localisation of the gland determined in the present study is in compliance with previous literature reports. The shape of the gland resembled an oval bean as in the case of chickens, and was similar to a water drop when observed medially.

In several studies conducted in avian species, it has been reported that both lobes of the uropygial gland are composed of tubules, arranged radially from the periphery to the centre, which open into a common duct (Dellmann & Brown, 1987; Hodges, 1974). Furthermore, it has been indicated that these tubules pertaining to the two lobes open into a papilla, which varies in shape and size among different

species. Reports indicate that this papilla is either inconspicuous or does not exist in waders, cranes, petrels and flamingos. Furthermore, it has been reported that a varying number of feathers exist on the tip of the papilla in different species (Johnston, 1988). The present study demonstrated an inconspicuous flat papilla with tuft of feathers on its tip. While some researchers have described the uropygial gland of the quail as a simple tubular gland with a holocrine mode of secretion, some other researchers have described the uropygial gland as a gland composed of a multitude of tubules lined by stratified epithelium, which are arranged radially around the central duct of each lobe (Kelek & Çınar, 2010). Furthermore, Harem *et al.* (2005) have observed structural differences in studies conducted in wild and domestic ducks. These researchers have pointed out to differences in the thickness of trabeculae and the cells composing the epithelial layers lining the tubules in the glandular structure pertaining to wild and domestic ducks. In a previous study conducted by Harem *et al.* (2010) in the osprey, the epithelium lining the tubules was determined to be composed of 4 different types of epithelial cells from the base to the lumen. Similar findings were obtained in the uropygial gland of the stork in the present study.

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RESUMEN: El estudio tuvo como objetivo la investigación anatómica e histológica de la glándula uropigial de la cigüeña blanca, junto con demostrar las características estructurales de ella. El material del estudio estuvo constituido por glándula uropigial de dos cigüeñas blancas adultas macho. Se determinó que la glándula se encuentra vía subcutánea entre la parte caudal del hueso lumbosacro y las primeras vértebras coccígeas. La glándula se compone de dos lóbulos que muestran un aspecto ovalado, vista desde arriba y se asemejan a una gota de agua cuando se observa en sentido medial. Un penacho de plumas estaba presente en el margen caudal de cada lóbulo. El presente estudio reveló que la glándula uropigial de la cigüeña blanca es una glándula tubular simple, que descarga su secreción al lumen de un modo holocrino. Cada lóbulo posee una gran cavidad de ubicación céntrica y un conducto excretor principal, además muestra la presencia de "túbulos periféricos" situados exteriormente y "túbulos centrales" situados interiormente. Estos túbulos secretores que componen el parénquima, estaban separados por tabiques de tejido conectivo denominado "trabéculas", y liberan su secreción en una luz central. La pared de los túbulos secretores se componen de cuatro capas: germinativa, intermedia, secretora y degenerativa. La tinción de plata demostró que el estroma de la glándula uropigial no contienen fibras reticulares. La anatomía e histología de esta glándula se ha examinado en algunas especies de aves. Hasta la fecha, este es el primer estudio en describir las particularidades histológicas y anatómicas de la glándula uropigial de la cigüeña blanca. Los resultados obtenidos contribuirán a llevar a cabo nuevos estudios relacionados en el área.

PALABRAS CLAVE: Cigüeña blanca; Glándula uropigial; Anatomía; Histología.

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