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PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 3 (2): 236-238, 2000

The Autonomic Innervation of the Bursa Cloacalis of Chickens and Pheasants

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Abstract: The aim of the present study was to compare the presence and topography of intra bursal adrenergic and ACHE-positive nerve structures in the bursa cloacalis of the chickens and pheasants from hatching until 12 months of age. The adrenergic nervous profiles were demonstrated visualized by means of verified histochemical method with glyoxylic acid and for demonstration of ACHE-positive nerve fibres were used the direct tiocholin method cytochemistry evidence acetylcholinesterase. In the bursa cloacalis the distribution and topography of adrenergic and ACHE-positive nerve formation in chickens and pheasants were corresponding. The visible nerve fibres were founded mainly in close connection with vessels or as solitary fibres running through fibrous septa around the lymphatic follicles. Nerve fibres in germinal center of lymphatic follicles were not discover. The highest density of adrenergic and ACHE-positive nerves was observed in the period between 3rd and 4th months of age. After this period gradual reduction of adrenergic and ACHE-positive nerve structures was observed and the bursa cloacalis of a 12 months old chicken and pheasant showed only single nerve structures located mainly in the perivascular topography.

Key words: Adrenergic nerve structures, ACHE-positive nerve structures, Autonomic innervation, Bursa of Fabricius, Chicken, Pheasant

Introduction

The morphological analyses of the innervation of the lymphopoietic organs have proved that the central nervous system influences the immune responses of an organism by means of autonomous nerves. The lymphatic organs have parasympathetic and sympathetic autonomic innervation (Nance *et al*., 1987; Kendall *et al*., 1994) although for years in the past there was debate over the presence of the parasympathetic component (Magni *et al*., 1987; Felten and Felten, 1989; Bulloch and Pomerantz, 1984; Al-Shawaf *et al*., 1987). Recently anatomical studies have revealed the presence of noradrenergic nerve fibers in the primary lymphatic organs (Novotny and Hsu, 1993; Felten *et al*., 1985; Sirotakova *et al*., 1997; Zentel *et al*., 1991).

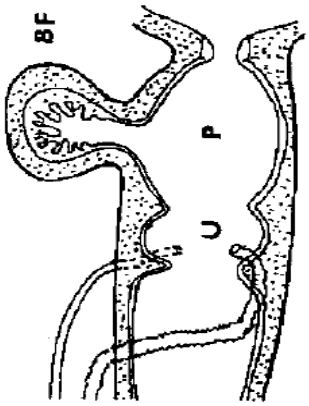

Fig. 1: Bursa cloacalis, general schema:
BF - bursa cloacalis (Fabricii)
U - urodaeum
P - proctodeum

In this paper we will present the results of our studies on the ontogenetic development of adrenergic and ACHE-positive nerve structures in the bursa cloacalis of chickens and pheasants. macroscopically the bursa cloacalis is an odd, hollow and blind ending sac approximately ovoid shape between dorsal wall of proctodeum and vertebral column (Fig. 1). It has the connection with cloaca through narrow opening. Tunica mucosa of bursa cloacalis created 10-12 longitudinal folds which have a three like fibrous tissue skeleton. The lymphatic tissue proper consists of abundant and tightly adjoining lymphatic follicles.

In this article we inform about the presentation, topography and distribution of adrenergic and ACHE-positive nerve fibres from the point of view of the ontogenetic development of the bursa cloacalis in chickens and pheasants. To study the effectoric innervation of the primary lymphopoietic organs from the aspect of imuno-neurohumoral mechanism during physiological and experimental conditions should be reflected in theoretical area and in clinical conditions.

Materials and Methods

The study of the innervation of the bursa cloacalis was performed on the histological sections obtained from 20 pheasants and 20 chickens of both sexes from hatching until 12 months of age. The chickens and pheasants were killed by aether narcosis and their bursae cloacales were removed. ACHE-positive nerve components were visualized by the direct tiocholin method cytochemistry evidence acetylcholinesterase by El-Badawi and Schenk (1967), adrenergic nerve components we visualized with glyoxylic acid in modification of Shvalev and Zhuckova (1987). Microscopic examination and photo documentation were performed using the NIKON.

