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HISTOLOGICAL AND HISTOCHEMICAL CHANGES OF THE BROILER'S HARDERIAN GLAND FOLLOWING SOME OCCULARLY INOCULATED VACCINES

BY

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Contents

Introduction

The Harderian gland plays an important role in local immunity of the eye and the respiratory tract of the chicken. The glandular secretion, with that of the lacrimal gland, cleans and moistens the cornea and lubricates the nictitating membrane. It was suggested that the gland also has a role in systemic immunity of the chicken (***Randall and Reece, 1996***).

The present study is primarily concerned with:-

1- The histological structure of the broiler's HG.

2- The histological development of HG in relation to age.

3- The histological and histochemical changes of the broiler's Harderian gland after occular vaccination with some vaccines as ND, IB, IBD and ILT vaccines.

4- The local and systemic immunological role of the Harderian gland through the determination of the antibody titre in both tears and serum.

Review of Literature

II- Review of Literature

Ballantyne and Fourman (1967) mentioned that the avian Harderian gland (HG) is seemed to be sebaceous. In many marine birds and in the domestic duck, this gland is large and it may produce an oily secretion which is spread by the nictitating membrane to protect the eye from sea-water. The gland is multilobular, and composed of many tubules lined with a single layer of tall columnar cells with basal nuclei. There is no evidence of the breakdown of cells or of cellular debris in the tubular lumen. In paraffin sections the most striking feature is the contrast between the paucity of cytoplasmic staining in the cells at the periphery of the lobules and its intensity in the central cells. This is reflected also in distribution of PAS +ve material in frozen sections, in which the central cells are found to contain many granules, and the peripheral cells contain few. The central cells also contain quantities of alcianophilic and metachromatic material. Lipid is present in all cells but it is more pronounced in the central cells. All the cells contain acid phosphatase but none show alkaline phosphatase activity. Succinic dehydrogenase is limited to the central cells. Adenosine triphosphatase occurs in blood vessels and the gland cells, and non-specific esterase occurs only in the tissue underlying the central cells. The overall structure and the absence of non-specific esterase in the secretory cells in the domestic duck revealed that the Harderian gland is not sebaceous. The high mucopolysaccharides and lipid content suggest that in this species it secretes mucus.

Bang and Bang (1968) have been observed large number of plasma cells (PCs) in the interstitium of the Harderian gland. They

reported that the plasmocytic series in the gland is composed of blast cells, immature (PCs), plasma like cells, and mature PCs. There are very few PCs present in the Harderian gland of newly-hatched chicks, but they increased in number as the birds become older, and they added that the local immune system of the respiratory tract consists of lymphoid cells and structures associated with mucous membranes that form the interface between the host and the external environment. In the respiratory tract of the fowl, there are paraoccular and nasal lymphoid structures, which consist of the gland of Harder (HG), lateral nasal gland, lacrimal gland and their glandular ducts. Aggregated lymphoid tissue within the larynx, trachea, and bronchi collectively form the bronchial-associated lymphoid tissues. The paired gland (HG) is located in the cranial and medial area of the orbits and represents the largest discrete accumulation of lymphoid tissue in the paraoccular area. The HG ducts empty secretions onto the eyes, lubricating the nictitating membrane since orbital secretion can drain into the upper respiratory tract. The HG has been suggested to play an important immunological role in providing local protection to this region. Therefore, interference with the proper functioning of this gland may affect the outcome of respiratory disease in chickens.

Besty (1968) mentioned that the main functions of the gland were to lubricate the movement of the nictitating membrane, wet the surface of the eye ball and nourish the a vascular cornea.

Muller et al., (1971) studied the gland of Harder as a source of antibody producing cells, whereas sheep RBCs were administered either intravenously (IV) or by dropping onto the eye orbit of 3-4 week old birds and 3, 4 and 5 days later assayed the HG for plaque forming cells

(PFC). PFC were not present in the HG of IV injected birds, but appeared after the occular application, which is the more natural route of exposure.

Wight et al. (1971) examined the Harderian gland histologically with reference to the genesis of plasma cells from a total 97 healthy fowls of light-weight laying strain (shavers), and they stated that the Harderian gland of the fowl lies in the orbit ventral and postero-medial to the eye ball. It extends rostrally from the region of the optic nerve and from its anterior extremity emerges its duct, which passes inferior to the origins of the superior and inferior oblique muscles. It is loosely attached to the periorbital fascia, so that when the eye is removed it usually remains in the cavity of the orbit. The gland is pale pink to brownish red and rather irregular in shape but generally strap like, and often has hour-glass major borders. The surface adjacent to the periorbital fascia is convex and that facing the eye ball is concave. The average dimensions of the gland in the adult birds are 17.3 x 7.4 x 2.2 mm and the mean weight is 84.4 mg. The major blood supply is from the ophthalmo-temporal branch of the external ophthalmic artery and drainage is via the ophthalmic vein. The inferior branch of the occulomotor nerve gives off small branches to the gland as it passes over it to the inferior oblique muscle. The Harderian gland is surrounded by a thin C.T capsule and septa dividing it into unequal lobules. From the capsule and septa strands of collagenous and reticular fibers extend between the acini and tubules which contain blood vessels and nerves. Foci of lymphocytes may be present in the capsule. The gland is a compound tubulo-acinar gland of merocrine secretion. The acini are located at the periphery of the lobules. The merocrine secretion of the peripheral acini passes via short tertiary tubules into secondary tubules and then into a main central collecting tubule. Acini and tubules

are lined by columnar epithelium. Between the secondary collecting tubules towards the center of the gland are varying numbers of pyroninophilic plasma cells. Other types of cells of the lymphoid series are very infrequent at any age, but in a one-day-old chick many heterophils are present in the interstitium. There are very few plasma cells in the interstitium one day after hatching but many appears during the next six weeks. There are very few plasma cells in newly hatched chicks but these progressively accumulate until large numbers are present.

Albini and wick (1973) have described the presence of lymphocytes with immunoglobulin surface determinates (ISD) in the chicken Harderian gland. ISD positive cells (ISD+) increased rapidly after hatching and peaked at 6 weeks of age (90%) and remained relatively constant thereafter.

Burns and Mackenzie (1973) reported that cholinesterases occure in all parts of the fowl's Harderian gland except the secretory acinar cells and nerve fibers. Pseudo-cholinesterase is confined to the plasma cells, capsule and paratubular region. Innervation of Harder's gland is cholinergic, no catecholamines being found. The Harderian gland of the domestic fowl is a compound tubulo-acinar gland innervated by the inferior branch of the occulomotor nerve. Nerve fibers penetrate the gland from the capsule.

Parry and Aitken (1973) suggested that lymphoid and plasma cell aggregations in the respiratory tract, notably the Harderian gland, may synthesize IgA antibody. FA technique demonstrated IgA in plasma cells of the Harderian gland. The duration of locally-conferred immunity was