Results

According to our investigation we found that in bursae cloacales of chickens and pheasants are present intra bursal adrenergic and ACHE-positive nerve components. These nerve structures were present in organ as early as on the first day after hatching and mainly were located along the vessels in the fibrous tissue. In the following period the density and ramification of adrenergic and

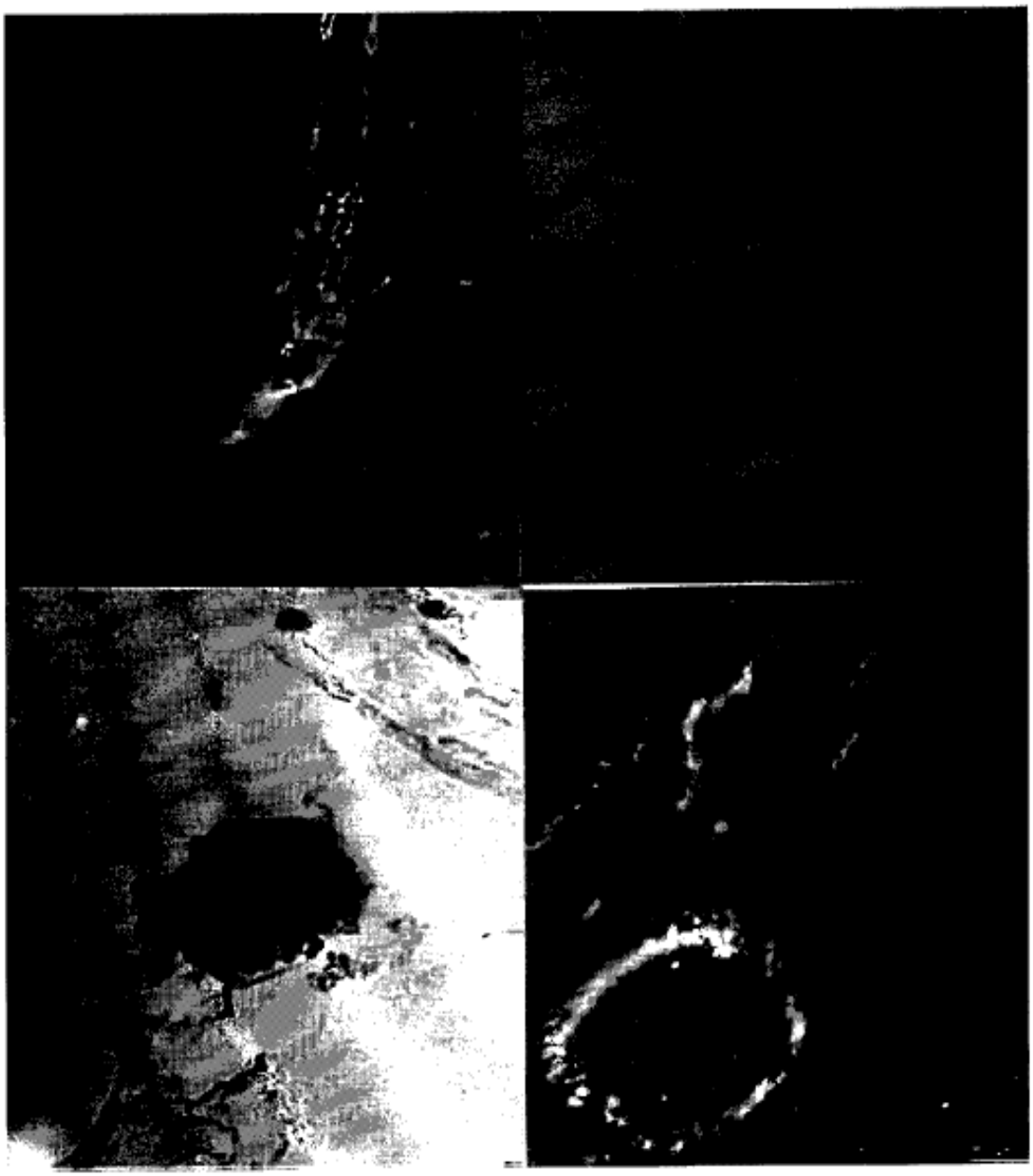

Fig. 2-5: (2) The bursa cloacalis of the Adrenergic nervous formations in the periarteriolar topography. Magi). X 120. (3) The bursa cloacalis of the pheasant. ACHE-positive nerve plexuses with thicker and thinner nerve fibres. Magn. X 120. (4) The bursa cloacalis of the chicken. ACHE-positive ganglion in the interfollicular septum. Magn. X 120. (5) The bursa cloacalis of pheasant. The adrenergi innervation of the arterioles in the bursa cloacalis, but innervation of the veins is very poor. Magn. X 120

ACHE-positive nerves increased and they were also observed in submucosa and between smooth muscular layers. In the microscopical pictures the dominant structures were periarteriolar adrenergic and ACHE-positive nerve plexuses with thicker and thinner nerve fibres and their groups. (Fig. 2 and 3). Particularly density of the nerve components we found in fibrous tissue and muscular layers between proctodeum and initial part of the bursa cloacalis. In the same topography besides adrenergic and ACHE-positive nerve fibres there were ganglionic ACHE-positive nerve cells. These ganglions achieve sometimes extraordinary dimensions and density of colour reaction product is not the same in all gangliocyte (Fig. 4). Adrenergic and ACHE-positive nerve fibres which are located in submucosa and on the base of mucosa folds are sometimes in very close relationship with marginal layers. Adjacent lymphatic follicles. Arteriolar branches with nerve plexused pass over the fibrous tissue construction approximately through the center of mucosal folds. Lymphatic follicles of the bursa cloacalis which lie very often near to the specific fluorescent adrenergic and

ACHE-positive nerve structures contain nerve profiles only at the most marginal layers. The presentation of nerve fibres in the center of lymphatic follicles was not proved by us. Unlike arterioles, in the wall of the small veins occurrence adrenergic, as well as ACHE-positive nerve profiles is very rare (Fig. 5).

In our opinion, the remarkable aspect of this observation that the density of adrenergic and ACHE-positive nerve structures increases until to the 4th month. The presence of nerve fibres in all locations mentioned was observed at that time. This is the period within which the bursa cloacalis reaches its largest size.

At five month after hatching a gradual reduction of adrenergic and ACHE-positive nerve component can be seen. The presence of more dense plexiform groupings of nerves in the bursa cloacalis of 12 month old pheasant was observed only sporadically.

Distribution and topography relationships adrenergic and ACHE-positive nerve structures in bursa cloacalis of chickens are basically the same as the pheasants. There is a one difference: chickens and pheasants have evidentially more innervation ACHE-positive nerve structures comparing to adrenergic innervation. The differences in presence and topography of autonomic nerve structures in bursa cloacalis of chickens and pheasants are from morphological points of view mainly in quantity of the marks.

Discussion

Our observations of bird bursa cloacalis provided unambiguous proof of the presence of adrenergic and ACHE-positive innervation which appeared to be specific. Considerable morphological-functional changes which occur in primary lymphopoietic organs of birds during ontogenesis, serves as a stimulus for our investigations into the intra-organ autonomous nerve system of the bursa cloacalis in various stages of ontogenetic development. Our results extend knowledge concerning the autonomous innervation of the bursa cloacalis which had not been described from the ontogenetic position. It is evident that a number of papers deal with the question of the noradrenergic components of the autonomous innervation of primary lymphopoietic organs (Inoue, 1973; Zentel *et al*., 1991; Zentel and Weihe, 1991; Singh, 1984; Felten *et al*., 1985) while cholinergic innervation is a subject of lesser interest to researchers (Inoue, 1973; Kendall *et al*., 1994). It is justifiable to assume that the lymphopoietic organs are affected by two components of the efferent autonomous system-sympathetic and parasympathetic. The sympathetic system inhibits while the parasympathetic system stimulates lymphopoiesis (Singh and Fatani, 1988).

Our experiments revealed that there is a direct relationship between the functional capacity of primary lymphopoietic organs and the presence of adrenergic and ACHE-positive nerve structures. During the period of increased lymphopoiesis adrenergic and ACHE-positive nerves are abundant in the bursa cloacalis lweek 12-14). Inoue (1973) failed to find ACHE-positive nerve fibres in the lymphatic follicles of bursa cloacalis in 21 day old chickens. We found nerve fibres in very close relationship with marginal layers of lymphatic follicles but penetrating of nerve fibres to the germinal center of lymphatic follicles we did not see.

The involution changes in the bursa cloacalis of pheasants in agreement with the reports of Sirotakova *et al*. (1997) are accompanied by a gradual decrease in the number of adrenergic and ACHE-positive nerve structures.

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